

Article

Stakeholders' Roles in the Delivery of Sustainable Housing Projects in Lagos State, Nigeria

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Abstract: The role stakeholders play is fundamental to the realisation of sustainable development. Consequentially, there is a need for the major stakeholders to be fully aware of their respective roles. Thus, this paper focused on assessing the stakeholders' roles in sustainable housing projects in Lagos State, Nigeria. A structured questionnaire survey was used to collect data from 259 stakeholders involved in sustainable housing projects in Lagos State, Nigeria. A total of 203 responses were obtained, representing a 78% response rate. Primary data regarding the extent of stakeholders' awareness of their roles in sustainable housing were collected. The data collected were analysed using mean ranking analysis and analysis of variance (ANOVA). The data collected were used to determine the extent of awareness of the stakeholders' role in sustainable housing projects in Lagos State, Nigeria. The results showed that all the stakeholders were aware of their respective roles in the delivery of sustainable housing projects and were highly conscious of them. Although their extent of awareness was at varying levels, there was no statistically significant difference of opinions amongst the different categories of stakeholders in the delivery of sustainable housing projects. The study concluded that Government and Project Managers have key roles to play as major stakeholders in the delivery of sustainable housing projects. The knowledge of the awareness of stakeholders' roles in the delivery of sustainable housing projects provides invaluable information to stakeholders regarding the important roles to focus attention on in achieving sustainable housing projects. The study provides a veritable basis for understanding and aligning stakeholder roles in sustainable housing project delivery.

Keywords: delivery; housing; projects; roles; stakeholders; sustainability



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1. Introduction

The construction sector has a crucial role in the realization of sustainable development. However, stakeholders involved in construction projects often lack a clear understanding of their roles and responsibilities. This study aims to explore and identify the key stakeholders who are expected to play a significant role in the implementation of sustainable housing projects in Lagos State, Nigeria. These stakeholders encompass various actors within the construction sector, including government agencies, contractors, developers, architects, residents, and community organisations. By investigating the roles, responsibilities, and contributions of these stakeholders, this research seeks to provide a comprehensive understanding of who is involved in driving sustainable housing delivery and shaping the future of the construction industry.

Effective stakeholder management is vital for the success of complex projects, and strong cooperation among stakeholders is essential for achieving sustainable housing goals [1]. Sustainable housing entails the creation of environmentally responsible and resource-efficient structures, incorporating sustainable practices throughout a building's

life cycle from design to construction, operation, maintenance, renovation, and deconstruction [2]. To achieve sustainable housing, major stakeholders must be fully aware of and actively involved in the process.

Stakeholders are individuals, groups, or organisations who may be affected by or have an impact on a project's decisions, activities, or outcomes [3]. Previous studies have demonstrated the significant role that stakeholders play in the adoption of sustainable housing projects [4]. These stakeholders can be classified into internal and external categories. Internal stakeholders include demand-side actors such as clients, financiers, client representatives, and end-users, as well as supply-side professionals such as architects, quantity surveyors, structural engineers, main contractors, subcontractors, and suppliers. External stakeholders encompass private actors like the local community, residents, conservationists, environmentalists, and archaeologists, as well as public entities such as regulatory and government agencies.

The influence of stakeholders is contingent upon their capabilities and roles within a project. Therefore, stakeholders must have a clear understanding of their roles to effectively fulfil their responsibilities and contribute to project success. Project performance can be evaluated based on various factors, including completion within cost, rework rates for faulty structures, adherence to project timelines, energy efficiency in building projects, stakeholder satisfaction, overall sustainability ratings, and the volume of sustainable housing projects produced [5]. Sustainable housing development aims to minimize negative environmental impacts by reducing resource and energy consumption, mitigating pollution, and enhancing economic efficiency and social cohesion [6,7]. In the context of sustainability in housing projects, various sustainable rating systems applied are important to be considered. In this regard, LEED (Leadership in Energy and Environmental Design) and EDGE (Excellence in Design for Greater Efficiencies) are internationally recognized sustainability rating certification tools. These tools play a crucial role in assessing and promoting sustainable practices in the construction industry [8,9]. Projects certified with LEED and EDGE demonstrate a commitment to sustainable principles and are associated with specific sustainability objectives and performance criteria [8,9].

It is essential to assess stakeholders' awareness of their roles and responsibilities in projects certified with sustainability rating tools to ascertain their level of understanding of their contributions to the process. Previous studies, such as [10], have merely identified stakeholders' capabilities and power and attempted to prioritize stakeholders based on their roles and contributions. However, it remains unclear whether stakeholders fully comprehend and agree with their designated roles before evaluating their influence based on their contributions to a project. Furthermore, ref. [11] explored stakeholder-based management and its impact on project success, emphasising how stakeholders can influence projects through their roles. Nevertheless, a significant number of stakeholders lack a clear understanding of what is expected from them [12,13]. Consequently, this study aims to identify and analyse stakeholders' roles and perceptions, shedding light on the importance of stakeholders' understanding and identification of their roles in sustainable housing projects. Building upon the identified gap in stakeholder understanding and engagement, the specific objectives of this research were formulated to identify the key stakeholders involved in sustainable housing projects and to determine their respective roles in promoting the successful delivery of sustainable housing projects in Lagos State. By achieving these objectives, this study aims to contribute to the existing body of knowledge on stakeholder involvement in sustainable housing, with the ultimate goal of informing policy, practice, and decision-making processes in the construction industry.

2. Literature Review

2.1. Construction Stakeholders

In a study on stakeholder impact analysis, ref. [14] identified a range of stakeholders in different types of projects. In a housing project, the identified external stakeholders were municipality/permit-granting government agency, administrative board, national

government, community residents, community/interest groups, and the media. In another case project by the same author, the national board of housing, a rescue service agency, and another government agency were identified. In another case, political groups and community interest groups were identified. In addition, ref. [15] developed a stakeholder model that identified project leaders, project sponsors, client organisations, end users, suppliers, subcontractors, and community and external independent concern groups as construction project stakeholders. Typical of any construction project, the interests in the project do not only reside with the client and the professional team. Based on findings from the literature, the professional team on a sustainable building project is very similar to the team usually engaged on a conventional project but with a much more significant focus on sustainability matters [16]. The professionals include the following: architect, quantity surveyor, civil/structural engineer, project manager, mechanical and electrical service engineer, and builder. The increasing form of fragmentation in construction projects contributes to the complexity of sustainable building procurement; this underlines the importance of firm coherence and incorporation of all stakeholders (internal and external) towards satisfactory project performance [17]. Figure 1 sectionalise all participants in the construction industry, they are as follows: government, developers, clients, buyers/end users, contractors, consultants (architects, other designers, engineers, quantity surveyors), and manufacturers/suppliers. This served as a visual representation of the diverse range of stakeholders involved in sustainable housing projects, highlighting their interrelationships and dependencies. By clearly outlining the different stakeholder groups, this study aimed to enhance the understanding of stakeholder management and shed light on the specific roles and responsibilities each group plays in achieving sustainable housing outcomes. Construction workers need to understand sustainable construction properly to give assurance that their distinct preparations and the selections they make that determine the actions of other individuals contribute as little as possible to the whole problem of the atmosphere [18].

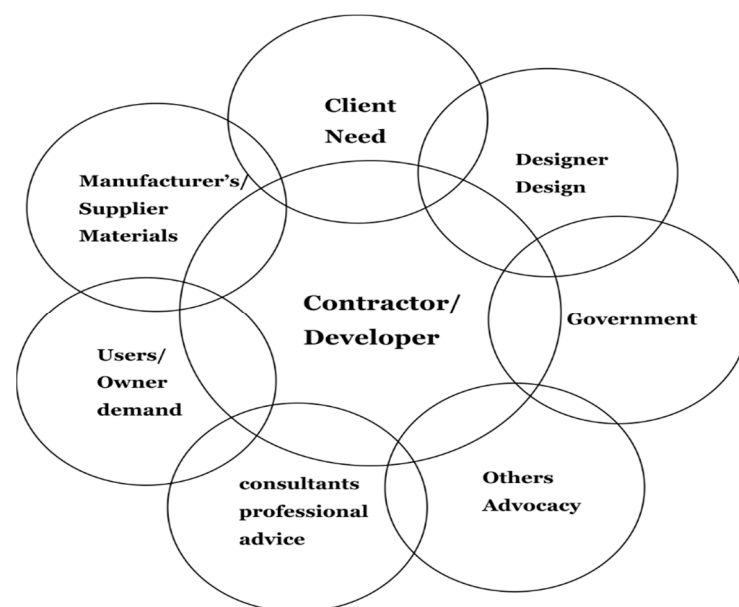


Figure 1. Stakeholders for sustainability. Source: [19].

