CONSUMER PREFERENCES AND WILLINGNESS TO PAY FOR BUILDINGS CONSTRUCTED WITH CIRCULAR PRINCIPLES

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ABSTRACT

The construction industry has been identified as a primary contributor to environmental degradation, primarily through the exploitation of resources and the generation of waste. This has resulted in circular construction, which is efficient with resources and minimises waste during the construction lifecycle. This study aims to investigate consumer preferences and willingness to pay for buildings constructed with circular principles. The objectives are to assess consumer awareness and understanding of circular construction principles and to identify the factors that influence consumer preferences for circular buildings. This study will use a cross-sectional survey data-gathering method and a quantitative approach. A systematic random sampling method was employed to select 385 participants, ensuring a representative sample size. Data were collected through a questionnaire that included multiple-choice, open-ended, and closed-ended questions, as well as five Likert scales. Descriptive statistics, including means, frequencies, percentages, and standard deviations, were used for data analysis. The study revealed that consumer awareness of circular construction principles remains significantly low. While direct awareness of circular construction was limited, respondents showed considerably higher recognition of related sustainability concepts. However, when probed further, many respondents associated these terms primarily with energy efficiency and the integration of renewable energy, rather than circular economy principles such as material circularity, life-cycle thinking, and waste elimination.

Keywords: Buildings. circular. consumer. cost. willingness

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1. INTRODUCTION

The construction sector remains one of the most resource-intensive and environmentally consequential industries globally, accounting for 36–40% of energy consumption and 37–39% of CO_2 emissions (IEA, 2023; UNEP, 2024; GlobalABC, 2023; World Green Building Council, 2023). These pressures are particularly acute in rapidly urbanising economies such as Ghana, where increasing population growth, rising housing demand, and inefficient resource use intensify environmental degradation and waste generation (Government of Ghana, 2023; UN-Habitat, 2024; CIA World Factbook, 2024; Cape Coast Metropolitan Assembly, 2023). To achieve its commitments under the Paris Agreement, Nationally Determined Contributions (NDCs), and SDG 11 (Sustainable Cities and Communities), Ghana must transition from linear "take–make–dispose" construction models toward sustainable and circular alternatives (UNFCCC, 2024; Ministry of Environment, Science, Technology & Innovation, 2023; UNEP, 2023; IPCC, 2023). However, despite the proven environmental and economic benefits of circular construction (CC), adoption remains limited in Ghana largely due to low consumer awareness, misconceptions, and a weak understanding of lifecycle benefits and policy frameworks (Osmani, 2021; Charef & Lu, 2021; Zemanová, 2023; Bucur, 2023). These knowledge gaps significantly hinder the country's transition toward sustainable construction practices.

Circular construction (CC) represents a regenerative building paradigm that prioritises material reuse, design for adaptability, resource efficiency, and lifecycle optimisation to decouple the built environment from resource depletion and waste generation (Ghisellini et al., 2016; Guerra et al., 2021; Zhang et al., 2021; Mhatre-Shah et al., 2024). In this context, consumer awareness refers to individuals' understanding of CC principles, including cost-saving potential, durability, certifications, and environmental benefits, while knowledge gaps denote misconceptions or informational deficits that distort consumer judgment (Ametepey et al., 2015; Adams et al., 2017; Papamichael et al., 2023; Benites et al., 2022). These gaps are particularly prominent in developing economies, where sustainability literacy is low and public communication about green construction policies is limited (Ezeudu & Ezeudu, 2019; Osei-Tutu et al., 2022; Rajendra & Mohanasundaram, 2023; Gasparri et al., 2023). As a result, consumers frequently perceive CC as expensive, technically complex, or design restrictive, discouraging adoption even when CC solutions are available (Mamun et al., 2023; Malmqvist et al., 2019; Wuni, 2022; Chileshe et al., 2024). Understanding these perceptions is essential for identifying behavioural and structural barriers that undermine CC uptake in Ghana.

This study bridges the identified gap by empirically examining consumer awareness of circular construction principles and assessing the knowledge gaps that hinder CC adoption in urban Ghana. Guided by the Knowledge–Attitude–Practice (KAP) model, which posits that awareness precedes attitudinal change and adoption behaviour, the study employs a cross-sectional survey design across Accra, Kumasi, Cape Coast, and Takoradi to quantify awareness levels, misconceptions, and perceived barriers (Rada et al., 2018; Zemanová, 2023; Charef & Lu, 2021; Papamichael et al., 2023). By integrating descriptive statistics, the Relative Importance Index (RII), and thematic analysis of open-ended responses, the study provides a multi-layered understanding of demand-side challenges. This perspective differs from earlier supply-focused research by placing consumers, rather than industry actors, at the centre of CC adoption analysis.

This study makes an important contribution to the circular economy and sustainable construction literature by offering one of the first empirical assessments of consumer awareness of CC in Ghana. Theoretically, it advances understanding of how awareness and perceptions shape adoption behaviour, extending the application of the KAP Model to the built environment (Rada et al., 2018; Zemanová, 2023; Benites et al., 2022; Charef & Lu, 2021). Empirically, the study provides city-level insights that can inform public education campaigns, financing reforms, and policy communication strategies tailored to Ghana's socio-economic context.

