

Sustainability in Construction: A Quantity Surveyor's Perspective on Green Building Practices

Olabanji M. KADI

Department of Quantity Surveying, Federal University of Technology, Minna, Nigeria

mikeolabanji@gmail.com

Abstract

Green costing is one of the new niches for the quantity surveying profession. With the advancement of technologies and mechanisms, integrating costs and other relevant data can be done to ensure greater financial transparency for projects. This study assesses a quantity surveyor's perspective on green building practices. The study targeted 46 registered quantity surveying firms in Abuja, Nigeria, according to the Nigerian Institute of Quantity Surveyors [NIQS] Directory. Three respondents were sampled from each firm, which include principal partners, senior quantity surveyors, and junior quantity surveyors. A quantitative research approach was thus employed, with the use of a questionnaire to collect data from 138 respondents consisting of quantity surveyors. The data analysis was performed using frequency count, percentage, mean item score, and standard deviation. Findings from the study revealed that 23.9% of respondents indicated awareness of green building, while 76.1% showed a lack of awareness. Furthermore, the findings reveal that 50.0% of the respondents believed that the current state of sustainable practices was significant. The most important challenges and barriers to the adoption of green building practices are a lack of government incentives, a lack of effort by local construction industry professional bodies, and a lack of stakeholder empowerment, with MIS = 4.40, 4.40, and 3.85 ranked 1st, 2nd, and 3rd, respectively. The findings concluded that, from a quantity surveyor's perspective, the current state of sustainable practices in the construction industry is increasingly significant and evolving. The research suggests that to facilitate a seamless shift towards sustainable green building, it is essential for players in the industry to actively investigate and embrace sustainable principles, particularly in the first phases of project design.

Keywords: Building, construction, green practices, quantity surveyor's, sustainability.

1.0 Introduction

The construction sector has seen rapid change, transitioning from traditional design and construction techniques to innovative delivery systems appropriate for sustainable building practices. This transformation offers quantity surveyors the chance to expand their positions and adapt to the industry's new demands.

Dobson et al. [1] assert that sustainable building requires a comprehensive and long-term perspective. In light of the transition towards sustainability, the existing parameters of the quantity surveying profession would be inadequate for maintaining competitiveness [2], [3], [4]. Consequently, it is essential for current quantity surveyors to augment their abilities and core competencies throughout the whole spectrum of sustainability.

Quantity surveyors, with a robust understanding of technology and innovation, serve as essential consultants across all phases of a project life cycle [3], [5], [6]. Sustainable building has been promoted as a solution for the social, economic, and environmental challenges afflicting the construction sector [2], [3], [7], [8].

In achieving sustainable built environments, Bolade-Oladepo et al. [9] identified the key aspects of sustainable clientship. Bolade-Oladepo et al. [9] delineated sustainable design, sustainable services design, sustainable cost management, sustainable construction, sustainable operation, and sustainable deconstruction as the principal domains of sustainable clientship. The quantity surveyor's function aligns with sustainable construction, cost management, operation, and deconstruction, as per the previously listed characteristics of a sustainable built environment. For quantity surveyors to perform well in these tasks, it is essential to comprehend the requirements of sustainable building and identify the necessary abilities.

The execution of sustainable building and its requirements vary across different nations. The quantity surveyor [QS], as the cost specialist in the building sector, is essential for attaining sustainable construction. Consequently, it is essential to cultivate the competencies of the QS to address these requirements. To maintain relevance in the business, quantity surveyors must include sustainable building practices with the continuously developing construction trends [10], [11]. Comprehending the principles of sustainable building is essential for a quantity surveyor to maintain efficacy in the sector. Carlidge [12] identified three primary domains where the essential competencies of quantity surveyors may significantly contribute to sustainability in the modern built environment: sustainability evaluation, sustainability performance, and sustainability value. Numerous researchers have delineated novel functions and services that quantity surveyors can provide to facilitate sustainable construction, including, but not limited to, green costing, carbon footprint analysis, property performance reporting, green

building rating assessment, and the financial implications of attaining a green rating [5], [10], [13], [14]. This research evaluates a quantity surveyor's viewpoint on sustainable construction techniques.