Sustainable procurement involves the contributions of several stakeholders with diverse social, environmental, and economic understandings and benefits. To be able to maintain a common focus and ensure the accomplishment of a project, effective communication needs to be maintained among all stakeholders [20]. Ref. [21] endorsed the continuous engagement of all stakeholders during the project lifecycle to frequently meet their requirements and expectations. A debated example is the Guangzhou-Shenzhen

Hong Kong Express Rail Link Project (Hong Kong section). Despite the socioeconomic awareness of the project in the Hong Kong Special Directorial Region and a general public investigation shown by the government previously, it attracted unusual disapproval from a lot of stakeholders.

The stakeholders are the occupants, the idealistic age group, politicians, regulators, and professionals among others that disapproved of family value issues, environmental effects, and value-for-money [22]. The “Vicious Circle of Blame” is another relevant concept to the stakeholders’ roles in the delivery of sustainable projects. It emphasises the adverse impacts of blaming each other for project failures. Stakeholders are accountable and responsible for their actions instead of engaging in a blame game. For project success, collaboration and corporation are important aspects and blaming others often tends to create a hostile environment that hinders project progress [23,24]. By laying the focus on learning and improvement, stakeholders can change setbacks into growing opportunities for project success. Finally, by breaching the vicious circle of blame success and sustainability of projects can be promoted while creating benefits for both the environment and the community [25]. Figure 2 indicates the Vicious Circle of Blame mentioned by [25]. The Vicious Circle of Blame is an important concept in understanding the dynamics of stakeholder roles and their impact on the outcomes of this study. In the context of sustainable housing delivery, the Vicious Circle of Blame refers to a situation where stakeholders involved in construction projects engage in a cycle of blaming each other for failures or shortcomings, leading to a lack of accountability and hindered progress in achieving sustainable goals.

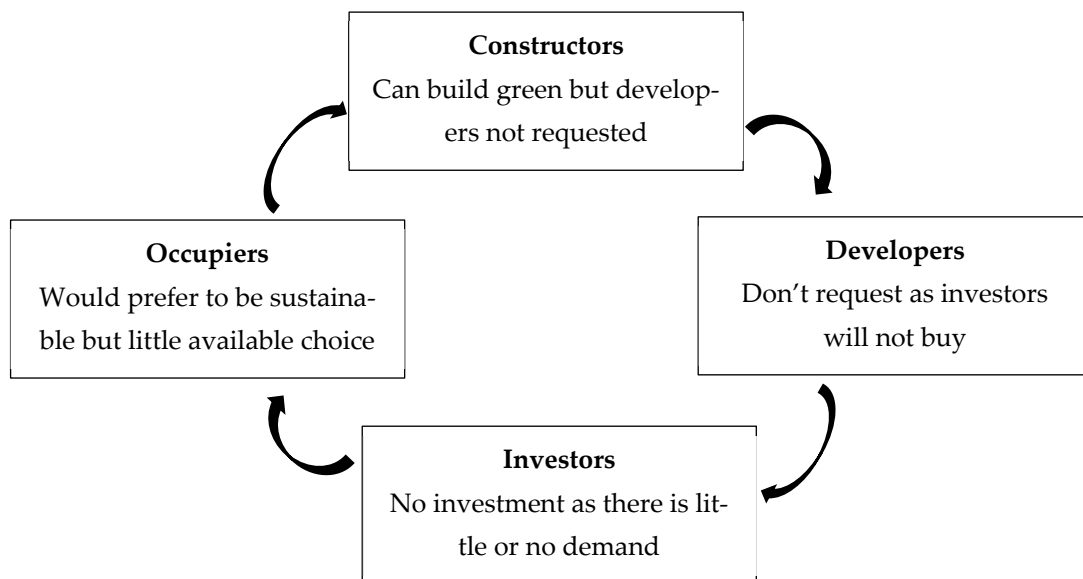


Figure 2. Vicious circle of blame. Source: [25].

The Vicious Circle of Blame idea emphasises the significance of accountability and cooperation in accomplishing long-term objectives. Despite not being specifically studied, its inclusion in the literature study still serves to indirectly highlight the importance of stakeholder roles and the necessity of a collaborative approach to project success. The comprehension of stakeholder dynamics in the delivery of sustainable housing is improved by these notions, which indirectly assist the empirical investigation.

2.2. Influence of Stakeholders on Sustainable Project Delivery

This section provides a review of the literature on stakeholder influence in the context of sustainable project delivery. While the literature on stakeholder influence is broad, it is essential to focus on its direct relevance to sustainable project delivery. One prominent theoretical model that examines stakeholder influence in the context of sustainable project delivery is Mendelow’s power/interest model [26]. This model classifies stake-

holders into four groups based on their power and interest: (1) High power/high interest, (2) High power/low interest, (3) Low power/high interest, and (4) Low power/low interest. The model suggests that stakeholders' influence on sustainable housing projects varies depending on their power and interest levels. This understanding justifies the notion that stakeholders have different influences on the performance of sustainable housing projects [27,28]. Furthermore, it highlights the importance of assigning stakeholder responsibilities based on their influence to address specific stakeholder factors. The impact of each stakeholder's contribution to performance is attributed to how their respective stakeholder factors affect the project outcome. In addition to Mendelow's model, the literature also considers influence from various perspectives. For instance, some studies [26] propose that influence can be measured based on hierarchical position, intelligence, skills, experience, saliency/importance in the process, and stakeholder resources. Other scholars [29] have developed models that describe stakeholder influence using theoretical pillars such as resource dependency, social network perspective, and institutional approach. By exploring and analysing these theoretical perspectives, this study aims to deepen our understanding of stakeholder influence on sustainable project delivery in the context of housing projects in Lagos State, Nigeria." Figure 3 indicates Mendelow's power/interest model in the context of sustainable project delivery.

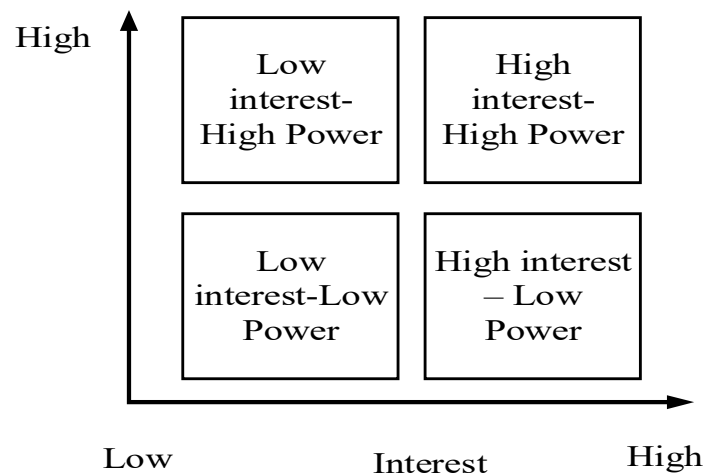


Figure 3. Power/interest Matrix. Source: [26].

2.3. Roles of Stakeholders in the Delivery of Sustainable Housing Projects

The construction industry is majorly defined as a principally fragmented sector because of the combination of various stakeholders. The disintegration and complication of communications amongst the various stakeholders with different desires contribute to an already complicated SC agenda, which makes implementation difficult [30]. Stakeholders relevant to sustainable construction have been grouped. They comprise the construction contractor, developers, client, government agency and construction consultants. The roles of these stakeholders are discussed in this section.

2.3.1. Contractor

Contractors constitute the major contributors to environmental and social challenges through their activities. Therefore, they are perceived to have an obvious obligation of leading to achieving a sustainable environment [31]. Refs. [32,33] identified the following as the roles of contractors in the delivery of sustainable housing projects: taking the lead in achieving a sustainable society through advocacy and other steps, complying with sustainability laws in the operation of their firms, advocating for the delivery and patronage of sustainable buildings, participating in setting sustainable demands and goals, efficiently meeting demands for sustainable practices in the market. Ref. [31] also identified other roles of contractors including adopting ethical sourcing strategies for sustainable

projects, complying with materials specifications and suggesting better options where possible, simulation of design scenarios to attain sustainability targets and studying, and interpreting the supply chain and sourcing standards for sustainable construction.

2.3.2. Government

Governments at national and local levels are in a major standpoint to provide laws, guidance, and motivations that can coordinate the activities of the construction industry. In addition, governments all over the world often are the major client of the construction industry [30]. From the beginning of the sustainability program, virtually every effort was originated by governments or focused on them. This is shown by the fact that several related sustainability investigations in the civilized world refer to a government initiative as the foundation for modification phenomena being researched [32,33]. A better way to pursue sustainable change is for government involvement along the submission of [34] by engaging the essential gravity and motivations of the segment. Ref. [35] identified the roles of government regulatory agencies in achieving sustainable housing projects to include the following: providing relevant legislation promoting sustainable constructions, providing guidance favouring sustainable construction, providing and applying necessary incentives for sustainable compliance, initiating and directing sustainability agenda during the construction period, funding sustainability teaching, research and development to sensitize the society on the importance of sustainable construction.