2. LITERATURE REVIEW

This section aims to critically examine prior research on CC awareness and adoption.

2.1 Global Landscape of Circular Construction (CC) Implementation

Circular construction (CC) has become a major global focus as a solution to environmental degradation, waste reduction, and resource efficiency in the built environment. In developed countries such as Europe, the CC is implemented through regulation, standardised certification, and unified material recovery systems (Malmqvist et al., 2019; Benites et al., 2022; GlobalABC, 2023; UNEP, 2024). These instruments have found backing in good policy requirements, including the EU Taxonomy and the Circular Economy Action Plan, which establish the enabling conditions for circular building materials, modular design, and lifecycle-oriented procurement.

Empirical research also shows how the high level of consumer literacy regarding green labels, lifecycle benefits, and principles of a circular design is at the centre of the process of facilitating the adoption of CC in Europe, Australia, and some parts of Asia (Guerra et al., 2021; Zhang et al., 2021; Mhatre-Shah et al., 2024; Adams et al., 2017). Despite this development, implementation worldwide is not universal. Circular buildings are still viewed as expensive and complicated even in more developed markets (Rajendra & Mohanasundaram, 2023; Osmani, 2021; Saavedra et al., 2017). These lessons support the value of consumer education and situational action in order to promote the use of CC.

2.2 Circular Construction in Sub-Saharan Africa and Developing Economies

The adoption of CC in developing regions, particularly in Sub-Saharan Africa (SSA), is structurally challenged by the poor enforcement of regulations, a fractured supply chain, inadequate recycling, and financial incentives (Ametepey et al., 2015; Ezeudu & Ezeudu, 2019; Gasparri et al., 2023; Tekpe et al., 2022). The works conducted in Nigeria, Kenya, South Africa, and Rwanda have shown that, although consumers in the SSA are moderately aware of their environmental concerns, they are also lowly literate about the concept of CC, including the ability to design the product, cost savings during its lifecycle, and material circularity (Mamun et al., 2023; Papamichael et al., 2023; Wuni, 2022; Chileshe et al., 2024). In addition, inadequate policy communication and ineffective interaction with housing consumers contribute to misconceptions that persist, such as the notion that circular buildings are costly, non-durable, or inflexible in design (Rajendra & Mohanasundaram, 2023; Adams et al., 2017; Osei-Tutu et al., 2022). Although there are some localised examples, e.g., Green Building Minimum Compliance System in Rwanda and Family Homes Fund in Nigeria, which have positively affected awareness, such initiatives are still local (Gasparri et al., 2023; Ezeudu & Ezeudu, 2019; Benites et al., 2022). The current context of SSA, hence, indicates that demand-side studies concentrated on consumer knowledge and perception of CC are in urgent need.

2.3 Consumer Awareness of Circular Construction in Ghana

A study in Ghana has generally explored CC and sustainability at the level of construction professionals, policymakers, and actors in the supply side. Research identifies primary obstacles such as low implementation of green building policies, high reliance on imported products, and few incentives to go circular (Ametepey et al., 2015; Akhimien et al., 2020; Tekpe et al., 2022; Osei-Tutu et al., 2022). Nevertheless, there is only a limited number of research on consumer engagement in sustainable building, not to mention research on the awareness of CC in households. According to existing research, there is a lack of awareness of sustainable housing policies in Ghana, and there is a backward perception regarding what circular building materials are, how long-lasting, safe, and affordable they are (Cape Coast Metropolitan Assembly, 2023; Osmani, 2021; Guerra et al., 2021; Gasparri et al., 2023). This is worrying, considering the fast urbanisation of Ghana and the increased demands to achieve climate-resilient housing targets. This is an important gap in the CC literature in Ghana, given the lack of empirical evidence on consumer-level knowledge rather than professional or institutional viewpoints.

2.4 Methodological Approaches in Prior Studies

Research studies exploring the use of CCs have employed varying research designs, depending on the target population and research purposes. Attitudes, perceptions, and awareness of CC among construction professionals or consumers often are captured using surveys (Benites et al., 2022; Adams et al., 2017; Chileshe et al., 2024). The concept of structural equation modelling (SEM and PLS-SEM) is frequently used in research that aims at examining causal relations among various sustainability constructs, including environmental literacy, behavioural intentions, and perceived barriers (Mhatre-Shah et al., 2024; Mamun et al., 2023; Saavedra et al., 2017). The issue of drivers and challenges of CC has been studied in depth through qualitative interviews and case studies, especially in regional or institutional tiers (Gasparri et

al., 2023; Tekpe et al., 2022; Akhimien et al., 2020). Although these methods are fruitful, the majority of them involve supply-chain participants, experts, or authorities.

