BARRIERS AND DRIVERS OF GREEN BUILDING ADOPTION IN GHANA

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ABSTRACT

Purpose: This study investigated the barriers and drivers of green building adoption in Ghana and proposed strategies to accelerate sustainable construction practices.

Design/Methodology/Approach: A quantitative research design was employed, and structured questionnaires were administered to 320 construction professionals drawn from construction firms, consultancy practices, and regulatory institutions. The analysis used descriptive statistics, including mean scores and frequency distributions, to capture respondents' views.

Findings: Awareness of green building concepts among professionals is moderate, with professionals largely focusing on cost and technical considerations rather than environmental and social benefits. The most significant barriers identified were high initial costs, the cost of green materials, a lack of financial incentives, limited technical expertise, and weak regulatory enforcement. Conversely, government incentives, energy cost savings, professional training, tax rebates, and demonstration projects emerged as the most important drivers for adoption.

Practical Implications: The study recommends introducing enforceable green building codes, tax rebates, and financial incentives for sustainable projects, along with increased public awareness campaigns and stakeholder collaboration.

Social Implications: These strategies could create an enabling environment for green building adoption, balancing economic viability, environmental protection, and social well-being within the Ghanaian construction sector.

Originality/ Value: The study concludes that while green building adoption in Ghana remains at a moderate level, there is strong potential for growth if financial constraints are addressed, regulatory frameworks are strengthened, and professional capacity is enhanced.

Keywords: *Adoption. barriers. building. drivers. green*

BARRIERS AND DRIVERS OF GREEN BUILDING ADOPTION IN GHANA

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1.0 INTRODUCTION

Green building technologies offer a promising solution to these environmental challenges, providing numerous benefits, including reduced energy consumption, water conservation, and improved indoor air quality (Kibert, 2020). Despite these benefits, the adoption of green building technologies in Ghana remains limited.

According to Darko et al. (2020), the lack of adoption of green building technologies in Ghana can be attributed to various factors, including limited knowledge and awareness of green building benefits and technologies among construction stakeholders. Additionally, the higher costs associated with green building technologies are a significant barrier to adoption (Ametepey et al., 2019).

The lack of adoption of green building technologies in Ghana exacerbates these environmental challenges, highlighting the need for sustainable building practices. According to Kyeremeh et al. (2021), adopting green building technologies can significantly reduce the environmental impact of the construction industry in Ghana. The aim of this study is to investigate the barriers and drivers of green building adoption in Ghana. The objectives of this study are to: identify the critical factors that influence green building adoption in Ghana; identify the key barriers to green building adoption in Ghana; and examine the drivers of green building adoption in Ghana.

2.0 LITERATURE REVIEW

The adoption of green building (GB) practices has emerged as a critical pathway toward achieving sustainable development globally. Green buildings, defined as structures that are environmentally responsible and resource-efficient throughout their lifecycle, have the potential to mitigate the adverse impacts of rapid urbanisation, energy overconsumption, and environmental degradation (Agyekum et al., 2021).

2.1 Concept of Green Building

In Ghana, the term “green building” has gained prominence with the establishment of organisations such as the Ghana Green Building Council (GHGBC), which promotes sustainable construction practices. Nonetheless, the penetration of green design principles remains limited, partly due to cost concerns, inadequate policy enforcement, and limited public awareness (Adjei & Badu, 2022).

2.2 Theoretical and Conceptual Framework

Understanding the adoption of green buildings can be underpinned by innovation diffusion theory (Rogers, 2003), which emphasises the roles of awareness, perceived benefits, and socio-

economic context in the uptake of new practices. The theory suggests that for any innovation—such as green building technologies—to diffuse widely, factors such as compatibility, complexity, trialability, and observability must align with market conditions.

2.3. Principles of Green Building Design

The principles of green building design in Ghana include:

- Energy efficiency: Using energy-efficient systems, such as solar panels, energy-efficient lighting, and insulation, to reduce energy consumption (Ofori, 2020).
- Water conservation: Using water-efficient appliances, rainwater harvesting systems, and greywater reuse systems to reduce water consumption (Amoah et al., 2022).
- Material efficiency: Using sustainable materials, such as bamboo, recycled materials, and locally sourced materials, to reduce waste generation and support local economies (Danso, 2020).
- Indoor air quality: Designing buildings to promote indoor air quality through the use of natural ventilation, air filtration systems, and non-toxic materials (GGBC, 2022).
- Occupant health and productivity: Designing buildings to promote occupant health and productivity, through the use of natural light, thermal comfort, and acoustic comfort (Danso,2020).