. To achieve the aim, the following objectives are formulated to:

1. To investigate the current state of sustainable practices in the construction industry from a quantity surveyor's perspective.
2. To identify the challenges and barriers to the adoption of green building practices.

1.2 Literature Review

1.2.1 Sustainable construction

The acknowledgement of sustainable construction was first presented in 1994 at the inaugural international conference on sustainable construction, held in Tampa, Florida, United States [15], [16]. The conference defined sustainable building as the establishment and maintenance of a healthy built environment via efficient resource utilisation and the application of ecological design principles [17]. Certain experts contend that the construction industry has an obligation to advocate for sustainability in building practices [19], [17]. Kibert [18] contended that sustainable construction needs to be seen as an integral component of sustainable development [18], [20]. This supports the assertion that sustainable building is the means through which the construction industry aids in achieving sustainable development [21].

This study defines sustainable construction as the use of sustainable development principles within the building sector. Considering the relationship between sustainable building and sustainable development, it is essential that sustainable construction techniques emphasise the core principles of sustainability. Sustainable development, as articulated by Brundtland et al. [1987], denotes development that satisfies present demands while guaranteeing that future generations may meet their own needs without compromise. The Venn diagram in Figure 2.1 illustrates that achieving sustainable development requires the integration of environmental, economic, and social dimensions of sustainability. The environmental dimension of sustainability primarily emphasises mitigating the adverse impacts of activities on the environment, while economic sustainability seeks to sustain robust economic growth while fulfilling human needs [22], [23], [24].

Ameh et al. [25] assert that the social dimension of sustainability includes addressing the legal, moral, and ethical obligations within the community where an activity occurs. To advance sustainable construction in alignment with sustainable development principles, it is essential to optimise the three pillars of sustainability.

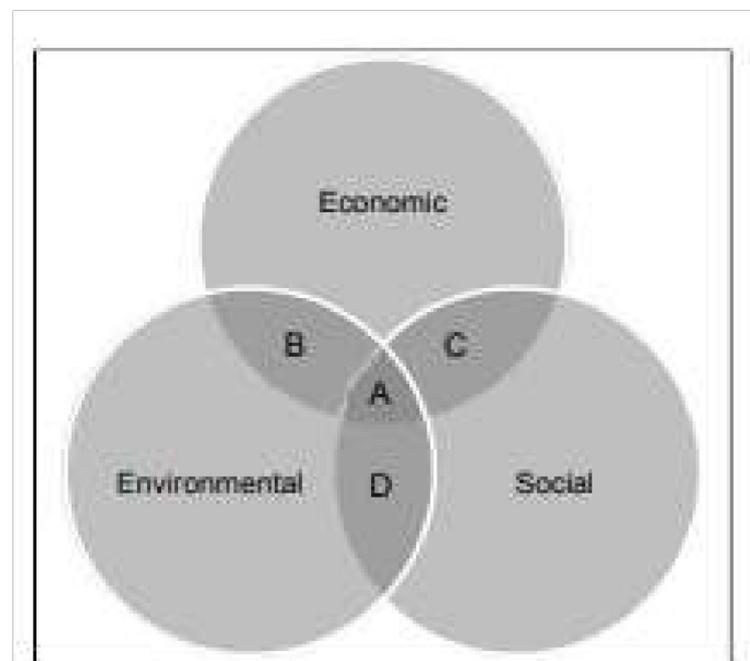


Figure 1: Three pillars of sustainability
Source: Edum-Fotwe and Price [26]

Figure 1 illustrates that sustainable construction manifests in several ways. Analysing one pillar, two pillars, or all three pillars aligns with the primary, secondary, and tertiary tiers of sustainable construction, accordingly. In the construction sector, the notion of sustainable building has traditionally emphasised two dimensions of sustainability: the environmental dimension and the economic dimension. This perspective is corroborated by other investigations [23],[19].

The emphasis has been on optimising environmental and economic sustainability, while the social sustainability dimension has been overlooked [26], [27], [13]. The situation is exacerbated by the reality that social sustainability is often the most misunderstood of the three sustainability pillars, thereby receiving the least consideration [16].