Since this research aims to quantify consumer awareness and identify knowledge gaps, the cross-sectional survey is the most suitable method. It allows the collection of generalised and similar data from a large, varied sample of a population spread across large urban centres. This methodology has been extensively proven to be effective in behavioural and sustainability studies in the assessment of awareness, attitudes, and barriers among demographic populations (Setia, 2023; Cheung, 2014; Kara, 2023; Howell et al., 2020). Therefore, the current research paper is methodologically consistent with the existing best practices and is related to the provision of novel information among a group of the population that has been underrepresented in the study of CC.

2.6 Theoretical Framework: Knowledge–Attitude–Practice (KAP) Model

This current study uses the Knowledge-Attitude-Practice (KAP) Model that assumes that knowledge is the precursor of attitudes, and attitudes determine the intentions and practices of behaviour (Rada et al., 2018; Zemanova, 2023; Charef & Lu, 2021; Papamichael et al., 2023). Within the circle of the CC, attitudes toward circular buildings are likely to develop due to the awareness of lifecycle advantages, policy frameworks, reusing the materials, and the environmental impact, which leads to changes in the adoption behaviour. The KAP Model is quite appropriate in studying consumer behaviour in developing economies, where a lack of knowledge and attitudes based on misconceptions can be a major setback to sustainable construction adoption. Based on this theoretical foundation, the research makes the study stronger in terms of its analytical background and provides a systematic explanation as to how awareness gaps lead to adoption barriers.

2.7 Research Gap and Novelty Statement

While global and regional studies have examined CC principles, policy challenges, and industry perceptions, there is a notable absence of empirical research quantifying consumer awareness of circular construction in Ghana. Existing work tends to focus on professionals, supply-chain actors, or technical and regulatory dimensions, leaving the demand side largely unexplored. The present study addresses this gap by offering one of the first multi-city, consumer-based assessments of CC awareness and knowledge gaps in Ghana. Its novelty lies in (i) focusing on household decision-makers rather than industry actors, (ii) integrating quantitative design, and (iii) applying the KAP framework to interpret behavioural implications. These contributions help clarify the role of consumer knowledge in shaping Ghana's transition toward sustainable and circular construction.

3. METHODOLOGY

This section outlines the methodology adopted to investigate consumers' knowledge deficits in Ghana.

3.1 Survey Development

The survey instrument was developed through a multi-stage process involving variable identification, expert validation, and pilot testing. First, the key constructs, consumer awareness of circular construction (CC) principles, knowledge gaps, and perceived barriers, were identified through an extensive review of previous empirical and theoretical studies in circular economy, sustainable construction, and consumer behaviour (Adams et al., 2017; Benites et al., 2022; Charef & Lu, 2021; Zhang et al., 2021). These constructs informed the initial drafting of 20 closed-ended items measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), capturing awareness of material reuse, lifecycle benefits, certifications, resource efficiency, and policy frameworks. To ensure content validity, the draft questionnaire was reviewed by four experts in circular construction, sustainability assessment, and environmental psychology, who evaluated

item clarity, relevance, and representativeness. Their feedback led to the refinement of ambiguous statements, the removal of redundant items, and modifications to improve readability and contextual relevance.

Following expert validation, the revised instrument underwent a pilot test with 30 adult respondents residing in Accra and Kumasi, selected to reflect the study's target population. The purpose of the pilot test was to evaluate reliability, internal consistency, and response comprehension. The pilot produced a Cronbach's alpha score of 0.84, indicating satisfactory reliability for exploratory research (Kumar & Murugan, 2018). Minor adjustments were made to the sequencing of items and demographic questions based on participant feedback. This systematic development process ensured that the final instrument was both valid and reliable before full-scale data collection.

3.2 Data Collection

3.2.1 Target Population and Sampling Frame

The target population comprised adult residents (18 years and above) in four major Ghanaian cities, Accra, Kumasi, Cape Coast, and Takoradi, who were involved in decision-making regarding housing choices, whether renting, purchasing, or constructing residential property. Inclusion criteria required respondents to (i) be 18 years or older, (ii) reside in one of the four cities for at least 12 months, and (iii) self-identify as contributing to household housing decisions. Individuals younger than 18, transient residents, or those not involved in housing-related decisions were excluded.

3.2.2 Sampling Technique

A stratified random sampling technique was employed to ensure representation across socio-economic groups. First, each city was stratified into neighbourhoods based on income classification (low-, middle-, and high-income areas). Within each stratum, households were selected using systematic random sampling with a fixed interval determined by estimated household density (Howell et al., 2020). At each selected household, one eligible respondent was randomly chosen using the Kish grid method. This approach enhanced representativeness and minimised sampling bias across demographic categories.

3.2.3 Sample Size and Response Rate

Although a population proportion formula and power analysis suggested a minimum of 385 respondents at a 95% confidence level and a 0.05 margin of error, logistical constraints and limited access yielded 250 distributed questionnaires, of which 200 were returned as valid, yielding an effective response rate of 80%. This sample size remains adequate for descriptive and nonparametric statistical analyses commonly used in awareness studies (Setia, 2023; Kara, 2023).