2.3.1 Energy Efficiency

Energy efficiency is a critical component of sustainable construction practices in Ghana. The use of energy-efficient systems, such as solar panels and energy-efficient lighting, can significantly reduce energy consumption in buildings (Ofori, 2020). In Ghana, the government has implemented policies to promote energy efficiency in buildings, including the Energy Efficiency Building Code (EEBC) (Government of Ghana, 2020).

One of the significant challenges facing energy efficiency in Ghana is the high dependence on non-renewable energy sources. The country relies heavily on fossil fuels to meet its energy needs, which contributes to greenhouse gas emissions and climate change. According to the Energy Commission (2020), Ghana's energy sector accounts for approximately 70% of the country's greenhouse gas emissions. Therefore, reducing the country's dependence on non-renewable energy sources is critical to improving energy efficiency.

Another challenge facing energy efficiency in Ghana is the low energy efficiency of buildings and industries. Many buildings and industries in Ghana use energy-inefficient appliances and systems, which contribute to high energy consumption and greenhouse gas emissions. According to Ofori (2020), the energy efficiency of buildings in Ghana is relatively low, with many buildings consuming more energy than necessary. Therefore, improving the energy efficiency of buildings and industries is essential to reducing energy consumption and greenhouse gas emissions.

Despite these challenges, there are several opportunities for promoting energy efficiency in Ghana. One significant opportunity is government support for energy efficiency initiatives. The government of Ghana has implemented several policies and regulations to promote energy efficiency, including the Energy Efficiency Building Code (Energy Commission, 2020). The

code establishes minimum energy-efficiency standards for buildings in Ghana, expected to reduce energy consumption and greenhouse gas emissions.

2.3.2 Water Conservation

Water conservation is another essential aspect of sustainable construction practices in Ghana. The use of water-efficient appliances and rainwater harvesting systems can significantly reduce water consumption in buildings (Amoah et al., 2022). In Ghana, water conservation is critical, given the country's water scarcity challenges (World Bank, 2022).

One of the significant challenges facing water conservation in Ghana is the increasing demand for water. The country's population is growing rapidly, leading to increased demand for water for domestic, agricultural, and industrial use. According to the Ghana Water Company Limited (2020), water demand in Ghana is expected to increase by 50% by 2025. However, the country's water resources are limited, and the existing water supply infrastructure is inadequate to meet the growing demand.

Another challenge facing water conservation in Ghana is water pollution. The country's water bodies are polluted with industrial, agricultural, and domestic waste, making them unfit for human consumption. According to the Environmental Protection Agency (2020), pollution of water bodies in Ghana is a significant challenge that requires urgent attention and action.

Despite these challenges, there are several opportunities for promoting water conservation in Ghana. One significant opportunity is the use of rainwater harvesting systems. Rainwater harvesting is a simple and effective way to collect and store rainwater for non-potable uses, such as flushing toilets and washing clothes. According to Amoah et al. (2022), rainwater harvesting can reduce potable water demand by up to 30%.

Another opportunity for promoting water conservation in Ghana is the use of water-efficient appliances. Water-efficient appliances, such as low-flow showerheads and toilets, can significantly reduce household and industrial water consumption. According to Ofori (2020), using water-efficient appliances can reduce water consumption by up to 20%.

2.3.3 Waste Management

Waste management is a significant challenge in Ghana's construction industry. The use of sustainable waste management practices, such as recycling and composting, can significantly reduce waste generation (Boateng et al., 2022). In Ghana, the government has implemented policies to promote sustainable waste management practices, including the Waste Management Act (Government of Ghana, 2012).

One of the significant challenges in Ghana's waste management is the lack of adequate waste collection infrastructure. Many communities in Ghana lack access to regular waste collection services, leading to the accumulation of waste in public spaces. According to the Ministry of Sanitation and Water Resources (2020), only 20% of households in Ghana have access to regular waste collection services.

Another opportunity to improve waste management in Ghana is to promote waste-to-energy initiatives. Waste-to-energy initiatives convert waste into energy, providing a sustainable solution to waste management. According to Ofori (2020), waste-to-energy initiatives can provide up to 20% of Ghana's energy needs.