Ref. [34] also identified the roles of government agencies to include design iterations towards sustainability targets, evaluating design decisions against sustainability assessment methodologies, monitoring project execution for compliance with agreed sustainability standards, obtaining necessary approvals promoting sustainable construction, and drafting and appraising the adequacy of procurement methods and options for sustainable construction. However, some of the government roles are not well known to the government agencies and this is in line with [36] who opined the non-awareness of the following roles: drafting and appraising the adequacy of contractual terms in the light of sustainable construction, outlining dispute resolution procedures available for sustainable construction, enforcing ethical sourcing standards for sustainable construction, informing stakeholders on choices of sustainable construction materials, monitoring new knowledge on sustainability and ethical supply chains, and partnering with stakeholders to drive public consciousness.

2.3.3. Developers

A set of respondents in the UK construction industry by [33] concluded that developers are the most significant stakeholder in defining SC practices. This approval is hypothetically tricky as some findings such as [35] had proposed that developers' low level of awareness of SC is a hindrance to SC. Therefore, there are some worries regarding whether developers have awareness about SC to request it, or if they are adequately concerned to make a difference. Ref. [37] identified the roles of developers in the achievement of sustainable housing projects to include the following: interest in sustainable construction, contributing sustainable ideas at the briefing stage, constant updating knowledge on sustainable building, arranging for funding and agreement of funding terms with the other stakeholders, commissioning relevant professionals knowledgeable in sustainable construction, adhering to sound professional advice promoting sustainable construction.

Designing sustainably, floor green ratio, harmless gas emissions, clear specification of sustainable features, characteristics, materials and methods, evaluating price decisions in line with sustainable project objectives, and defining information required from sustainable stakeholders. Ref. [35] also identified the roles of developers to include appraisal of sustainability credentials of design professionals, identifying and allocating risks associated with sustainable buildings, preparing occupancy guides for end users, preparing post-construction maintenance plans incorporating sustainable features, appraising client's fund acquisition decisions and advising accordingly on benefits of sustainable projects,

facilitating stakeholder engagement on general and sustainability matters, and compliance with ethical sourcing of sustainable construction materials.

2.3.4. Architects

Architects play a vital role in sustainable housing delivery by incorporating eco-friendly design principles and practices into the project. They are responsible for integrating energy-efficient systems, passive design strategies, and sustainable materials into the building's design [8]. Architects also collaborate with other stakeholders to ensure that the project meets sustainability standards and certifications [9].

2.3.5. Structural Engineers

Structural engineers contribute to sustainable housing projects by designing efficient and resilient structures that minimize the use of materials and resources. They consider factors such as sustainable construction techniques, optimal use of materials, and innovative structural systems to enhance the project's sustainability [38]. Structural engineers also play a crucial role in ensuring the durability and safety of sustainable buildings [39].

2.3.6. Quantity Surveyors

Quantity surveyors contribute to sustainable housing delivery by providing cost management and value engineering services. They assess the economic feasibility of sustainable initiatives and help in identifying cost-effective solutions for implementing sustainable practices [40]. Quantity surveyors also play a role in evaluating the life-cycle costs of sustainable building materials and technologies [41].

2.3.7. Project Managers

Project managers play a key role in overseeing the entire construction process and ensuring the successful delivery of sustainable housing projects. They are responsible for coordinating and integrating the efforts of various stakeholders, including architects, engineers, and contractors [42]. Project managers also facilitate the implementation of sustainable strategies, monitor project timelines, and address any sustainability-related challenges that may arise [43].

2.3.8. Electrical Engineers

Electrical engineers contribute to sustainable housing delivery by designing energy-efficient electrical systems. They focus on integrating renewable energy sources, implementing energy-saving technologies, and optimizing the electrical infrastructure to minimize energy consumption and reduce environmental impact [44]. Electrical engineers also play a role in developing smart and sustainable building automation systems [45].

2.3.9. Mechanical Engineers

Mechanical engineers contribute to sustainable housing projects by designing energy-efficient HVAC (Heating, Ventilation, and Air Conditioning) systems. They focus on optimizing energy performance, improving indoor air quality, and integrating renewable energy sources for heating and cooling [46]. Mechanical engineers also play a role in implementing water-efficient plumbing systems and promoting sustainable water management practices [47].

2.3.10. Builders

Builders have a crucial role in translating sustainable design concepts into reality. They are responsible for executing construction activities in alignment with sustainable building practices, ensuring proper waste management, and implementing energy-efficient systems [48]. Builders play a role in sourcing sustainable construction materials and employing environmentally friendly construction techniques [49].

2.3.11. Government Regulatory Agencies

Government regulatory agencies play a pivotal role in sustainable housing delivery by setting standards, regulations, and guidelines for construction practices. They enforce compliance with sustainability codes, promote the use of green building certifications, and support sustainable housing initiatives through incentives and policies [50]. Government agencies also play a role in monitoring and assessing the environmental impact of housing projects [51].

3. Methodology

A quantitative research approach was adopted for this study focusing on gathering data from stakeholders involved in sustainable housing projects in Lagos State, Nigeria. The research question that informed the use of this approach was to determine the extent of stakeholders' awareness of roles on sustainable housing projects in the study area. To achieve this, a structured questionnaire survey was conducted. The questionnaire was designed to collect primary data. The questionnaire was developed based on relevant literature and research on stakeholder management in construction projects. It included a combination of closed-ended and Likert-scale questions to gather quantitative data on stakeholders' perceptions and behaviours. To identify the stakeholders, a systematic approach was followed. Initially, a comprehensive review of relevant literature was conducted to identify potential stakeholder groups involved in sustainable housing projects. These stakeholder groups were further validated through consultations with industry experts and professionals. The final list of stakeholders included in the study was based on their relevance and impact on sustainable housing delivery.

3.1. Study Population

The study population comprised stakeholders involved in LEED and EDGE sustainable housing projects in Lagos State, Nigeria. The identified projects were described as sustainable because they have adopted sustainability principles and obtained an international sustainability rating certification(s) from Leadership in Energy and Environmental Design (LEED) and EDGE between 2010 and 2020. The target population of respondents comprised all the stakeholders that participated essentially on the supply side of project delivery. This consists of Architects, Structural Engineers, Quantity Surveyors, Project Managers, Electrical Engineers, Mechanical Engineers and Builders, and Government Regulatory Agencies. The sampling technique used to locate the respondents in this study was purposive sampling. Purposive sampling was employed to specifically target stakeholders involved in LEED- and EDGE-certified sustainable housing projects in Lagos State, Nigeria. This technique allowed for the deliberate selection of participants based on their specific involvement and expertise in sustainable housing projects. By using purposive sampling, the study aimed to gather insights and perspectives from stakeholders who possess valuable knowledge and experiences related to sustainable housing delivery in the study area.

3.2. Data Collection

A structured questionnaire survey was distributed to identify 259 stakeholders involved in sustainable housing projects in Lagos State, Nigeria. The chosen sample size was determined based on the principles of statistical significance and adequacy for conducting a comprehensive study [8,9]. By including 259 stakeholders, this study aimed to ensure an adequate representation of the diverse perspectives and roles within the sustainable housing projects in Lagos State. Furthermore, focusing on stakeholders in Lagos State, Nigeria was driven by the geographical scope of this research, which aimed to examine the specific context and dynamics of sustainable housing projects in a defined area [38]. Lagos State was selected due to its significance as a rapidly urbanizing region with a substantial number of sustainable housing projects and the presence of LEED- and EDGE-certified projects [38,39]. This geographical focus enhances the relevance and applicability of the

study findings to the local context, allowing for a deeper understanding of the roles of stakeholders in sustainable housing projects in Lagos State, Nigeria [38,39].

3.3. Data Analysis

The data collected from the structured questionnaire survey were analysed using appropriate statistical techniques. The mean score analysis was employed as a tool to determine the awareness on roles in sustainable housing projects. The mean score analysis calculates the average score for each role based on the responses obtained from the stakeholders.

A total of 203 responses were returned, representing a 78% response rate. The data collected were analysed using mean score analysis alongside analysis of variance (ANOVA) and a mean analysis was calculated using the following mean score analysis formula:

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

where MS = Mean Score

n_0 = no of respondents who answered “not applicable”

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”

The 6-point Likert scale was chosen for scoring the factors in this study due to its effectiveness in capturing nuanced responses and allowing for a wider range of response options. This scale provides respondents with more gradations of agreement or disagreement, enabling them to express their opinions and perceptions in a more detailed manner. By using a 6-point Likert scale, the study aimed to obtain a more precise and comprehensive understanding of the stakeholders’ views on their roles in sustainable housing projects. This approach facilitates a finer level of analysis and interpretation of the data, contributing to a more robust assessment of stakeholder perspectives and the identification of critical factors influencing sustainable housing delivery.