3.3.4 Data Collection Procedure

Data were collected between February and April 2024 using a mixed-mode approach combining face-to-face administration and digital forms distributed through community associations, housing forums, and professional networks. Respondents were informed of the study's purpose and provided verbal or written consent prior to participation. The study complied with all applicable ethical standards for human subject research. Participation was voluntary, informed consent was obtained, and respondents were assured of confidentiality. All procedures adhered to Ghana's Data Protection Act (Act 843) and institutional research guidelines.

3.3 Data Analysis

Data analysis was conducted using SPSS (Version 26) and NVivo 12. Prior to analysis, data were screened for completeness, outliers, and inconsistencies. Missing data amounting to less than 5% of the dataset were handled using mean substitution for Likert-scale responses and listwise deletion for demographic variables, as needed. Normality assumptions were assessed using skewness and kurtosis statistics, confirming the non-normal distribution typical of ordinal Likert-scale data.

Descriptive statistics (means, standard deviations, and frequencies) were used to summarise awareness levels and demographic attributes. The Relative Importance Index (RII) was computed to rank the perceived significance of CC awareness items, following standard procedures for ordinal datasets. To examine whether awareness levels differed significantly across demographic groups, nonparametric inferential tests, specifically the Kruskal–Wallis H test, were used because the data were ordinal and violated normality assumptions.

4. RESULTS

This section presents the quantitative and qualitative findings of the study. Results are organised into five subsections: (i) demographic characteristics of respondents, (ii) consumer awareness of circular construction (CC) principles, (iii) perceived barriers to CC adoption, (iv) Kruskal-Wallis Tests Between Demographic Variables and Consumer, and (v) thematically coded misconceptions. All awareness items (CA1–CA20) and barrier items (BA1–BA20) have been coded to enhance clarity and consistency.

4.1 Demographic Characteristics of Respondents

A total of 200 valid responses were obtained from adult housing decision-makers across Accra, Kumasi, Cape Coast, and Takoradi. Table 1 summarises the demographic distribution across gender, age, education, occupation, housing type, and years of work experience. Respondents were evenly distributed by gender, while the majority were aged 26–40 years (63.5%). Educational attainment was high, with 67% holding bachelor's or postgraduate degrees. Approximately 32% of respondents were employed in construction-related fields**.**

Table 1: Demographic Characteristics of Respondents

Demographic Characteristics	Category	Frequency	Percentage (%)
Gender	Male	99	49.5
	Female	101	50.5
Age Group of Decision-makers Regarding Housing Choices	18-20 years	16	8.0
	21-25 years	32	16.0
	26-30 years	43	21.5
	31-35 years	45	22.5
	36-40 years	39	19.5
	41-45 years	15	7.5
	46 years and above	10	5.0
Academic Qualification	Senior High School Certificate	22	11.0
	HND/Diploma	43	21.5
	Bachelor degree	87	43.5
	Master's degree	46	23.0
	PhD	2	1.0
Working Experience	1-5 years	26	13.0
	6-10 years	39	19.5
	11-15 years	31	15.5
	16-20 years	32	16.0
	21-25 years	22	11.0
	26-30 years	9	4.5
	31 years and above	41	20.5
Housing Type	Apartment	81	40.5
	Townhouse	29	14.5
	Semi-Detached house	47	23.5
	Detached house	43	21.5
Occupation	Construction/Architect/Engineering	64	32.0
	Real Estate/Property Development	38	19.0
	Government/Public Administration	24	12.0
	Retail/Service Industry	13	6.5
	Finance/Banking	11	5.5
	Education/Academia	30	15.0
	Health Care	20	10.0
Total		200	100.0

Source: Field Data, 2024

4.2 Consumer Awareness of Circular Construction Principles

Consumer awareness of circular construction (CC) was assessed using 20 coded Likert-scale items (CA1–CA20). Table 2 presents the mean scores, standard deviations, and Relative Importance Index (RII) rankings. Overall, awareness levels were generally low to moderate across most CC principles. The highest-ranked items indicated moderate recognition of cost-saving potential (CA1), environmental certifications (CA2), and carbon-emission reduction benefits (CA4). Awareness of resource efficiency (CA3) and the future relevance of CC practices (CA5) also ranked within the upper tier. In contrast, lower-ranked items reflected limited familiarity with lifecycle benefits (CA14), material reuse and recycling (CA15), and long-term economic advantages (CA17). Awareness of government policy frameworks (CA11), ongoing CC projects in respondents' cities (CA7), and foundational CC concepts (CA20) remained notably low.

Standard deviation is reported alongside mean scores to indicate the variability and consistency of respondents' awareness levels across each CC item. While the mean reflects the central tendency, the SD shows how widely responses are spread. A high SD suggests substantial disagreement or diverse awareness among respondents, while a low SD indicates relative consensus.

Reporting SD is therefore essential for evaluating whether awareness gaps are uniformly distributed or concentrated within specific demographic groups. This information directly supports subsequent inferential analysis (Kruskal–Wallis tests) and strengthens the interpretation of awareness disparities.