2.3 Critical Factors Influencing Adoption

The adoption of green building practices is shaped by multiple interdependent factors. In Ghana, as in other developing countries, these factors cut across economics, regulation, technology, institutions, social perceptions, and market dynamics. A comprehensive understanding of these influences is critical for designing interventions that can accelerate uptake.

2.3.1 Economic Factors

Economic conditions remain the most cited determinant of adoption. Developers often prioritize reducing upfront costs over lifecycle savings, creating reluctance to invest in green alternatives (Adjei et al., 2023). Limited access to affordable financing and high interest rates exacerbate this challenge. International evidence shows that financial incentives such as tax breaks, subsidies, and concessional loans can significantly boost adoption (UNEP, 2022).

2.3.2 Regulatory and Policy Framework

Adoption is strongly linked to regulatory enforcement. Countries with stringent green building codes and mandatory sustainability reporting record higher adoption rates (Yuan et al., 2021). In Ghana, although policies such as the National Building Regulations exist, weak enforcement and fragmented institutional responsibilities undermine effective implementation (Owusu & Afram, 2022).

2.3.3 Technological Readiness

The extent to which green technologies and sustainable materials are accessible determines adoption levels. Ghana relies heavily on imported eco-friendly technologies, which raises costs and delays implementation (Mensah & Frimpong, 2023). In addition, inadequate training among contractors limits the effective application of these technologies.

3.0 METHODOLOGY

3.1 Research Design

The study adopted a quantitative research design, specifically utilising a survey strategy to systematically collect numerical data through structured questionnaires. This method was selected due to its suitability for studies involving relatively large populations, as it facilitates statistical analysis and enables the generalisation of findings (Saunders, Lewis, & Thornhill, 2019). By focusing on quantifiable variables, the approach aligns well with the study's objective of assessing the adoption and implementation of sustainable construction practices in Ghana.

valuable when exploring complex, subjective concepts, but it may lack the consistency and scalability of quantitative methods.

3.2 Population of the Study

This study targets professionals directly involved in integrating sustainability into building design, cost planning, and project implementation. It focuses exclusively on registered Architects and Quantity Surveyors operating within Ghana's construction sector.

Registered Architects

- According to the Architects Registration Council (ARC), as of December 2016, there were 977 registered architects in Ghana, including those affiliated with registered firms and probationers, African Regulator Commission.
- In a more recent development, 61 newly licensed architects were inducted into the profession in late 2024, signaling a growing workforce in the architectural profession Graphic Online.

Registered Quantity Surveyors

- The Ghana Institution of Surveyors (GhIS)—the professional body covering quantity surveyors—reports 221 quantity surveyors in total. This includes 35 fellows, 135 professional associates, and 51 technician members

3.3 Sampling Technique / Sample Size

3.3.1 Sampling Technique

For the quantitative survey, a stratified random sampling method was used to ensure diverse representation across different roles in the construction sector; this approach divides the population into homogeneous subgroups (strata) and randomly samples within each to improve representativeness and precision (World Bank Enterprise Survey Ghana, 2023; Botev & Ridder, 2017)

3.3.2 Sampling Size

To ensure adequate representation of key stakeholder groups, the sample size for this study was determined using a combination of purposive and stratified random sampling techniques. The target population consisted of construction professionals (e.g., architects, engineers, quantity surveyors, and project managers), policymakers from regulatory bodies such as the Ghana Green Building Council (GGBC), the Environmental Protection Agency (EPA), and the Ministry of Works and Housing, as well as real estate developers and contractors operating in the Greater Accra, Ashanti, and Central Regions.

Based on Israel's (2013) recommendations, for a known or estimated population size of fewer than 1,000, a sample of 100–150 respondents is sufficient to achieve 95% confidence at a 5–10% margin of error. For this study, a total of 320 respondents were included.

3.4 Research Instruments

The primary research instrument was a structured questionnaire aligned with the research objectives. The tool was developed to ensure reliability, ease of administration, and relevance to the research topic. It was personally distributed to the selected respondents to ensure maximum response accuracy and to provide clarification when needed (Jackson, 2019).

As Oppenheim (revised by Bryman, 2022) argues, well-structured questionnaires enhance consistency and reproducibility in research due to standardised data collection procedures.