The test value used for mean score analysis was the mean value calculated from the Likert-scale responses. Hypotheses were not used in this analysis as the focus was on determining the different in submissions on the factors rather than testing specific hypotheses. The analysis included an analysis of variance (ANOVA) to examine the differences in perceptions among the respondents based on the identified stakeholders. The specific ANOVA used in this study was a one-way ANOVA, which allowed for the comparison of means across different stakeholder groups. The ANOVA was necessary to explore potential variations in stakeholder perspectives and gain insights into the significance of differences in submissions on stakeholder roles in sustainable housing delivery.

To ensure the validity and reliability of the data, multiple measures were implemented in this study. The questionnaire used in the research was developed based on a comprehensive review of existing literature ensuring the inclusion of relevant and appropriate items. Further, measures of internal consistency, such as Cronbach’s alpha coefficient, were calculated to assess the reliability of the questionnaire items measuring the key variables. This analysis determined the extent to which the items within each construct were consistent and measured the same underlying concept. Moreover, the survey administration process was carefully managed, providing clear instructions to respondents and minimizing errors and biases. These measures collectively ensured the validity and reliability of the data collected for this study.

4. Results

4.1. Respondents' General Information

Table 1 below displayed the respondents' years of experience in sustainable construction and the number of projects handled in the last ten years. The Table reveals 66% of the stakeholders had less or equal to 5 years of experience in sustainable construction, 27.1% had between 6 and 10 years of experience, 5.4% had between 11–15 years of experience, 0.5% had between 16–20 years of experience, while 1% had between 21–25 years of experience. This is an indication that over 70% of the respondents had up to 10 years of experience in sustainable construction in the study area, which may not be surprising because sustainable construction is still coming up in Nigeria and not many projects are within the status of sustainable construction, hence the findings of this study. Considering the number of projects handled in the last 10 years, the result of the analysis showed that 63.1% of the respondents had handled more than 5 projects in the last 10 years while 36.9% of the respondents had handled less or equal to 5 projects in the last 10 years. From Table 1 which reveals the general characteristics of the respondents, it is evident that the respondents to the questionnaire survey are well-educated, professionally qualified, and experienced to a good degree in sustainable construction. As such, it can be inferred that the data received from them can be relied upon for this study.

Table 1. Profile of Respondents.

Background Information	Parameter	Frequency	Percent
Type of Organisation	Government Agency	39	19.21
	Contractor	74	36.45
	Developer	90	44.33
	Architects	20	9.85
	Quantity Surveyors	62	30.54
Designation of Respondent	Engineers	25	12.32
	Builders	30	14.78
	Project Managers	27	13.30
	Government	39	19.21
	1–5 years	48	23.6
Years of Construction Industry Experience	6–10 years	80	39.4
	11–15 years	26	12.8
	16–20 years	26	12.8
	21–25 years	23	11.3
	1–5 years	134	66
Years of Experience in Sustainable Construction	6–10 years	55	27.1
	11–15 projects	11	5.4
	16–20 years	1	0.5
	21–25 years	2	1
	Probationers	52	25.6
Professional Membership of the Respondents	Corporate Members	111	54.7
	Fellows	40	19.7
	1–5 projects	75	36.9
Number of Projects handled in the last ten years	6–10 projects	48	23.6
	11–15 projects	43	21.2
	16–20 projects	17	8.4
	21–25 projects	20	9.9

The mentioned factors include the type of organisation, designation of respondents, years of experience, and professional membership and can potentially influence the roles played by stakeholders in sustainable housing delivery as mentioned in the following section. The factors also highlight the depth of respondents' experience in the construction industry and serve as a pointer on the relevance of the respondents to the context of the study.

4.1.1. Type of Organisation

The type of organisation a stakeholder belongs to, such as government agencies, contractors, developers, or other relevant entities, can influence their level of authority, resources, and decision-making power. Different types of organisations may have varying priorities, policies, and approaches to sustainability. For example, government agencies may have regulatory and oversight roles, contractors may focus on construction practices, and developers may emphasise project planning and design. The type of organisation can shape the extent of stakeholders' involvement and their ability to influence sustainable housing projects.

4.1.2. Designation of Respondents

The designation or role of the respondents within their respective organisations can impact their responsibilities and influence in sustainable housing projects. Stakeholders in different roles, such as project managers, sustainability officers, architects, engineers, or policymakers, may have distinct perspectives, expertise, and decision-making authority. Their designations can determine the specific tasks and responsibilities they undertake concerning sustainable housing, and the level of influence they have in shaping project outcomes.

4.1.3. Years of Experience

Both construction industry experience and sustainable construction experience can play a significant role in shaping stakeholders' understanding, knowledge, and expertise in sustainable housing delivery. Stakeholders with extensive experience in the construction industry may possess practical insights into project management, construction techniques, and industry dynamics. On the other hand, stakeholders with substantial experience in sustainable construction can have a deeper understanding of green building principles, sustainable materials, energy-efficient practices, and relevant regulations. Experience can enhance stakeholders' ability to contribute effectively, make informed decisions, and navigate sustainability challenges in housing projects.

4.1.4. Professional Membership

Membership in professional associations or organisations related to construction, architecture, sustainability, or housing can influence stakeholders' exposure to industry best practices, networking opportunities, continuing education, and access to resources. Being part of such professional communities can provide stakeholders with valuable insights, updates on emerging trends, and opportunities for collaboration. Professional memberships can contribute to stakeholders' knowledge base, influence their perspectives on sustainable housing, and shape their engagement and participation in advancing sustainable practices.

Table 2 presents the stakeholders' roles in the delivery of sustainable housing projects, specifically focusing on three types of organisations: government, contractors, and developers. Each section represents the roles and provides additional information such as mean score (MS) and degrees of freedom (R). Here is a breakdown of the table:

Contractor's roles

This section outlines the roles of contractors involved in sustainable housing projects. The roles are listed from 1 to 10, and the corresponding information is as follows:

MS: Mean Score, representing the average rating given by respondents for each role on a 6-point Likert scale. Higher values indicate a stronger agreement with the delivery of a role by a particular stakeholder. R: represents the rank, and the Degrees of Freedom indicating the variability in the data is the number of categories or responses minus one.

Government's roles

This section highlights the roles of government entities in the delivery of sustainable housing projects. The roles are listed from 1 to 16, and the information provided includes MS and R, similar to the previous section.

Developers' roles

This section focuses on the roles of developers in sustainable housing projects. The roles are listed from 1 to 17, along with the corresponding MS and R. The interpretation of some specific results from Table 2 is as follows:

Contractor's roles

Role 1: "Taking the lead in achieving a sustainable society through advocacy and other steps."

The MS for all organisations is 3.52, indicating a moderate level of agreement on this being contractor's role.

The R is 1, suggesting that it has the highest mean score, stakeholders agree more on the role being mainly delivered by contractors compared to other roles.

Role 3: "Complying with sustainability laws in the operation of their firms."

The MS for all organisations is 3.50, suggesting a high level of agreement on the contractors' duty to strictly comply with sustainability laws as one of their major duties. The R is 2, indicating it is ranked 2nd among the 10 roles listed.

Government's roles

Role 2: "Monitor project execution for compliance with agreed sustainability standards."

The MS for all organisations is 3.38, indicating a generally high level of agreement on government being the stakeholder responsible for monitoring project execution for sustainability compliance. The R is 2, suggesting it ranked 2nd.

Role 8: "Providing relevant legislation promoting sustainable constructions."

The MS for all organisations is 3.23, indicating a moderate level of agreement that government provide legislations to promote sustainable construction. The role ranked number 8 with regards to the expectations of the stakeholders as to who mainly delivers this role in the context of sustainable housing delivery.

Developers' roles:

Role 1: "Contributing sustainable ideas at the briefing stage."

The MS for all organisations is 3.37, suggesting a moderate level of agreement on the need for developers to contribute to sustainable ideas during the briefing stage as part of their roles. The R is 1, indicating it is adjudged number 1 among other roles.

Role 9: "Identifying and allocating risks associated with sustainable buildings."

The MS for all organisations is 3.27, indicating a moderate level of agreement on the importance of developers identifying and allocating risks related to sustainable buildings as a role. The R is 9, suggesting it ranked 9th among other roles attributed to the developers as stakeholders. It should be noted that the effective delivery of a role might require the contributions of other stakeholders, although, the role is being identified to be associated with one stakeholder much more than the other.

Table 3 presents various stakeholders' roles in sustainable construction, along with the ANOVA results that provide insights into the significance of the difference in stakeholders' awareness of the roles. The F-statistic and *p*-value help determine the level of agreement or disagreement among respondents. The results of Table 3 are further discussed below.

Contractors' roles

The awareness on contractors' roles in achieving a sustainable society through advocacy and other steps, complying with material specifications, and meeting sustainable demands in the market are not statistically significantly different among stakeholders. Contractors complying with sustainability laws and advocating for sustainable buildings is also not statistically significant.

Table 2. Extent of Awareness of Roles of Stakeholders in the Delivery of sustainable housing projects based on the Type of Organisation.