Table 2: Consumer Awareness of Circular Construction Principles

Rank	Code	Awareness Item	Mean	SD	RII
1	CA1	I know that circular construction can lower operational costs over time.	2.39	1.33	0.478
2	CA2	I am familiar with the environmental certifications related to circular construction.	2.39	1.31	0.478
3	CA4	I understand the impact of circular construction on reducing carbon emissions.	2.37	1.34	0.474
4	CA3	I understand the importance of resource efficiency in circular construction.	2.35	1.18	0.470
5	CA5	I believe that circular construction is essential for future building practices.	2.33	1.37	0.466
6	CA6	I am familiar with the concept of building adaptability in circular construction.	2.29	1.34	0.458
7	CA7	I am aware of any ongoing circular construction projects in my city.	2.29	1.27	0.458

8	CA8	I am aware of the role of technology in advancing circular construction.	2.29	1.18	0.458
9	CA10	I am aware of the differences between circular and traditional construction methods.	2.22	1.19	0.444
10	CA9	I know that circular construction reduces waste during building processes.	2.22	1.26	0.444
11	CA11	I understand the role of government policies in promoting circular construction.	2.21	1.33	0.442
12	CA12	I understand how certification schemes support quality assurance in circular construction.	2.24	1.30	0.448
13	CA13	I know the potential financial incentives for investing in circular buildings.	2.16	1.14	0.432
14	CA16	I am aware of the challenges associated with implementing circular construction.	2.28	1.24	0.458
15	CA14	I understand the lifecycle benefits of circular construction.	2.15	1.16	0.430
16	CA15	I know that circular construction involves the reuse and recycling of materials.	2.15	1.25	0.430
17	CA17	I am aware of the long-term economic benefits of circular construction.	2.13	1.25	0.426
18	CA18	I have seen or heard about circular buildings in my area.	2.11	1.22	0.422
19	CA20	I am familiar with the concept of circular construction.	2.08	1.13	0.416
20	CA19	I understand how circular construction contributes to environmental sustainability.	2.07	1.11	0.414

RII=Relative Importance Index, **SD**=Standard Deviation
Source: Field Data, 2024

4.3 Barriers to Awareness and Adoption of Circular Construction

Respondents evaluated 20 perceived barriers to circular construction (CC) adoption (BA1–BA20). Table 3 presents the ranked mean scores and associated standard deviations. Overall, the results show that respondents perceive a wide range of obstacles, with several practical and design-related concerns emerging as the most prominent barriers. The highest-ranked barrier was the perception that circular buildings may not adequately meet respondents' housing needs (BA12), followed by concerns regarding maintenance challenges (BA6) and the perceived complexity or advanced nature of CC technologies (BA18). Market-related concerns, including the belief that CC buildings occupy a niche market (BA13) and persistent doubts about the durability of recycled materials (BA7), also ranked highly.

Design-related perceptions formed another cluster of significant barriers, with respondents expressing reservations about design appeal (BA5), method complexity (BA11), structural safety (BA15), and availability of design variety (BA19). Institutional and regulatory barriers such as uncertain long-term benefits (BA10), inadequate incentives (BA4), limited professional capacity (BA16), and weak government support (BA9) ranked in the middle tier.

Barriers relating to information and market development, including limited availability of CC buildings (BA3), lack of information (BA2), and underdeveloped CC markets (BA20), were also acknowledged but ranked lower than practical and design-related factors. The belief that circular buildings are expensive (BA1), while still prevalent in the qualitative responses, ranked lowest among the quantified barriers.

Table 3: Perceived Barriers to Circular Construction Adoption

Rank	Code	Barrier Item	Mean	SD
1	BA12	I believe that circular buildings do not meet all my housing needs.	2.99	1.26
2	BA6	I think the maintenance of circular buildings might be challenging.	2.98	1.30
3	BA18	I think the technology used in circular construction is too advanced.	2.94	1.32
4	BA13	I think the market for circular buildings is too niche.	2.92	1.35
5	BA7	I am concerned about the durability of recycled materials.	2.91	1.36
6	BA5	I believe that circular buildings have a limited design appeal.	2.88	1.23
7	BA11	I feel that circular construction methods are too complex.	2.88	1.31
8	BA15	I believe that circular buildings might not be as safe as traditional buildings.	2.88	1.28
9	BA19	I believe that circular buildings do not offer enough variety in design.	2.88	1.33
10	BA14	I am concerned about the resale value of circular buildings.	2.86	1.32
11	BA16	I think there is a lack of skilled professionals in circular construction.	2.86	1.24
12	BA10	I am unsure about the long-term benefits of circular buildings.	2.82	1.33
13	BA4	I think there are too few incentives to invest in circular buildings.	2.81	1.40
14	BA17	I am unsure about the quality of circular buildings.	2.80	1.24
15	BA8	I believe that circular construction is still a new and untested concept.	2.79	1.29
16	BA9	I think there is insufficient government support for circular construction.	2.79	1.25
17	BA3	I feel that circular buildings are not widely available.	2.77	1.30

18	BA2	I think there is a lack of information about circular construction.	2.76	1.23
19	BA20	I think that circular construction is not yet fully developed.	2.74	1.28
20	BA1	I believe the cost of circular buildings is too high.	2.70	1.27

RII=Relative Importance Index, **SD**=Standard Deviation

Source: Field Data, 2024

Standard deviation is included to indicate the degree of variability in respondents' perceptions of each barrier. While mean scores indicate the average severity of a perceived barrier, SD values indicate whether respondents generally agreed or expressed widely differing views. Higher SD values suggest divergent perceptions, often associated with varying levels of exposure to CC concepts, whereas lower SD values indicate greater consensus. Reporting SD values, therefore, enhances the interpretability of the results and supports subsequent inferential analyses.