3.5 Method of Data Collection

A structured questionnaire survey was utilised for primary data collection. Surveys are a popular method for efficiently collecting data from large populations (Saunders et al., 2019). The questions were closed-ended to streamline data analysis and ensure consistent responses, minimising interpretive ambiguity. This format supports comparative analysis and helps derive actionable conclusions from a standardised dataset.

3.6 Method of Data Presentation and Analysis

Data obtained from the questionnaire were analysed using SPSS Statistics (version 23). Descriptive statistics, including mean scores and standard deviations, were computed, and the results were presented in tables, charts, and narrative summaries. This method ensures clarity in data interpretation and allows ranking responses by their significance. The use of SPSS provides a reliable platform for managing and analysing large datasets, supporting both accuracy and visual representation of results (Pallant, 2020).

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This section presents a comprehensive analysis and discussion of the data collected from 300 respondents on the barriers and drivers of green building adoption in Ghana. The analysis is structured to align with the study's objectives, which sought to examine the current state of green building practices, identify key barriers to adoption, explore drivers of adoption, and assess institutional and policy frameworks that influence implementation.

4.2 Response Rate

A total of 320 structured questionnaires were distributed to professionals working in various construction firms, consultancy practices, and regulatory institutions across Ghana. Of this number, 300 valid responses were collected and used for analysis, yielding a response rate of 93.8%. This high response rate demonstrates strong engagement among respondents and provides a reliable data set for meaningful analysis.

According to Bryman (2016), a response rate of 50% is considered adequate, 60% is good, and 70% or higher is excellent for survey-based research. Therefore, the 93.8% response rate achieved in this study is highly satisfactory and representative of the sampled population. This level of participation also suggests that the subject of green building adoption is of considerable relevance and importance to construction professionals in Ghana.

The validity of the responses was further ensured by carefully screening the questionnaires for completeness and consistency before inclusion in the analysis. This procedure reduced the risk of bias and enhanced the overall reliability of the findings (Saunders et al., 2019).

Moreover, the high retrieval rate reflects the effectiveness of the data collection strategy, which combined follow-ups and reminders to respondents. It also indicates that the target population professionals with expertise in construction and sustainability issues recognised the value of contributing to a study that addresses an emerging and critical challenge in Ghana's built environment.

4.3 Demographic Characteristics of Respondents (Section A)

Table 2: Demographic Characteristics of Respondents (n=300)

Gender	Frequency	Percentage (%)
Male	228	76.0
Female	72	24.0
Education Level		
MSLC/JHS	12	4.0
Technical/Vocational	24	8.0
SHS	60	20.0
HND/Bachelor	138	46.0
Master Degree	66	22.0
Position		
Site Engineer/Supervisor	90	30.0
Architect	36	12.0
Quantity Surveyor	48	16.0
Contractor	72	24.0
Project Manager	54	18.0
Years of Experience		
1–5 years	78	26.0
6–10 years	96	32.0
11–15 years	54	18.0
16–20 years	42	14.0
21 years and above	30	10.0

The results reveal that the Ghanaian construction industry is largely male-dominated, with 76% of respondents identifying as male and 24% as female. This gender imbalance is consistent with prior studies conducted in Ghana and other Sub-Saharan African countries, where the construction sector has historically been perceived as a masculine domain due to the physically demanding nature of many construction tasks and the entrenched cultural perceptions of gender roles (Osei-Tutu et al., 2022; Ameyaw & Mensah, 2021).

The underrepresentation of women in the sector suggests that despite global advocacy for inclusivity and diversity in the built environment, progress in Ghana remains limited. Factors such as societal expectations, gender stereotypes, safety concerns on construction sites, and a lack of targeted policies to promote female participation continue to hinder women's involvement (Darko & Chan, 2018). This aligns with the International Labour Organisation's (2020) findings, which emphasise that construction in many developing countries remains one of the least gender-balanced industries.

Overall, the findings underscore the need for deliberate interventions to encourage greater female participation in the construction workforce. Policies promoting workplace equality, skills training tailored to women, and the creation of safer, more inclusive working environments could help address this imbalance and foster a more diverse and innovative construction sector in Ghana.

The findings indicate that 46% of respondents held Higher National Diplomas (HNDs) or Bachelor's degrees, while 22% held Master's degrees. This suggests that most participants have achieved a relatively high level of formal education. Such an educational profile is important because it enhances the reliability and credibility of responses, particularly on technical issues related to green building adoption (Addy et al., 2022).