S/N	Stakeholders' Roles	All		Government		Contractors		Developers	
		MS	R	MS	R	MS	R	MS	R
CONTRACTOR'S ROLES									
1	Taking the lead in achieving a sustainable society through advocacy and other steps	3.52	1	3.46	3	3.46	2	3.59	1
2	Complying with material specifications and suggesting better options where possible	3.50	2	3.49	2	3.50	1	3.51	3
3	Complying with sustainability laws in the operation of their firms	3.50	2	3.72	1	3.38	5	3.50	4
4	Advocating for the delivery and patronage of sustainable buildings	3.47	4	3.36	7	3.39	3	3.59	1
5	Participating in setting sustainable demands and goals	3.43	5	3.46	3	3.35	6	3.49	5
6	Efficiently meeting demands for sustainable practices in the market	3.39	6	3.28	9	3.39	3	3.44	6
7	Adopting ethical sourcing strategies for sustainable projects	3.37	7	3.41	5	3.34	7	3.39	7
8	Simulation of design scenarios to attain sustainability. Targets	3.30	8	3.38	6	3.30	8	3.26	9
9	Studying and interpreting the supply chain and sourcing standards for sustainable construction	3.28	9	3.33	8	3.24	9	3.28	8
10	Updating ethical/responsible manufacturing and sourcing standards	3.14	10	3.26	10	3.05	10	3.17	10
GOVERNMENT'S ROLE									
1	Initiating and directing sustainability agenda during the construction period	3.42	1	3.28	5	3.36	2	3.53	1
2	Monitoring project execution for compliance with agreed sustainability standards	3.38	2	3.26	8	3.38	1	3.44	2
3	Providing guidance favouring sustainable construction	3.36	3	3.18	15	3.36	2	3.44	2
4	Evaluating design decisions against sustainability assessment methodologies	3.35	4	3.21	10	3.34	4	3.42	4
5	Obtaining necessary approvals promoting sustainable construction	3.34	5	3.44	1	3.27	6	3.36	5
6	Providing and applying necessary incentives for sustainable compliance	3.29	6	3.28	5	3.32	5	3.26	7
7	Informing stakeholders on choices of sustainable construction materials	3.27	7	3.36	2	3.22	7	3.27	6
8	Providing relevant legislation promoting sustainable construction	3.23	8	3.33	3	3.22	7	3.20	12
9	Drafting and appraising the adequacy of contractual terms in the light of sustainable construction	3.21	9	3.18	14	3.20	9	3.22	10
10	Enforcing ethical sourcing standards for sustainable construction	3.20	10	3.31	4	3.14	12	3.20	12
11	Outlining dispute resolution procedures available for sustainable construction	3.19	11	3.15	16	3.12	13	3.26	7
12	Designing iterations towards sustainability target	3.17	12	3.21	10	3.08	14	3.22	10
13	Partnering with stakeholders to drive public consciousness	3.17	12	3.21	10	3.05	15	3.24	9
14	Drafting and appraising the adequacy of procurement method options for sustainable construction	3.16	14	3.21	10	3.16	10	3.14	14
15	Monitoring new knowledge on sustainability and ethical supply chain	3.16	14	3.26	8	3.15	11	3.13	15
16	Funding sustainability teaching, research, and development to sensitize society to the importance of sustainable construction	3.11	16	3.28	5	3.03	16	3.10	16

Table 2. Cont.

S/N	Stakeholders' Roles	All		Government		Contractors		Developers	
		MS	R	MS	R	MS	R	MS	R
DEVELOPERS' ROLES									
1	Contributing sustainable ideas at the briefing stage	3.37	1	3.46	1	3.32	1	3.38	2
2	Adherence to sound professional advice promoting sustainable construction	3.35	2	3.36	5	3.32	1	3.37	3
3	Constantly updating knowledge on sustainable building	3.34	3	3.31	7	3.24	8	3.44	1
4	Interest in sustainable construction	3.33	4	3.23	13	3.32	1	3.37	3
5	Clear specification of sustainable features, characteristics, materials, and methods	3.33	4	3.33	6	3.31	4	3.34	5
6	Evaluating price decisions in line with sustainable project objectives	3.30	6	3.38	2	3.30	5	3.26	10
7	Appraisal of sustainability credentials of design professionals	3.30	6	3.38	2	3.22	11	3.32	6
8	Design sustainably—floor, green ratio, harmless gas emissions, etc.	3.28	8	3.28	11	3.27	7	3.29	8
9	Identifying and allocating risks associated with sustainable buildings	3.27	9	3.15	16	3.28	6	3.31	7
10	Commissioning relevant professionals knowledgeable in sustainable construction	3.25	10	3.26	12	3.23	10	3.27	9
11	Preparing a post-construction maintenance plan incorporating sustainable features	3.24	11	3.31	7	3.24	8	3.21	12
12	Defining information required from sustainable stakeholders	3.21	12	3.31	7	3.22	11	3.17	15
13	Appraising client's fund acquisition decisions and advising accordingly on the benefits of sustainable projects	3.21	12	3.31	7	3.18	13	3.19	13
14	Compliance with ethical sourcing of sustainable construction materials	3.20	14	3.38	2	3.11	16	3.19	13
15	Facilitating stakeholder engagement on general and sustainability matters	3.17	15	3.13	17	3.12	15	3.23	11
16	Preparing occupancy guide for end users	3.15	16	3.21	15	3.14	14	3.14	17
17	Arranging for funding and agreement on funding terms with the other stakeholders	3.11	17	3.23	13	2.97	17	3.17	15

Government's role

The government plays a significant role in promoting sustainable construction through various actions such as initiating and directing sustainability agendas, monitoring project execution, providing guidance, and obtaining necessary approvals. Government involvement in providing incentives, relevant legislation, and dispute-resolution procedures for sustainable construction are largely agreed to, variance in opinions is not statistically significant.

Developers' roles

Developers' roles in sustainable construction identified were agreed to and variance in stakeholders' opinions are generally not statistically significant. Clear specification of sustainable features, adherence to professional advice, constant knowledge update, and interest in sustainable construction are emphasised. Designing sustainably, evaluating price decisions, and identifying risks associated with sustainable buildings are associated with developers. Developers are also responsible for commissioning knowledgeable professionals and preparing post-construction maintenance plans. Compliance with ethical sourcing of sustainable materials and facilitating stakeholder engagement are associated to developers and variance in submissions are not statistically significant.

Table 3. Extent of awareness of roles of stakeholders in the delivery of sustainable housing projects based on the type of organisation.

S/N	Stakeholders' Roles	ANOVA	
		F Stat	p Value
CONTRACTORS' ROLES			
1	Taking the lead in achieving a sustainable society through advocacy and other steps	0.338	0.714
2	Complying with material specifications and suggesting better options where possible	0.006	0.994
3	Complying with sustainability laws in the operation of their firms	1.316	0.270
4	Advocating for the delivery and patronage of sustainable buildings	1.088	0.339
5	Participating in setting sustainable demands and goals	0.334	0.716
6	Efficiently meeting demands for sustainable practices in the market	0.324	0.724
7	Adopting ethical sourcing strategies for sustainable projects	0.076	0.927
8	Simulation of design scenarios to attain sustainability targets	0.135	0.874
9	Studying and interpreting the supply chain and sourcing standards for sustainable construction	0.067	0.936
10	Updating ethical/responsible manufacturing and sourcing standards	0.375	0.688
GOVERNMENT'S ROLE			
1	Initiating and directing sustainability agenda during the construction period	0.901	0.408
2	Monitoring project execution for compliance with agreed sustainability standards	0.332	0.718
3	Providing guidance favouring sustainable construction	0.827	0.439
4	Evaluating design decisions against sustainability assessment methodologies	0.447	0.640
5	Obtaining necessary approvals promoting sustainable construction	0.241	0.786
6	Providing and applying necessary incentives for sustainable compliance	0.077	0.926
7	Informing stakeholders on choices of sustainable construction materials	0.170	0.844
8	Providing relevant legislation promoting sustainable construction	0.183	0.833
9	Drafting and appraising the adequacy of contractual terms in the light of sustainable construction	0.016	0.984
10	Enforcing ethical sourcing standards for sustainable construction	0.248	0.781
11	Outlining dispute resolution procedures available for sustainable construction	0.259	0.772
12	Design iterations towards sustainability target	0.312	0.733
13	Partnering with stakeholders to drive public consciousness	0.486	0.616
14	Drafting and appraising the adequacy of procurement method options for sustainable construction	0.032	0.969
15	Monitoring new knowledge on sustainability and ethical supply chain	0.147	0.863
16	Funding sustainability teaching, research, and development to sensitize society to the importance of sustainable construction	0.543	0.582
DEVELOPERS' ROLES			
1	Contributing sustainable ideas at the briefing stage	0.173	0.841
2	Adherence to sound professional advice promoting sustainable construction	0.024	0.976
3	Constantly updating knowledge on sustainable building	0.594	0.553
4	Interest in sustainable construction	0.196	0.822
5	Clear specification of sustainable features, characteristics, materials, and methods	0.015	0.985
6	Evaluating price decisions in line with sustainable project objectives	0.151	0.860
7	Appraisal of sustainability credentials of design professionals	0.300	0.741
8	Design sustainably—floor, green ratio, harmless gas emissions, etc.	0.004	0.996
9	Identifying and allocating risks associated with sustainable buildings	0.239	0.788
10	Commissioning relevant professionals knowledgeable in sustainable construction	0.019	0.981
11	Preparing a post-construction maintenance plan incorporating sustainable features	0.079	0.924
12	Defining information required from sustainable stakeholders	0.197	0.821
13	Appraising client's fund acquisition decisions and advising accordingly on the benefits of sustainable projects	0.170	0.844
14	Compliance with ethical sourcing of sustainable construction materials	0.625	0.536
15	Facilitating stakeholder engagement on general and sustainability matters	0.195	0.823
16	Preparing occupancy guide for end users	0.041	0.960
17	Arranging for funding and agreement on funding terms with the other stakeholders	0.699	0.498