1.2.2 Green building

Green building is a practical instrument created by the construction industry to accomplish the objectives of sustainable development. This is accomplished by the preservation and efficient utilisation of resources like as water, waste, and energy. It involves mitigating the impact of materials and emissions on the environment and enhancing indoor environmental quality through green design [18].

In order for the Nigerian construction sector to remain competitive in the global construction industry, it is essential to promptly implement measures to enhance the expertise of construction professionals [28], [29]. The process involves the integration of several methods and processes aimed at reducing building energy consumption and improving human health [30],[31].

It is well acknowledged that conventional buildings contribute approximately 40% of the world's energy usage [30]. According to Feltes [32], green building is not a practical option unless it is economically advantageous compared to traditional construction techniques. Vinyangkoon [33] said that green buildings produce cost savings in operation and maintenance by integrating energy-efficient lighting systems, enhancing air quality, and using green roofs that recycle runoff water to minimise waste.

The integration of sustainability aims and objectives should be included into the interconnected building processes from now on [34]. The adoption and expansion of green building practices in developed nations is evident through the establishment of green building standards, such as the Building Research Establishment Environmental Assessment Method [BREEAM], the Australian Building Greenhouse Rating Tool [ABGR], and the Green Building Council [USGBC] utilised in the United States. The USGBC is a non-profit organisation that created the Leadership in Energy and Environmental Design [LEED] system [35], [36].

2.0 Methodology

This study used a survey design methodology, since it effectively facilitates the acquisition of quantitative data from a broad and varied respondent pool within a concise timeframe [Bryman, 2016]. A study population is defined as a compilation of all instances that meet certain, meticulously selected criteria. Population elements refer to the individual members of a population, such as quantity surveyors. The study's targeted population included the 46 registered quantity surveying businesses in Abuja, Nigeria, as listed in the Nigerian Institute of Quantity Surveyors [NIQS] Directory [NIQS, 2024]. Three responses were selected from each company, including the Principal Partner, Senior Quantity Surveyors, and Junior Quantity Surveyors. The study's population size is 138, indicating three respondents from every firm, representing a census of all quantity surveying companies in Abuja. The data collecting tool used in this study is a questionnaire, reflecting the quantitative character of the research. A well-designed questionnaire was created to obtain pertinent information for the investigation. The questionnaire had closed-ended questions. The acquired data was presented and analysed via IBM's Statistical Package for the Social Sciences [SPSS] version 25 and Microsoft Excel 2016 through descriptive tools. The analysis of the gathered data was conducted using the following descriptive techniques.

3.0 Results and Discussion

3.1. The demographic information of the respondents

This section delineates and examines the findings of the demographic analysis of the respondents from the field survey conducted in this research. Five [5] demographic factors were analysed. Table 1 displays the ranking of participants. The results indicated that 54.0% of the participants were principal partners, whilst 29.0% and 18.0% were junior quantity surveyors and senior quantity surveyors, respectively. A significant proportion of the responders [83%] were either main quantity surveyors or senior quantity surveyors. Consequently, the respondents had sufficient information about organisational culture and overall quality management practices inside their respective enterprises. Furthermore, Table 1 presents the results of the years of experience of respondents in consultation services. The findings indicated that 18% of respondents possessed less than 5 years of experience, 29% had 6–10 years, 11% had 11–15 years, 11% had 16–20 years, and 32% had over 20 years of experience in consultancy. In general, over 82% of the respondents have six or more years of expertise in consultant services. The majority of responders has extensive expertise in the subject of quantity surveying. Furthermore, Table 1 displays the results of respondents' knowledge of green construction inside their organisation. The results reveal that 23.9% of respondents demonstrated awareness of green construction, whilst 76.1% exhibited a lack of understanding. This study aligns with Christabel and Vincent [38], indicating that attitudes among professional Quantity Surveyors vary according to age, membership levels, and job experience. The impact of limited understanding of sustainable building on its adoption in Nigeria aligns with results from literature [39]; [40] across

various nations. The outcome further corroborates the conclusions of Oke *et al.* [41]. Public knowledge of sustainable building is crucial for its acceptance [25]. Oke *et al.* [41] assert that the adoption of sustainable building initiates with awareness, followed by interest.