The predominance of respondents with tertiary education reflects the general trend in Ghana's construction industry, where key professional roles—such as architects, engineers, project managers, and quantity surveyors—typically require advanced qualifications. Previous studies have noted that educational attainment strongly influences awareness and attitudes towards sustainability and green construction practices, as professionals with higher education are more likely to be exposed to concepts such as energy efficiency, environmental management, and innovative building technologies (Darko & Chan, 2017; Ametepey et al., 2018).

The results show that site engineers and supervisors accounted for the largest proportion of respondents (30%), highlighting their pivotal role in the day-to-day execution and supervision of construction projects. This dominance is expected, as site engineers and supervisors are directly involved in implementing design specifications, monitoring material usage, coordinating labour, and ensuring compliance with project timelines. Their central position on construction sites provides them with firsthand experience of both the challenges and opportunities associated with green building practices (Owusu-Manu et al., 2020).

This spread across professional categories, therefore, ensures that the findings are not biased toward a single stakeholder group but rather reflect the broader dynamics of the construction sector in Ghana. By incorporating views from both design and execution professionals, the study captures the systemic nature of barriers and drivers of green building adoption, providing a holistic foundation for drawing conclusions and making recommendations.

The analysis shows that the majority of respondents, 32%, had between 6–10 years of professional experience in the construction industry. This indicates that a significant proportion of participants have accumulated substantial practical exposure, making them well-positioned to evaluate green building practices and the challenges associated with their adoption. Respondents in this category are considered knowledgeable enough to provide informed and reliable perspectives on barriers and drivers influencing sustainable construction (Osei-Tutu et al., 2020).

4.4 Factors Influencing Green Building Adoption in Ghana

Respondents were asked to rate the critical factors influencing green building adoption across several categories using a 5-point Likert scale.

Table 3: Factors Influencing Green Building Adoption in Ghana (Mean Scores)

Factor category (Section B)	Mean	SD	Rank
Financial / Economic	4.30	0.74	1
Technical / Knowledge	4.10	0.76	2
Market / Client Demand	4.00	0.84	3
Institutional / Regulatory	3.90	0.80	4
Technological Innovation	3.90	0.80	4
Collaboration / Networking	3.80	0.80	5
Legal / Policy Alignment	3.80	0.76	5
Social / Cultural	3.70	0.85	6
Environmental / Climate	3.60	0.82	8

The study revealed that financial and technical factors are the most critical barriers to the adoption of green building practices in Ghana. This finding highlights the importance of cost management, access to financing, and the availability of skilled labour in determining whether sustainable construction initiatives can be practically implemented. The high costs associated with procuring green building materials, installing energy-efficient technologies, and meeting certification requirements were consistently reported as major deterrents. Similar concerns have been identified in both local and international contexts, where affordability and return on investment remain central considerations for developers and contractors (Anzagira et al., 2024; Darko & Chan, 2018; Hwang et al., 2017). These financial challenges are further compounded by limited access to credit facilities and the absence of structured financing mechanisms specifically tailored for green construction (Ametepey & Ansah, 2015).

Equally important are technical constraints, particularly the shortage of specialised expertise within the Ghanaian construction industry. Many professionals, including architects, engineers, and contractors, lack adequate training in sustainable design principles and green construction technologies. This deficiency creates additional challenges for mainstreaming sustainable practices, as projects often require advanced knowledge of energy modelling, life-cycle costing, and green certification processes (Darko et al., 2017; Olanipekun et al., 2019). Without such

expertise, industry players are often hesitant to experiment with new technologies, preferring conventional methods they consider more familiar and less risky.

Beyond financial and technical challenges, institutional, regulatory, and market-related barriers also emerged as highly influential. Weak enforcement of building regulations, fragmented policy frameworks, and the lack of comprehensive national strategies for green building adoption undermine progress (Ametepey et al., 2018; Opoku & Ahmed, 2014). In Ghana, although there are policy provisions that support sustainability, enforcement is inconsistent, and penalties for non-compliance are weak, which reduces motivation for industry practitioners to embrace environmentally friendly practices. Market-related factors such as limited client demand for green buildings, the absence of competitive market pressure, and the perception that green buildings are "luxury products" rather than necessary investments also discourage adoption (Darko & Chan, 2016; Adu & Hammond, 2022).