4.2. Discussion of Findings

The objective of this research was set to assess the extent of stakeholders' awareness of their roles in the delivery of sustainable housing projects in Lagos State, Nigeria. The study considered three categories of stakeholders (Government, Developers and Contractors) and

examined their roles based on these categories. To achieve the objective, the various roles of different stakeholders in the delivery of sustainable housing projects were defined and respondents were requested to provide their experience on the extent of their awareness of these roles. The scorings provided by the respondents were subjected to Mean Score Analysis (MSA) and Analysis of Variance (ANOVA). The result obtained is presented in Table 2.

The result from Table 2 showed that all the identified roles had mean values of above 3.00, which signifies that the respondents have a moderate to high extent of awareness of stakeholders' roles in sustainable housing projects ($3.11 \leq MS \leq 3.52$). This implies that the stakeholders were aware of these roles in the delivery of sustainable housing projects and could be conscious of them. Taking into consideration the different categorized roles, regarding contractors' awareness of their roles, Table 2 shows that respondents in government organisations perceive that complying with the sustainability laws in the operation of their firms is the role of which contractors are most aware. It is closely followed by complying with material specifications and suggesting better options where possible, taking the lead in achieving a sustainable society through advocacy and other steps, participating in setting sustainable demands and goals, and adopting ethical sourcing strategies for sustainable targets.

Similarly, respondents in developers' organisations perceived that taking the lead in achieving a sustainable society through advocacy and other steps and advocating for the delivery and patronage of sustainable buildings are the roles contractors are mostly aware of. These are followed by complying with material specifications and suggesting better options where possible, complying with sustainability laws in the operation of their firm, and participating in setting sustainable demands and goals. Contractors perceive that they are mostly complying with material specifications and suggesting better options where possible with mean scores. It is closely followed by taking the lead in achieving a sustainable society through advocacy and other steps, advocating for the delivery and patronage of sustainable buildings, and efficiently meeting demands for sustainable practices in the market, complying with sustainability laws in the operations of their firms.

Overall, the five (5) top contractors' roles with a high extent of awareness include taking the lead in achieving a sustainable society through advocacy and other steps, complying with material specifications and suggesting better options where possible and complying with sustainability laws in the operation of their firms, advocating for the delivery and patronage of sustainable buildings, and participating in setting sustainable demands and goals. Considering various categories of stakeholders surveyed, it is observed that the result followed the same trend, although not without little variations.

On government awareness of their roles, Table 2 also shows that respondents in contractors' organisations perceive that monitoring of project execution for compliance with agreed sustainability standards is the role of which the government are mostly aware with a mean score. This is closely followed by initiating and directing sustainability agenda during the construction period and providing guidance favouring sustainable construction, evaluating design decisions against sustainability assessment methodologies, and providing and applying necessary incentives for sustainable compliance. Similarly, respondents in developers' organisations perceive that initiating and directing sustainable agenda during construction agenda is the role government is most likely aware of. These are followed by monitoring project execution for compliance with agreed sustainability standards and providing guidance favouring sustainable construction, evaluating design decisions, and obtaining necessary approvals promoting sustainable construction. However, the government perceives their roles differently. They suggest being most aware of obtaining necessary approvals promoting sustainable construction, followed by informing stakeholders on choices of sustainable construction materials and providing relevant legislation promoting sustainable constructions, enforcing ethical sourcing standards for sustainable constructions, funding sustainability teaching, and research and development to sensitise society to the importance of sustainable construction.

Overall, the top five (5) government roles with a high extent of awareness as assessed by all respondents include initiating and directing sustainability agenda during the construction period, monitoring project execution for compliance with agreed sustainability standards, providing guidance favouring sustainable construction, evaluating design decisions against sustainability assessment methodologies, and obtaining necessary approvals promoting sustainable construction. Contrary to the rankings of the extent of awareness of these government roles under contractors and developers, the government category of stakeholders showed variations in the rankings of these roles.

On developers' awareness of their roles, Table 2 also shows that respondents in government organisations perceive that contributing sustainable ideas at the briefing stage is the role of which developers are mostly aware, with a mean score. This is closely followed by evaluating price decisions in line with sustainable project objectives, appraisal of sustainability credentials of design professionals, compliance with ethical sourcing of sustainable construction materials, and adherence to sound professional advice promoting sustainable construction. Similarly, respondents in contractors' organisations perceive that contributing sustainable ideas at the briefing stage, adherence to sound professional advice promoting sustainable construction, and developing interest in construction are the roles developers are mostly aware of, with a mean score.

Developers perceive that they are mostly aware of constantly updating knowledge on sustainable building, with a mean score. This is closely followed by contributing sustainable ideas at the briefing stage, adherence to sound professional advice promoting sustainable constructions, developing interest in sustainable constructions, and clear specification of sustainable features, characteristics, materials, and methods. In the overall analysis, assessing the developers' roles, the top five rated roles from the analysis were contributing sustainable ideas at the briefing stage, adherence to sound professional advice promoting sustainable construction, constantly updating knowledge on sustainable building, interest in sustainable construction, and clear specification of sustainable features, characteristics, materials, and methods. There is an obvious variation in how each category of stakeholders ranked the extent of awareness of these developers' roles. With the highest MS value of 3.52 out of 5 on the rating scale, it can be inferred that the extent of awareness of these roles was not meeting expectations; hence, more effort may need to be directed into the awareness drive to improve respondents' understanding of their roles in sustainable housing project for enhanced performance as expected by the general masses. This is in agreement with [52], which established that the level of awareness and understanding of stakeholders' roles in sustainable housing projects requires more attention as this is essential to the implementation of successful sustainable construction.

Ref. [32] acknowledged the low level of awareness of the stakeholders identified by his research; it could be argued that there is an improvement in the level of awareness recorded by this study possibly because of the time effect. This is expected because the built environment is on the process of development and better advancement should be expected if related research is carried out in the near future on the awareness level of the built environment stakeholders and their involvement in sustainable buildings. In addition, Refs. [32,33,53] as well as Komolafe and Oyewole (2018) recognized the importance of the stakeholder's awareness on different aspects of sustainable built environment. Ref. [33] identified government regulatory agencies and building professionals as stakeholders with relatively high levels of awareness of sustainable buildings and users were identified as stakeholders with low levels of awareness.

This is also a confirmation of the need for consciousness on the part of all the stakeholders on the state-of-the-art sustainable built environment and to create more interest in sustainable buildings to be able to meet up with the challenges of the competitive built environment in which they are operating. Ref. [36] also advocated for an improvement in the knowledge of stakeholders (like contractors and developers) on sustainable construction in Nigeria, which corroborates the finding that the level of awareness of the identified stakeholders can be higher. Ref. [20] identified stakeholders as co-creators of value in

sustainable urban development; ref. [29] therefore suggested that stakeholder participation, which can be aided by an improved level of awareness, can contribute to enhanced productivity through the provision of forums for dialogue and interactions during the project's development stages. Their participation will therefore result in enhanced project sustainability value created within the built environment.

A further analysis was carried out to examine the differences in opinions of different categories of stakeholders regarding the extent of awareness of stakeholders' roles in sustainable housing project delivery. This was performed using Analysis of Variance (ANOVA). The result of the analysis is presented in the ANOVA column of Table 1. The result in Table 1 also indicated that no significant difference existed in respondents' perceptions of the extent of awareness of the different categories of stakeholders' roles in the delivery of sustainable housing projects. This is revealed by their F-Stat at $p > 0.05$. These contractors' roles include taking the lead in achieving a sustainable society through advocacy and other steps, complying with material specifications and suggesting better options where possible, complying with sustainability laws in the operation of their firms, advocating for the delivery and patronage of sustainable buildings, and participating in setting sustainable demands and goals, among others.