5. Discussion

The purpose of this discussion is to interpret the findings presented in the results section by explaining what the results reveal, why these patterns occur, and what they imply for circular construction (CC) adoption in Ghana. The discussion draws on the Knowledge–Attitude–Practice (KAP) model and situates the findings within the broader context of research conducted in Ghana, Sub-Saharan Africa (SSA), and other regions. It also links each key finding to its theoretical and practical implications.

The results reveal a generally low to moderate level of consumer awareness of circular construction (CC) in Ghana, with awareness concentrated around high-level concepts such as cost-saving potential (CA1), environmental certifications (CA2), and carbon-emission reduction benefits (CA4). These items ranked highest but scored below the midpoint of the 5-point scale, suggesting that awareness is superficial rather than comprehensive. In contrast, very low awareness was recorded for lifecycle benefits (CA14), reuse and recycling principles (CA15), and foundational CC concepts (CA20), indicating that most consumers lack an understanding of the core technical and systemic features of CC. This pattern suggests that although consumers have been exposed to general sustainability narratives, deeper knowledge related to CC design, lifecycle thinking, and policy frameworks remains limited. Similar findings were reported in Ghana by Ametepey et al. (2015), who noted low levels of green literacy despite increasing public dialogue on sustainability. Studies in other SSA contexts, such as Kenya, South Africa, and Nigeria, also found that consumers tend to associate sustainability with broad environmental messaging but possess limited understanding of technical CC concepts (Osei-Tutu et al., 2022; Gasparri et al., 2023; Ezeudu & Ezeudu, 2019). Internationally, research shows that higher consumer literacy in Europe and parts of Asia is strongly influenced by regulatory visibility and familiarity with certification (Benites et al., 2022; Guerra et al., 2021), a condition that is still emerging in Ghana.

The barrier analysis further underscores the deep-rooted misconceptions that shape consumer attitudes toward CC. The highest-ranked barrier was the perception that circular buildings may not meet functional housing needs (BA12), followed by concerns about maintenance challenges (BA6), technological complexity (BA18), market immaturity (BA13), and the durability of recycled materials (BA7). These concerns highlight that consumers question the practicality, performance, and long-term reliability of CC. Prior studies in SSA similarly report that consumers

often perceive CC as technically complex, experimental, or incompatible with traditional housing expectations (Chileshe et al., 2024; Mamun et al., 2023; Rajendra & Mohanasundaram, 2023). This reinforces a broader trend in developing economies, where risks related to reliability, safety, and quality outweigh potential cost savings. Interestingly, the belief that circular buildings are expensive (BA1) ranked lowest in the quantitative results, despite persistent cost anxiety in the qualitative feedback. This divergence indicates that, while cost remains psychologically salient, it is overshadowed by performance-related concerns in this study. This finding contrasts with international studies, which repeatedly cite cost as the foremost barrier (Adams et al., 2017; Saavedra et al., 2017), but aligns with some emerging economies, where consumers prioritize perceived safety and functional adequacy over economic considerations.

6. CONCLUSION

This study provides one of the first empirical assessments of consumer awareness of circular construction (CC) in Ghana, revealing a fragmented understanding of CC principles and persistent misconceptions that hinder its adoption. Although respondents demonstrated partial awareness of cost-saving and environmental benefits, deeper knowledge, particularly regarding lifecycle thinking, material reuse, and policy frameworks, remained limited. These findings underscore that awareness gaps, rather than cost alone, constitute a major barrier to CC uptake among Ghanaian consumers.

The results, therefore, provide new demand-side insights into a research area previously dominated by supply-side analyses of professionals and institutions. Practically, the findings carry important implications for policymakers, industry leaders, and financial institutions. For government stakeholders, the low awareness of CC policy frameworks calls for stronger communication strategies, simplified certification schemes, and the implementation of visible demonstration projects in major cities. For industry practitioners, addressing misconceptions about durability, maintenance, and design flexibility is essential to improving consumer acceptance.

Developers and contractors can support adoption by integrating consumer education into marketing and showcasing diverse CC building typologies. Financial institutions also have a critical role in reducing perceived risks by offering targeted green financing products and incentives that make CC options more accessible. For academia, the study highlights the need for curriculum enhancements, public awareness collaborations, and interdisciplinary research involving behavioural science, construction management, and environmental policy. Educational institutions can contribute by embedding CC concepts within architecture, engineering, and sustainability programs and engaging students in CC demonstration initiatives.

As the study offers valuable insights, some limitations must be acknowledged. The sample size, urban focus, and cross-sectional design limit generalizability and the ability to track changes in awareness over time.