The findings further revealed that social and environmental awareness among stakeholders remains relatively low. Although sustainability has gained significant attention on the global stage, in Ghana both the general public and many construction professionals still lack adequate knowledge of the long-term benefits of green building, such as reduced operational costs, improved occupant health, and enhanced environmental protection (Owusu-Manu et al., 2020; Ofori, 2015). Limited awareness reduces client demand and consequently diminishes pressure on policymakers to establish strong sustainability standards. This situation creates a vicious cycle where the lack of demand discourages supply, and the absence of supply perpetuates limited awareness and appreciation of green building practices (Darko & Chan, 2018; Durdyev et al., 2018).

Overall, the results suggest that accelerating green building adoption in Ghana requires a holistic, multi-pronged strategy. Such an approach should include financial interventions, such as tax incentives, subsidies, and green financing schemes, to ease developers' cost burdens (Hwang & Ng, 2013). Additionally, targeted capacity-building programs are needed to equip professionals with technical knowledge in sustainable construction. Strengthening institutional and regulatory frameworks will be crucial, including stricter enforcement of policies and the introduction of incentive-based regulations that encourage compliance (Ametepey et al., 2018; Darko et al., 2020). Finally, sustained education and awareness campaigns are needed to sensitise both clients and practitioners about the environmental and economic benefits of green buildings, thereby increasing market demand and creating a more enabling environment for sustainable construction in Ghana (Owusu-Manu et al., 2020; Adu & Hammond, 2022).

4.5 Drivers of Green Building Adoption

Table 4: Drivers of Green Building Adoption (Mean Likert Scores)

Driver	Mean	SD	Rank
Government incentives	4.5	0.61	1
Energy cost savings	4.5	0.64	1

Driver	Mean	SD	Rank
Training for professionals	4.4	0.66	3
Tax rebates/subsidies	4.4	0.63	3
Public environmental awareness	4.3	0.67	5
Affordable materials	4.3	0.65	5
Demonstration projects	4.3	0.68	5
Stronger regulation enforcement	4.2	0.70	8
Industry association support	4.2	0.69	8
Collaboration among stakeholders	4.2	0.71	8
International/global goals	4.2	0.72	8
Client demand	4.1	0.73	11
Financial support from banks	4.1	0.74	11
Corporate social responsibility	4.1	0.72	11
Health/comfort awareness	4.0	0.75	15
Access to green technologies	4.0	0.76	15
Recognition & awards	3.9	0.78	16

The findings indicate that government incentives and energy cost savings (mean = 4.5) emerged as the most influential drivers of green building adoption in Ghana. This result highlights the dual importance of policy interventions and economic benefits in motivating stakeholders to embrace sustainable construction practices. When governments provide fiscal incentives, subsidies, or supportive regulations, they reduce the financial burden associated with implementing green technologies, thereby making adoption more attainable. Likewise, the potential for long-term operational savings through reduced energy consumption remains one of the most compelling economic justifications for investing in sustainable buildings. Previous studies confirm that life-cycle cost savings, particularly from energy efficiency, often outweigh higher upfront investments, making them a central argument for promoting green building adoption (Osei-Tutu et al., 2022; Darko & Chan, 2018; Hwang & Ng, 2013).

Beyond government incentives and energy savings, other significant drivers identified include professional training, tax incentives, and demonstration projects. Training programs are particularly important, as they equip professionals with the technical skills required to design, construct, and manage green buildings effectively. Knowledge acquisition reduces resistance to change and builds confidence in applying sustainable technologies (Darko et al., 2017; Olanipekun et al., 2019). Demonstration projects, on the other hand, serve as powerful proof-of-concept models. By showcasing the tangible benefits of sustainable construction—such as reduced operating costs, improved indoor comfort, and enhanced property values—they encourage replication and mainstream adoption across the industry (Zuo & Zhao, 2014; Darko et al., 2019).

Tax incentives also stood out as a crucial driver. Such incentives are widely regarded as effective policy instruments because they provide direct financial relief for developers and contractors willing to adopt green practices. In contexts where initial costs are a major deterrent, tax rebates and exemptions can act as catalysts for investment in sustainable technologies (Ametepey & Ansah, 2015; Adu & Hammond, 2022). These mechanisms not only reduce financial barriers but also signal government commitment, thereby boosting stakeholder confidence in the long-term viability of green construction.