Table 1: Demographic Information of the Respondents

Rank	Frequency	Percent
Principal partner	75	54.3
Senior Quantity surveyors	24	17.4
Junior Quantity surveyors	39	28.3
Total	138	100.00
Year of experience in the consultancy business	Frequency	Percent
1-5 years	24	17.4
6 – 10 years	39	28.3
11 – 15 years	15	10.9
16-20 years	15	10.9
> 20 years	45	32.6
Total	138	100.00
Respondent's years of experience in the firm	Frequency	Percent
1-5 years	63	45.6
6 – 10 years	15	10.9
11 – 15 years	24	17.4
16 – 20years	-	-
> 20 years	36	26.1
Total	138	100.00
Respondents' awareness of green Building	Frequency	Percent
Yes	33	23.9
No	105	76.1
Total	138	100.0

3.2 Current state of sustainable practices in the construction industry from a quantity surveyor's perspective

Table 2 shows the current state of sustainable practices in the construction industry from a quantity surveyor's perspective. The findings reveal that 50.0% of the respondents were perceptive that the current state of sustainable practices was significant, 17.4% opined very significant, 13.0% opined insignificant, 10.9% were moderately significant, and the remaining 8.7% opined minor. This implies that, from a quantity surveyor's perspective, the current state of sustainable practices in the construction industry is increasingly significant and evolving.

Table 2: Current state of sustainable practices

Current State of Sustainable Practices	Frequency	Percent
Very significant	24	17.4
Significant	68	50.0
Moderately Significant	15	10.9
Minor	12	8.7
Insignificant	18	13.0
Total	138	100.00

3.3 Challenges and Barriers to the Adoption of Green Building Practices

The research established the mean index score [MIS] to illustrate the significance of the problems and constraints to adopting green building methods. Table 3 indicates that the primary challenges and obstacles to the implementation of green building practices are insufficient government incentives, inadequate initiatives by local

construction industry professional organisations, and a deficiency in stakeholder empowerment, with MIS scores of 4.40, 4.40, and 3.85, ranked 1st, 2nd, and 3rd, respectively. Suboptimal waste management strategies, ineffective energy generation and utilisation methods, and conventional architecture have not been integrated into green building designs, with MIS scores of 3.79, 3.78, and 3.77 ranking 8th, 9th, and 10th, respectively, as the least significant challenges and obstacles to the implementation of green building practices. The average significance of all identified obstacles and hurdles to the implementation of green building methods was substantial [MIS = 3.83]. The absence of governmental incentives, insufficient effort from local construction industry professional bodies, and inadequate empowerment of stakeholders in Nigeria align with the findings from various studies [42],[43], [45], [39] conducted in different countries. Secondly, the impact of inadequate urban planning and ineffective enforcement of land use policies on the promotion of sustainable construction in Nigeria corroborates the findings from various studies [40], [42], [43], [44], [45], [46], conducted in different countries.

Table 3: Challenges and Barriers to the Adoption of Green Building Practices

CODE/NO	Challenges and Barriers to the Adoption of Green Building Practices	MIS	SD	Rank	Decision
C1	Lack of incentives from the Government	4.00	0.60	1st	Important
C2	Lack of effort by local construction industry professional bodies	4.00	0.56	2nd	Important
C3	Lack of empowerment of stakeholders	3.83	0.72	3rd	Important
C4	Lack of proper urban planning and poor enforcement of land use policies	3.81	0.83	4th	Important
C5	Financial challenges on the part of developers and regulators	3.81	0.87	4th	Important
C6	Limited education and research on green building concepts	3.80	0.67	5th	Important
C7	Cultural barriers	3.80	0.79	5th	Important
C8	Poor waste management strategies	3.79	0.86	8th	Important
C9	Inefficient methods of generating and using energy	3.78	0.77	9th	Important
C10	Traditional architecture has not been incorporated into green building designs	3.77	0.85	10th	Important
	Average MIS	3.83			Important