Future research should employ longitudinal designs, experimental awareness interventions, and advanced modelling techniques, such as PLS-SEM, to examine causal pathways among awareness, attitudes, and adoption. Therefore, this study establishes a foundational understanding of consumer-level awareness gaps in circular construction within Ghana. By addressing these gaps through targeted policy actions, educational reforms, and industry engagement, stakeholders can accelerate the transition towards a more sustainable and circular built environment. Future research building on this baseline will be essential to enhancing CC adoption and supporting Ghana's broader environmental and climate-resilience objectives.

REFERENCES

Adams, K. T., Osmani, M., Thorpe, T., & Thornback, J. (2017). Circular economy in construction: Current awareness, challenges and enablers. Proceedings of the Institution of Civil Engineers: Waste and Resource Management, 170(1), 15–24. https://doi.org/10.1680/jwarm.16.00011

Akhimien, N. G., Latif, E., & Hou, S. S. (2020). Application of circular economy principles in buildings: A systematic review. Journal of Building Engineering, 38, 102041. https://doi.org/10.1016/j.jobe.2020.102041

Alhawamdeh, M., Lee, A., & Saad, A. (2024). Designing for a Circular Economy in the Architecture, Engineering, and Construction Industry: Insights from Italy. Buildings, 14(7), 1946. https://doi.org/10.3390/buildings14071946

Ametepey, S. O., Aigbavboa, C. O., & Ansah, S. K. (2015). Barriers to successful implementation of sustainable construction in the Ghanaian construction industry. Procedia Manufacturing, 3, 1682–1689. https://doi.org/10.1016/j.promfg.2015.07.988

Benites, H. S., Osmond, P., & Prasad, D. (2022). Inquiry on perceptions and practices of built environment professionals regarding regenerative and circular approaches. Buildings, 13(1), 63. https://doi.org/10.3390/buildings13010063

Bucur, L. (2023). Exploring the role of consumers in promoting a circular economy: Increasing awareness and engagement. Proceedings of the . . . International Conference on Business Excellence, 17(1), 38–47. https://doi.org/10.2478/picbe-2023-0006

Cao, J., Wu, W., Hu, M., & Wang, Y. (2023). Green Building Technologies Targeting Carbon Neutrality. Energies, 16(2), 836. https://doi.org/10.3390/en16020836

Cape Coast Metropolitan. (2023). Cape Coast Metropolitan population statistics. Retrieved August 21, 2024, from https://www.citypopulation.de/en/ghana/admin/central/0202__cape_coast_metropolitan/

Central Intelligence Agency (CIA). (2024). Ghana – The World Factbook. Retrieved August 21, 2024, from https://www.cia.gov/the-world-factbook/countries/ghana/

Charef, R., & Lu, W. (2021). Factor dynamics to facilitate circular economy adoption in construction. Journal of Cleaner Production, 319, 128639. https://doi.org/10.1016/j.jclepro.2021.128639
Cheung, A.K.L. (2014). Structured Questionnaires. In: Michalos, A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_2888
Chileshe, N., Rameezdeen, R., & Hosseini, M. R. (2024). Drivers of sustainable construction practices in developing countries: A systematic review. Journal of Cleaner Production, 434, 139832. https://doi.org/10.1016/j.jclepro.2023.139832
Data Protection Act (Act 843). (2012, October 16). Data Protection Act. Ghana GeoPortal. Retrieved December 6, 2024, from https://ghana.africageoportal.com/pages/7fdf58a641a74f85a15f2a06a6538fb9
Ellen MacArthur Foundation (2022). Universal Circular Economy Policy Goals. Ellen MacArthur Foundation. Available at: https://www.ellenmacarthurfoundation.org/universal-policy-goals/examples#:~:text=The%20Universal%20Circular%20Economy%20Policy,value)%2C%20and%20regenerate%20nature (Accessed March 16, 2025).
Ezeudu, O. B., & Ezeudu, T. S. (2019). Implementation of circular economy principles in industrial solid waste management: Case studies from a developing economy (Nigeria). Recycling, 4(4), 42. https://doi.org/10.3390/recycling4040042
Gasparri, E., Arasteh, S., Kuru, A., Stracchi, P., & Brambilla, A. (2023). Circular economy in construction: A systematic review of knowledge gaps towards a novel research framework. Frontiers in Built Environment, 9. https://doi.org/10.3389/fbuil.2023.1239757
Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production, 114, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007
Global ABC. (2021). Towards a zero-emission, efficient and resilient buildings and construction sector: Align stakeholders along the buildings and construction value chain, governments, private sector, research, civil society with the well-below 2 degree Paris Agreement Goals. Global Alliance for Buildings and Construction (GlobalABC). Retrieved March 16, 2025, from https://climateaction.unfccc.int/Initiatives?id=30
Guerra, B. C., Shahi, S., Mollaei, A., Skaf, N., Weber, O., Leite, F., & Haas, C. (2021). Circular economy applications in the construction industry: A global scan of trends and opportunities. Journal of Cleaner Production, 324, 129125. https://doi.org/10.1016/j.jclepro.2021.129125
Howell, C. R., Su, W., Nassel, A. F., Agne, A. A., & Cherrington, A. L. (2020). Area based stratified random sampling using geospatial technology in a community-based survey. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-09793-0
Humpenöder, F., Popp, A., Merfort, L., Luderer, G., Weindl, I., Bodirsky, B. L., Stevanovic, M., Klein, D., Rodrigues, R., Bauer, N., Dietrich, J. P., Lotze-Campen, H., & Rockström, J. (2024). Food matters: Dietary shifts increase the feasibility of 1.5°C pathways in line with