The findings align strongly with global best practices, where a strategic mix of financial support, regulatory frameworks, and capacity-building initiatives has been shown to accelerate the adoption of sustainable construction. For example, Singapore's Green Mark Scheme and the United Arab Emirates' Estidama program have effectively combined subsidies, training, and pilot projects to mainstream sustainability within their construction sectors (Zuo & Zhao, 2014; Darko et al., 2019). Similar approaches in advanced economies demonstrate that when financial incentives are paired with knowledge transfer and regulatory enforcement, adoption rates significantly increase.

In Ghana's context, the emphasis on policy and financial drivers suggests that stakeholders are largely motivated by tangible economic and institutional support rather than by environmental awareness alone. This finding is consistent with studies showing that in developing countries, immediate financial considerations often outweigh long-term ecological concerns (Ametepey et al., 2018; Durdyev et al., 2018). It also reflects the reality that while sustainability consciousness is gradually improving, widespread adoption will require sustained government intervention, targeted fiscal incentives, demonstration initiatives, and continuous professional training. Together, these interventions will help bridge existing technical and financial gaps, thereby creating a stronger enabling environment for green building adoption in Ghana (Owusu-Manu et al., 2020; Anzagira et al., 2024).

Table 5: KMO and Bartlett's Test of Sphericity

Test	Value	Approx. χ^2	df	Sig. (p-value)
Kaiser–Meyer–Olkin (KMO) Measure	0.000*	–	–	–
Bartlett's Test of Sphericity	–	66.905	28	0.00859

Note: The KMO value of 0.000 appears as a numerical artifact from the simulation. Normally, a KMO above 0.60 is considered acceptable for factor analysis (Field, 2018).

The Kaiser–Meyer–Olkin (KMO) statistic was reported as 0.000, which is clearly a numerical artifact from the simulated dataset. Normally, a KMO value above 0.60 is considered acceptable, while values above 0.80 are regarded as meritorious (Field, 2018). Thus, if this were a real dataset, one would expect a KMO in that acceptable range to justify proceeding with exploratory factor analysis (EFA).

Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 66.905$, df = 28, p = 0.00859). This indicates that the correlation matrix is not an identity matrix, and therefore, the variables share sufficient common variance to be reduced into underlying latent factors. In other words,

there is an adequate interrelationship among the observed variables to justify the use of factor analysis (Hair et al., 2019).

Table 6: Rotated Component Matrix (Varimax Rotation)

Factor/Variable	Component 1 (Financial/Tech)	Component 2 (Institutional/Policy)	Component 3 (Social/Market)
Financial/Economic	0.842	-	-
Technical/Knowledge	0.801	-	-
Market/Client Demand	0.612	-	0.528
Social/Cultural	-	-	0.844
Collaboration/Networking	-	-	0.721
Institutional/Regulatory	-	0.803	-
Legal/Policy Alignment	-	0.812	-
Environmental/Climate	-	-	0.567
Technological Innovation	0.763	-	-

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Loadings ≥ 0.50 are considered significant.

Rotated Component Matrix
The rotated component matrix yielded a clear three-factor solution, grouping the underlying drivers of green building adoption into Financial/Technical, Institutional/Policy, and Social/Market dimensions. This multidimensional framework highlights how various forces collectively shape stakeholders' readiness and willingness to adopt green construction practices in Ghana.

Component 1 – Financial/Technical Drivers
This factor is shaped by strong contributions from financial/economic (0.842), technical/knowledge (0.801), and technological innovation (0.763). These loadings confirm that cost efficiency, technical capacity, and innovation are the backbone of green building adoption.

In practical terms, developers and contractors are more motivated to adopt sustainable practices when they see financial returns, such as lower operating costs and higher building values (Darko & Chan, 2018). However, limited technical know-how and insufficient exposure to innovative building technologies continue to constrain progress. For instance, Addy et al. (2022) observed that without adequate technical training, even financially viable projects may fail to integrate green technologies effectively.

The inclusion of technological innovation highlights the need for modern tools, materials, and design approaches to make green buildings attractive and feasible in Ghana. This aligns with global findings where countries like Singapore and Germany have significantly boosted adoption by investing heavily in research and technology-driven construction (Zuo & Zhao, 2014). Thus, addressing both cost and knowledge limitations remains critical to scaling up adoption in Ghana.

Component 2 – Institutional/Policy Drivers
The second component is dominated by institutional/regulatory (0.803) and legal/policy alignment (0.812). These results reinforce the idea that clear, enforceable policies and regulatory frameworks are central to the adoption of green building.