4.0 Conclusion

This study critically examined the current state of sustainable practices in the Nigerian construction industry from the perspective of quantity surveyors, with a focus on firms operating in Abuja. The findings reveal that while sustainable construction is gaining traction, there remains a significant gap in awareness, knowledge, and implementation of green building practices among professionals. Specifically, only 23.9% of the surveyed quantity surveyors demonstrated adequate awareness of green building principles, which underscores a pressing need for capacity building. Despite this limitation, a majority of respondents [50%] acknowledge the growing importance of sustainability in the construction process. The study further identified major barriers to the adoption of green building practices, including lack of government incentives, insufficient efforts from professional bodies, and inadequate stakeholder empowerment. From a quantity surveyor's viewpoint, integrating sustainability into the early stages of design, planning, and cost evaluation is not only necessary but inevitable for industry advancement. The role of the quantity surveyor must therefore evolve beyond traditional cost management to include sustainability assessment, green costing, and life-cycle analysis. In conclusion, while the Nigerian construction industry is gradually aligning with global trends in sustainability, more deliberate efforts are required from government, professional bodies, educational institutions, and private stakeholders to drive widespread adoption of green building practices. The insights from this research provide a foundation for further studies and offer direction for policy formulation and professional development. Based on the findings of this study, the following recommendations are proposed:

1. The Nigerian Institute of Quantity Surveyors [NIQS] and related professional bodies should organize continuous professional development [CPD] programs, workshops, and seminars to enhance awareness and deepen the understanding of green building practices among quantity surveyors.
2. Tertiary institutions offering Quantity Surveying should embed sustainability, green costing, and environmental economics into their core curriculum to equip future professionals with relevant competencies.
3. The Nigerian government should provide fiscal incentives such as tax breaks, grants, and subsidies for construction projects that adopt green building practices. This would encourage wider industry adoption.
4. Developers, contractors, and consultants should be actively engaged and empowered through policy frameworks and public-private partnerships to encourage sustainable construction initiatives.

This study contributes to the growing body of literature on sustainable construction by offering a contextual understanding of green building practices from a quantity surveyor's perspective in Abuja, Nigeria. It uniquely highlights the limited awareness among QS professionals, quantifies the perceived significance of sustainable practices, and prioritizes practical barriers such as government inaction and institutional inertia. By isolating the roles and challenges of quantity surveyors in green construction, the study fills a critical gap in both local and international sustainability discourse. It also provides an empirical foundation for policy development, curriculum reform, and future research in sustainable quantity surveying.