The government's roles include initiating and directing the sustainability agenda during the construction period, monitoring project execution for compliance with agreed sustainability standards, providing guidance favouring sustainable construction, and evaluating design decisions against sustainability assessment methodologies, among others. The developers' roles include contributing sustainable ideas at the briefing stage, adherence to sound professional advice promoting sustainable construction, constantly updating knowledge on sustainable building, and interest in sustainable construction. This implies that all the respondents irrespective of their category perceived the extent of awareness of all contractor, government, and developer roles in the same way. It can be inferred that category of stakeholders has no significant effect on the views of the respondents about the level of awareness of the roles of stakeholders in the delivery of sustainable housing projects.

The top-rated roles as identified by the study are very germane in achieving sustainable housing. For instance, all stakeholders especially developers should be aware that they need to take the lead in advocacy activities to achieve a sustainable society. As the main drivers of sustainable construction, they must be at the forefront of making sure every other stakeholder involved in the construction industry sees the implementation of sustainable construction. Observing the next rated role, contractors must be well aware that in the bid to ensure sustainable housing, complying with material specifications and suggesting better options should be taken as the topmost priority. Their understanding of this role would bring a big shift in the implementation of sustainable housing. As ref. [37] pointed out that one of the main barriers to sustainable project implementation was the lack of existing laws on the enforcement and regulation of sustainable building, the government should be well aware of its role in initiating, directing, and also maintaining the sustainability agenda during the construction period by enforcing necessary laws and regulations. When all stakeholders are well aware of these roles and prioritize them, then the goal of sustainable housing would be realised.

4.3. Theoretical and Practical Implications of the Study

4.3.1. Theoretical Implications

Enhanced understanding of stakeholder dynamics: By applying Mendelow's power/interest model, the study contributes to the theoretical understanding of how stakeholders' power and interests influence their roles in sustainable project delivery. It provides insights into the relationships and interactions among stakeholders in sustainable housing delivery and how these factors can shape decision-making processes, project outcomes, and sustainability performance.

The empirical analysis provides valuable insights into the extent of stakeholders' awareness of their roles in the delivery of sustainable housing projects in Lagos State, Nigeria. By examining the perceptions of different stakeholder categories (Government, Developers, and Contractors), the study discovers how stakeholders understand and prioritize their roles in sustainable construction practices. The findings of the analysis align with Mendelow's power/interest model, emphasising the influence of stakeholders' power and interest on their engagement in project delivery. The analysis also reveals that stakeholders demonstrate a moderate to high extent of awareness of their roles, indicating their recognition of the importance of sustainable practices. For instance, contractors demonstrate awareness of roles such as complying with material specifications, suggesting better options, and taking the lead in achieving a sustainable society. Developers are aware of roles related to advocating for sustainable buildings, constantly updating knowledge, and adhering to professional advice. The government stakeholders are aware of roles such as initiating and directing sustainability agenda, monitoring compliance, and providing guidance. The alignment of these findings with Mendelow's model validates its applicability in understanding stakeholder dynamics and their involvement in sustainable housing projects. By considering stakeholders' power and interest, the empirical analysis strengthens the theoretical understanding of stakeholders' roles and contributes to the broader framework of sustainable project delivery.

Identification of key stakeholder roles: The study's findings contribute to the theoretical knowledge regarding the specific roles that different stakeholders play in sustainable housing delivery. It helps to identify and categorize stakeholder roles based on their ability, power, and interest levels, highlighting their varying degrees of influence and involvement in promoting sustainability.

4.3.2. Practical Implications

Stakeholder management and engagement: The study's findings can inform practical strategies for stakeholder management and engagement in sustainable housing projects. Understanding stakeholders' power, interests, and roles can help project managers and practitioners tailor their communication, involvement, and collaboration efforts with stakeholders. It enables the development of targeted engagement plans and facilitates effective stakeholder participation throughout the project lifecycle.

Decision-making and project planning: The insights gained from the study can guide decision-making processes in sustainable housing delivery. Project stakeholders, including government agencies, contractors, and developers, can use the findings to assess the power and interests of various stakeholders and incorporate their perspectives into project planning, design, and implementation. This can lead to more informed and inclusive decision-making, considering the diverse needs and objectives of stakeholders.

Sustainable project governance: The study's implications can support the development of effective governance structures for sustainable housing projects. Understanding the roles and influence of different stakeholders can help in establishing appropriate mechanisms for collaboration, coordination, and accountability. It can aid in designing governance frameworks that promote sustainable practices, address power imbalances, and facilitate the achievement of sustainability goals.

5. Conclusions

This study examined the Stakeholders' Roles in the Delivery of Sustainable Housing Projects. The identified the key stakeholders and highlighted stakeholders' agreement with identified respective roles towards promoting the successful delivery of sustainable housing projects in Lagos State, Nigeria. The study concluded that the stakeholders are largely aware of their respective roles in the delivery of sustainable housing projects and were highly conscious of them although their extent of awareness is at varying capacity. From the result, the contractors' roles had a high extent of awareness when compared with the government and developers' roles. It is suggested that further studies could examine

the delivery efficiency of the roles by the stakeholders, as well as the roles and delivery efficiency of professionals' roles on sustainable building projects. Furthermore, other studies can compare stakeholders' roles in sustainable housing projects between Lagos and other states or administrative divisions. A regional comparison could generate new implications. It is important to acknowledge the limitations of the study, which may include sample size, geographic scope, and generalizability of findings. These limitations have been explicitly stated to provide transparency and ensure the appropriate interpretation of the study's results. Based on the study's limitations and the complexity of stakeholder dynamics in sustainable housing delivery, recommendations for further research have been made. These include conducting larger-scale studies with diverse samples, exploring the impact of cultural and contextual factors, investigating the dynamics of stakeholder collaboration and conflict resolution, and examining the long-term sustainability outcomes of different stakeholder roles and interactions.

While this study focuses on one specific state in Nigeria, the findings and insights obtained from this research can provide valuable implications for other countries in Sub-Saharan Africa and the global south. The context of sustainable housing delivery in Lagos State reflects common challenges and dynamics faced by many rapidly urbanizing regions in the region and beyond. The issues related to stakeholder awareness, roles, and the implementation of sustainable practices in the construction industry are often influenced by similar factors, such as resource constraints, policy frameworks, and socio-economic contexts. Therefore, the study's findings can serve as a starting point for further research and comparative analysis in other countries to validate and expand upon the insights obtained. By contextualizing the research within the broader sub-Saharan African and global south context, it becomes evident that the study's findings have the potential to contribute to the understanding of stakeholder dynamics and sustainable housing delivery beyond the specific case of Lagos State. These recommendations can guide future research efforts to deepen the understanding of stakeholder engagement and its implications for sustainable project delivery.

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References

1. Jepsen, A.L.; Eskerod, P. Stakeholder analysis in projects—Challenges in using current guidelines in the real world. *Int. J. Proj. Manag.* **2009**, *27*, 335–343. [[CrossRef](#)]
2. Shen, L.Y.; Song, S.C.; Hao, J.L.; Tam, V.W.Y. Collaboration among Project Participants towards Sustainable Construction—A Hong Kong Study. *Open Constr. Build. Technol. J.* **2008**, *2*, 59–68. [[CrossRef](#)]
3. Vyas, S.; Ahmed, S.; Parashar, A. BEE (Bureau of energy efficiency) and Green Buildings. *Int. J. Res.* **2014**, *1*, 23–32.
4. Beltrán, P.; Chaparro-González, F.; Pastor-Ferrando, J.-P.; Pla-Rubio, A. An AHP (Analytic Hierarchy Process)/ANP (Analytic Network Process)-based multi-criteria decision approach for the selection of solar-thermal power plant investment projects. *Energy* **2017**, *66*, 222–238. [[CrossRef](#)]
5. Olanipekun, A.O. Motivating Project Owners to Increase Their Commitment towards Improving the Delivery Performance of Green Building Projects. Ph.D. Thesis, Queensland University of Technology, Brisbane, Australia, 2017.
6. Senaratne, S.; Hewamanage, P.R. The role of team leadership in achieving LEED certification in a green building project. *Built Environ. Proj. Asset Manag.* **2015**, *5*, 170–183. [[CrossRef](#)]