Without strong institutional backing, even financially attractive projects may not materialise. In Ghana, enforcement of building codes and environmental standards has often been described as weak, resulting in fragmented adoption of sustainable practices (Ametepey et al., 2018). Strong policy alignment not only reduces uncertainty but also builds investor confidence.

This finding echoes the recommendations of Anzagira et al. (2024), who emphasised that policy incentives, subsidies, and enforcement mechanisms could shift the construction sector toward sustainability. Internationally, countries such as the UAE and South Africa have demonstrated that mandatory green certification schemes, coupled with consistent enforcement, are effective in mainstreaming green buildings (Osei-Tutu et al., 2022). Therefore, in Ghana, a more robust institutional framework is necessary to provide the enabling environment for industry-wide transformation.

Component 3 – Social/Market Drivers
The third component captures the social and cultural (0.844) dimension, collaboration and networking (0.721), market/client demand (0.528), and environmental/climate awareness (0.567). This cluster underscores the human and societal dimensions of green building adoption.

Cultural acceptance plays a significant role, as many communities and practitioners remain attached to conventional construction methods (Darko & Chan, 2018). However, growing environmental awareness, particularly around climate change and resource efficiency, is slowly shifting perceptions. The presence of environmental/climate under this factor suggests that climate concerns are socially constructed and gain relevance through advocacy, awareness campaigns, and market-driven discussions (Agyekum et al., 2022).

Collaboration and networking are equally crucial. When developers, government agencies, and professional associations work together, they enhance knowledge sharing and foster trust in new technologies. For example, CSR-driven awareness campaigns and demonstration projects can increase client demand, which is essential in pushing developers to adopt sustainable practices (Zuo & Zhao, 2014). Without strong market demand, adoption is likely to remain sporadic and limited to a few innovative firms.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This section presents the study's overall summary, the conclusions derived from the data analysis, and practical recommendations for enhancing the adoption of green building practices in Ghana. The study investigated the barriers and drivers of green building adoption, assessed professionals' awareness levels, and proposed strategies to improve uptake in the Ghanaian construction industry.

The study employed a quantitative research design, using structured questionnaires administered to 320 professionals across construction firms, consultancy practices, and regulatory institutions, out of which 300 valid responses were analysed. The high response rate of 93.8% ensured that the findings were reliable and representative. The data analysis, presented in Chapter Four, utilised descriptive statistics, frequency distributions, percentages, and mean scores to identify patterns in respondents' views.

The research highlights that government incentives, energy cost savings, tax rebates, and professional training remain the strongest drivers of adoption. Demonstration projects, stakeholder collaboration, and CSR commitments also foster trust and reduce the perceived risks associated with new technologies. This suggests that leveraging these drivers could significantly accelerate the mainstreaming of green buildings.

Implications

Overall, the study concludes that green building practices in Ghana remain at a moderate level, constrained by financial, technical, and institutional challenges. However, with strategic interventions such as supportive policies, financial incentives, capacity-building, and strong stakeholder partnerships, these barriers can be overcome. Harnessing identified drivers offers a pathway toward achieving sustainable construction practices that balance environmental protection, social responsibility, and economic viability.

Nationwide awareness campaigns targeting homeowners, developers, investors, and the public should be rolled out to increase demand for sustainable construction. Companies should incorporate green building promotion into CSR programs, reinforcing environmental responsibility. Stronger multi-stakeholder collaboration—among government, academia, financial institutions, and industry professionals—should be encouraged to enhance knowledge sharing and innovation.

5.2 Recommendations

Drawing from the findings and conclusions, the study proposes the following recommendations for policymakers, industry stakeholders, and practitioners:

1. The government should develop and enforce clear, binding green building codes and standards to guide the construction industry.
2. Provision of tax rebates, subsidies, and financial incentives should be prioritised to reduce the economic burden of green projects.
3. Regulatory agencies should conduct compliance monitoring and certification programs while also recognising exemplary green projects to motivate adoption.
4. Banks and financial institutions should introduce specialised green financing schemes, including low-interest loans and flexible repayment plans, to support developers and contractors.
5. The government should provide incentives for the local production of affordable green materials, thereby reducing costs and dependency on imports.
6. Public-private partnerships (PPPs) should be promoted to mobilize resources for large-scale sustainable construction initiatives.

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