References

- [1] D. W. Dobson, A. Sourani, B. Sertyesilisik, and A. Tunstall, "Sustainable construction: Analysis of its costs and benefits," *American Journal of Civil Engineering and Architecture*, vol. 1, no. 2, pp. 32–38, 2013, doi: 10.12691/ajcea-1-2-.
- [2] G. Yogeshwaran, B. A. S. Perera, and M. R. F. Ariyachandra, "Competencies expected of graduate quantity surveyors working in developing countries," *Journal of Financial Management of Property and Construction*, vol. 23, no. 2, pp. 202–220, 2018, doi: 10.1108/JFMPC-06-2017-0019.
- [3] P. B. S. Chamikara, B. A. S. Perera, and M. N. N. Rodrigo, "Competencies of the quantity surveyor in performing for sustainable construction," *International Journal of Construction Management*, vol. 20, no. 3, pp. 237–251, 2020, doi: 10.1080/15623599.2018.1484848.
- [4] O. R. Olaniyan and A. S. Olaniyan, "The role of quantity surveyors in managing life cycle costs in sustainable construction," *Int. J. Adv. Multidiscip. Res. Stud.*, vol. 5, no. 2, pp. 1112–1117, 2025.
- [5] Y. M. Wong, "The expanded role of quantity surveyors in green buildings," 2017. [Online]. Available: www.nziqs.co.nz/Portals/9/PAQS/Abstracts/260%20-%20y%20wong.pdf.
- [6] M. Ahmed, "Identifying barriers to the implementation and development of sustainable construction," *International Journal of Construction Management*, vol. 1, pp. 1–12, 2021, doi: 10.1080/15623599.2021.19675.
- [7] T. H. Lim, A. Z. J. Liu, and B. L. Oo, "Awareness and practices of sustainable construction in Australia: Consultant quantity surveyors' perception," *AIP Conference Proceedings*, vol. 2124, Jul. 2019, doi: 10.1063/1.5117120.
- [8] Chandramohan, B. A. K. S. Perera, and K. G. Dewagoda, "Diversification of professional quantity surveyors' roles in the construction industry: The skills and competencies required," *International Journal of Construction Management*, vol. 2, pp. 1–8, 2020, doi: 10.1080/15623599.2020.1720058.
- [9] F. A. Bolade-Oladepo, F. O. Oladipo, and O. A. Fasuyi, "Sustainable built environment: The role of quantity surveyors," *IOSR Journal of Engineering (IOSRJEN)*, vol. 10, no. 1, pp. 2278–8719, 2020. [Online]. Available: http://iosrjen.org/Papers/vol10_issue1/Series-1/A1001010106.pdf.
- [10] A. Opoku and C. Egbu, "The relevance of sustainability literacy in a postgraduate built environment program," *International Journal of Construction Education and Research*, pp. 1–13, 2017, doi: 10.1080/15578771.2017.1286417.
- [11] O. R. Olaniyan and A. Adegoroye, "Bridging development and sustainability: An analysis of the Nigerian real estate sector," *European Journal of Theoretical and Applied Sciences*, vol. 2, no. 2, pp. 809–823, 2024.
- [12] E. Cartlidge, "Faster-than-light neutrinos: OPERA confirms and submits results, but unease remains," *Science Insider*, 2011. [Online]. Available: <https://www.science.org/content/article/faster-light-neutrinos-opera-confirms-and-submits-results-unease-remains>.
- [13] K. Shehu, "Role of quantity surveyor in green building development," *Nasara Journal of Science and Technology*, vol. 10, no. 1, pp. 45–55, 2023.
- [14] D. T. Omotayo, S. W. Tan, and D. Ekundayo, "Sustainable construction and the versatility of the quantity surveying profession in Singapore," *Smart and Sustainable Built Environment*, vol. 12, no. 2, pp. 435–457, 2023.
- [15] J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, 3rd ed. Hoboken, NJ: John Wiley & Sons, 2013.