7. Waniko, D.P. Green Building in Nigeria: Emerging Opportunities for the Quantity Surveying Profession. 2012. Available online: <http://alive2green.com/greenbuilding/green-building-in-nigeria-emerging-opportunities-for-the-quantity-surveying-profession/> (accessed on 20 September 2014).
8. Smith, M.; Duffy, A. Architects' perspectives on integrating sustainability into architectural practice. *J. Green Build.* **2018**, *13*, 49–69.
9. Schiavon, S.; Altomonte, S. Green building certification systems: A comparative review. *Energy Build.* **2015**, *109*, 201–214.
10. Bourne, L.M.; Walker, D.H.T. Visualising and mapping stakeholder influence. *Manag. Decis.* **2005**, *43*, 649–660. [[CrossRef](#)]
11. Rajablu, M.; Marthandan, G.; Yusoff, W.F. Managing for Stakeholders: The Role of Stakeholder-Based Management in Project Success. *J. Asian Soc. Sci.* **2015**, *11*, 111–125. [[CrossRef](#)]
12. Mitchell, R.K.; Bradley, R.A.; Wood, D.J. Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Acad. Manag. Rev.* **1997**, *22*, 853–885. [[CrossRef](#)]
13. Post, J.E.; Preston, L.E.; Sachs, S. *Redefining the Corporation—Stakeholder Management and Organizational*; Stanford University Press: Redwood City, CA, USA, 2002.
14. Olander, S.; Martine, C. Stakeholder participation for sustainable property development. *Procedia Econ. Financ.* **2015**, *21*, 57–63.
15. Walker, D.H.T.; Bourne, L.M.; Shelley, A. Influence, stakeholder mapping and visualization. *Constr. Manag. Econ.* **2008**, *26*, 645–658. [[CrossRef](#)]
16. Phillips, R.; Freeman, E.; Wicks, A.C. What stakeholder theory is not. *Bus. Ethics Q.* **2003**, *13*, 479–502.
17. Jiang, W.; Wong, J.K. Key activity areas of corporate social responsibility (CSR) in the construction industry: A study of China. *J. Clean. Prod.* **2016**, *113*, 850–860. [[CrossRef](#)]
18. Parkin, S. Sustainable development: The concept and the practical challenge. *Proc. Inst. Civ. Eng.—Civ. Eng.* **2000**, *138*, 3–8. [[CrossRef](#)]
19. Bal, M.; Bryde, D.; Fearon, D.; Ochieng, E. Stakeholder engagement: Achieving sustainability in the construction sector. *Sustainability* **2013**, *5*, 695–710. [[CrossRef](#)]
20. Ng, S.T.; Li, T.H.; Wong, J.M. Rethinking public participation in infrastructure projects. *Proc. Inst. Civil Eng. Munic. Eng.* **2012**, *165*, 101–113.
21. Li, Y.Y.; Chen, P.-H.; Chew DA, S.; Teo, C.C.; Ding, R.G. Exploration of critical external partners of architecture/engineering/construction (AEC) firms for delivering green building projects in Singapore. *J. Green Build.* **2012**, *7*, 193–209. [[CrossRef](#)]
22. Liang, F.Y. Influences on innovation benefits during implementation: Client's perspective. *J. Constr. Eng. Manag.* **2010**, *133*, 306–315. [[CrossRef](#)]
23. Takim, R. The management of stakeholders' needs and expectations in the development of construction project in Malaysia. *Mod. Appl. Sci.* **2009**, *3*, 167–175. [[CrossRef](#)]
24. Winch, C. *Dimensions of Expertise: A Conceptual Exploration of Vocational Knowledge*. Bloomsbury Publishing: London, UK, 2013.
25. Cadman, D. *The Vicious Circle of Blame. Sustainable Construction Task Group*; The RICS Research Foundation: London, UK, 2000.
26. Mendelow, A.L. Environmental scanning—the impact of the stakeholder concept. In Proceedings of the 2nd International Conference on Information Systems, Cambridge, MA, USA, 7–9 December 1981.
27. Calvert, S. *Managing Stakeholders: The Commercial Project Manager*; McGraw-Hill: New York, NY, USA, 1995.
28. Beringer, C.; Jonas, D.; Kock, A. Behavior of internal stakeholders in project portfolio management and its impact on success. *Int. J. Proj. Manag.* **2013**, *31*, 830–846. [[CrossRef](#)]
29. Gomes, R.C.; Liddle, J.; Gomes, L.O.M. A five-sided model of stakeholder influence. *Public Manag. Rev.* **2010**, *12*, 701–724. [[CrossRef](#)]
30. Williams, K.; Dair, C. What is stopping sustainable building in England? Barriers experienced by stakeholders in delivering sustainable developments. *Sustain. Dev.* **2007**, *15*, 135–147. [[CrossRef](#)]
31. Osuizugbo, I. Traditional Building—Construction Problems: Need for Espousal of Sustainable Construction in Nigeria. *Int. J. Sci. Res. Publ.* **2018**, *8*, 194–199. [[CrossRef](#)]
32. Pitt, M.; Tucker, M.; Riley, M.; Longden, J. Towards sustainable construction: Promotion and best practices. *Constr. Innov. Inf. Process Manag.* **2009**, *9*, 201–224. [[CrossRef](#)]
33. Gan, X.; Zuo, J.; Ye, K.; Skitmore, M.; Xiong, B. Why sustainable construction? Why not? An owner's perspective. *Habitat Int.* **2015**, *47*, 61–68. [[CrossRef](#)]
34. Dalibi, S.G.; Feng, J.C.; Shuangqin, L.; Sadiq, A.; Bello, B.S.; Danja, I.I. Hindrances to Green Building Developments in Nigeria's Built Environment: "The Project Professionals' Perspectives". *IOP Conf. Ser. Earth Environ. Sci.* **2017**, *63*, 012033. [[CrossRef](#)]
35. Daniel, E.I.; Oshineye, O.; Oshodi, O. Barriers to Sustainable Construction Practice in Nigeria. In *Proceeding of the 34th Annual ARCOM Conference, Belfast, UK, 3–5 September 2018*; Gorse, C., Neilson, C.J., Eds.; Association of Researchers in Construction Management: Belfast, UK, 2018.
36. AlSanad, S. Awareness, drivers, actions, and barriers of sustainable construction in Kuwait. *Procedia Eng.* **2015**, *118*, 969–983. [[CrossRef](#)]
37. Circo, C.J. Using mandates and incentives to promote sustainable construction and green building projects in the private sector: A call for more state land use policy initiatives. *Penn St. L. Rev.* **2007**, *112*, 731.

38. Ong, P.S.; Kang, S. Green engineering practices in structural engineering: State-of-the-art and future directions. *J. Green Build.* **2018**, *13*, 37–60.
39. Panagiotidou, M.; May, D. Role of the structural engineer in sustainable design. In *Sustainable Buildings and Structures*; Springer: Cham, Switzerland, 2017; pp. 1–18.
40. Smith, J.L.; Love, P.E. Quantity surveyors and sustainability: A review of the Australian quantity surveying profession. *J. Constr. Eng. Manag.* **2012**, *139*, 1263–1271.
41. Akintoye, A.; Chinyio, E.A. Life cycle costing techniques for maintenance of building assets. *Facilities* **2005**, *23*, 347–364.
42. Aibinu, A.A.; Ofori, G. The roles and responsibilities of project managers in sustainable building projects. *J. Constr. Dev. Ctries.* **2007**, *12*, 15–34.
43. Loosemore, M.; Lim, B.T. Stakeholder engagement in building projects: Exploring the contribution of social network analysis. *Eng. Constr. Archit. Manag.* **2015**, *22*, 674–693.
44. Riffat, S.B.; Ma, X. Sustainable architecture in the UK: Current state and future directions. *Energy Build.* **2003**, *35*, 553–566.
45. Zhou, G.; Ma, Z. A review on building energy efficiency in China during “12th Five Year Plan”. *Renew. Sustain. Energy Rev.* **2017**, *75*, 220–232.
46. Srebric, J.; Chen, Q.; Javed, S. Review of sustainable urban district cooling systems. *Energy Build.* **2004**, *36*, 393–398.
47. Kang, J.; Skitmore, M. Impact of plumbing system design on construction waste generation. *Build. Res. Inf.* **2002**, *30*, 381–394.
48. Papargyropoulou, E.; Jones, N.; Iribarren, D. The food waste hierarchy as a framework for the management of food surplus and food waste. *J. Clean. Prod.* **2014**, *76*, 106–115. [[CrossRef](#)]
49. Ruiz-Torres, A.J.; Fernandez-Sanchez, G. Environmental impact and life cycle assessment (LCA) of traditional and ecological building systems: A case study in Spain. *Build. Environ.* **2013**, *65*, 99–108.
50. Lützkendorf, T.; Lorenz, D. Sustainable building certification: A review of comparative assessment systems. *Int. J. Sustain. Build. Technol. Urban Dev.* **2005**, *1*, 221–234.
51. Sutrisna, M.; Shah, M.N. An assessment of sustainable housing development in Malaysia: Regulatory framework and stakeholder engagement. *Int. J. Sustain. Build. Technol. Urban Dev.* **2019**, *10*, 214–226.
52. Nduka, D.; Ogunsanmi, O. Construction Professionals’ Perception on Green Building Awareness and Accruable Benefits in Construction Projects in Nigeria. *Covenant J. Res. Built Environ.* **2015**, *5*, 188–197.
53. Mukherjee, A.; Muga, H. An integrative framework for studying sustainable practices and its adoption in the AEC industry: A case study. *J. Eng. Technol. Manag.* **2010**, *27*, 197–214. [[CrossRef](#)]

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