- [16] L. Chen et al., "Conversion of waste into sustainable construction materials: A review of recent developments and prospects," *Materials Today Sustainability*, p. 100930, 2024.
- [17] R. C. Hill and P. A. Bowen, "Sustainable construction: Principles and a framework for attainment," *Construction Management and Economics*, vol. 15, pp. 223–239, 1997.
- [18] J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, 2nd ed. Hoboken, NJ: John Wiley, 2008.
- [19] L. Bourdeau, "Sustainable development and the future of construction: A comparison of visions from various countries," *Building Research & Information*, vol. 27, pp. 354–366, 1999.
- [20] N. Islam et al., "Review on sustainable construction and demolition waste management. Challenges and research prospects," *Sustainability*, vol. 16, no. 8, p. 3289, 2024.
- [21] CIB, *Agenda 21 on Sustainable Construction*. Rotterdam: CIB, 1999.
- [22] X. Gan et al., "Why sustainable construction? Why not? An owner's perspective," *Habitat International*, vol. 47, pp. 61–68, 2015.
- [23] Z. Majdalani, M. Ajam, and T. Mezher, "Sustainability in the construction industry: A Lebanese case study," *Construction Innovation*, vol. 6, pp. 33–46, 2006.
- [24] H. C. Victar et al., "Roles and competencies of quantity surveyors in achieving a circular built environment: An investigation according to 3R principles," *Smart and Sustainable Built Environment*, vol. 13, no. 4, pp. 1015–1040, 2024.
- [25] S. Ameh et al., "Sustainable construction education: Assessing the adequacy of built-environment professionals' training," in *West Africa Built Environment Research (WABER) Conference*, 2010.
- [26] F. T. Edum-Fotwe and A. D. F. Price, "A social ontology for appraising sustainability of construction projects and developments," *International Journal of Project Management*, vol. 27, no. 4, pp. 313–322, 2009.
- [27] L. Y. Shen et al., "Collaboration among project participants towards sustainable construction—A Hong Kong study," *Open Construction and Building Technology Journal*, vol. 2, pp. 59–68, 2008.
- [28] O. Onososen, O. Osanyin, and M. O. Adeyemo, "Drivers and barriers to the implementation of green building development," *PM World Journal*, vol. 8, no. 9, pp. 1–15, 2019.
- [29] S. Yin et al., "Green buildings: Requirements, features, life cycle, and relevant intelligent technologies," *Internet of Things and Cyber-Physical Systems*, 2024.
- [30] Q. K. Qian, E. H. Chan, and A. G. Khalid, "Challenges in delivering green building projects: Unearthing the transaction costs (TCs)," *Sustainability*, vol. 7, no. 4, pp. 3615–3636, 2015.
- [31] O. Iwuanyanwu et al., "The role of green building materials in sustainable architecture: Innovations, challenges, and future trends," *International Journal of Applied Research in Social Sciences*, vol. 6, no. 8, pp. 1935–1950, 2024.
- [32] V. Feltes, *Toward Sustainable Building: Green Building Design and Integration in the Built Environment*. Washington State University, 2007.
- [33] Vinyangkoon, *Commercial Green Building: The Value-Added Gap Perspective*. Stockholm: Department of Real Estate Management, 2012.
- [34] Z. K. I. Zakariyyah et al., "Indigenous construction firms' entrepreneurial orientation for sustainable development," in *13th Annual Research Conference and Fair*, 2018, pp. 209–217.
- [35] S. Sayce, "Is sustainability reflected in commercial property prices: A review of existing evidence," *Journal of RICS Sustainability*, 2010.
- [36] K. Shimizu, "What constrains or facilitates divestitures of formerly acquired firms? The effects of organizational inertia," *Journal of Management*, vol. 31, no. 1, pp. 50–72, 2010.
- [37] Bryman, *Social Research Methods*. Oxford University Press, 2016.
- [38] H. M.-F. Christabel and N. C.-W. Vincent, "Quantity surveyors' background and training, and their ethical concepts, conceptions and interests considerations," *Construction Management and Economics*, vol. 21, no. 1, pp. 43–67, 2010, doi: 10.1080/014461903200006511.
- [39] S. D. Djokoto, J. Dadzie, and E. Ohemeng-Ababio, "Barriers to sustainable construction in the Ghanaian construction industry: Consultants perspectives," *Journal of Sustainable Development*, vol. 7, no. 1, p. 134, 2014.
- [40] Enshassi et al., "Perception of construction managers towards safety in Palestine," *International Journal of Construction Management*, vol. 7, no. 2, pp. 41–51, 2007.
- [41] T. R. Oke et al., *Urban Climates*. Cambridge University Press, 2017.
- [42] O. Ametepey, C. Aigbavboab, and K. Ansahb, "Barriers to successful implementation of sustainable construction in the Ghanaian construction industry," in *6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015)*, 2015, pp. 1682–1689.
- [43] Aghimien et al., "Barriers to sustainable construction practices in the Zambian construction industry," in *International Conference on Industrial Engineering and Operations Management*, 2018, pp. 2383–2392.

- [44] Mosly, "Barriers to the diffusion and adoption of green buildings in Saudi Arabia," *Journal of Management and Sustainability*, vol. 5, no. 4, pp. 104–114, 2015.
- [45] Darko and A. P. C. Chan, "Review of barriers to green building adoption," *Sustainable Development*, 2016, doi: 10.1002/sd.1651.
- [46] P. S. Abraham and H. Gundimeda, "'Greening' the buildings—An analysis of barriers to adoption in India," *Cities and the Environment (CATE)*, vol. 10, no. 1, pp. 1–20, 2018.