the Paris Agreement. Science Advances, 10. https://doi.org/10.1126/sciadv.adj3832
Hoosain, M. S., Paul, B. S., Doorsamy, W., & Ramakrishna, S. (2023). The Influence of Circular Economy and 4IR Technologies on the Climate–Water–Energy–Food Nexus and the SDGs. Water, 15(4), 787. https://doi.org/10.3390/w15040787
Kara, H. (2023). Quantitative data analysis. In H. Kara (Ed.), Research and evaluation for busy students and practitioners (2nd ed., pp. 173–186). Policy Press.
Kinemo, S. (2024). Relative importance index in ranking performance management practices towards organizational performance. NG Journal of Social Development, 13(2), 54–60. https://doi.org/10.4314/ngjsd.v13i2.4
Kumar, D., & Murugan, M. (2018). Likert scale – The potential pitfalls every novice researcher needs to know. Indian Journal of Applied Research, 8(5), 45–48.
Malmqvist, T., Moncaster, A., Rasmussen, F., & Birgisdóttir, H. (2019). Circularity in the built environment: A call for a paradigm shift. In Handbook of the circular economy (pp. 321–335). Edward Elgar. https://doi.org/10.4337/9781788972727.00042
Mamun, A. A., Rahman, M. K., Masud, M. M., & Mohiuddin, M. (2023). Willingness to pay premium prices for green buildings: Evidence from an emerging economy. Environmental Science and Pollution Research, 30(32), 78718–78734. https://doi.org/10.1007/s11356-023-27998-9
Mhatre-Shah, P., Gedam, V., & Unnikrishnan, S. (2024). Assessing the environmental and economic impacts of adopting circular economy for sustainable resource management in the Indian construction sector. Journal of Indian Business Research, 16(1), 23–54. https://doi.org/10.1108/jibr-05-2023-0169
Mofolasayo, A. S. (2022). A Framework for the Application of Optimization Techniques in the Achievement of Global Emission Targets in the Housing Sector. Trends Journal of Sciences Research, 1(1), 73–103. https://doi.org/10.31586/wjcea.2022.512
Mostafa, S. & Ahmad, I. A. (2017). Recent developments in systematic sampling: a review. Journal of Statistical Theory and Practice, 12(2), 290-310. https://doi.org/10.1080/15598608.2017.1353456
Osei-Tutu, S., Ayarkwa, J., Osei-Asibey, D., Nani, G., & Afful, A. E. (2022). Barriers impeding circular economy (CE) uptake in the construction industry. Smart and Sustainable Built Environment, 12(4), 892–918. https://doi.org/10.1108/sasbe-03-2022-0049
Osmani, M. (2021). Circular economy in the construction industry: A review of stakeholders' awareness, drivers, and barriers. Sustainable Production and Consumption, 27, 405–420. https://doi.org/10.1016/j.spc.2020.11.012
Papamichael, I., Voukkali, I., Loizia, P., Stylianou, M., Economou, F., Vardopoulos, I., Klontza, E. E., Lekkas, D. F., & Zorpas, A. A. (2023). Measuring Circularity: Tools for monitoring a smooth transition to Circular Economy. Sustainable Chemistry and Pharmacy, 36, 101330. https://doi.org/10.1016/j.scp.2023.101330
Rada, E. C., Ragazzi, M., Torretta, V., Castagna, G., Adami, L., & Cioca, L. I. (2018). Circular economy and waste to energy. AIP Conference Proceedings, 1968(1), 030001. https://doi.org/10.1063/1.5039237

Rajendra, P., & Mohanasundaram, T. (2023). Environmental Sustainability: Harmonizing Construction Mining Industry Practices with the Implementation of Green Consumption and Sustainable Building Materials in Bangalore, India. Journal of Mines Metals and Fuels, 2685–2698. https://doi.org/10.18311/jmmf/2023/41760

Saavedra, Y. M., Iritani, D. R., Pavan, A. L., & Ometto, A. R. (2017). Theoretical contribution of industrial ecology to circular economy. Journal of Cleaner Production, 170, 1514–1522. https://doi.org/10.1016/j.jclepro.2017.09.260

Setia, M. S. (2023). Cross-sectional studies. In Epidemiology for the uninitiated (pp. 269–291). Cambridge University Press. https://doi.org/10.1017/9781009010054.014

Simpeh, E. K., & Smallwood, J. (2018). Analysis of the benefits of green building in South Africa. Journal of Construction Project Management and Innovation, 8(2), 1829–1851.

Taherdoost, H. (2022). Designing a questionnaire for a research paper: A comprehensive guide to design and develop an effective questionnaire. Asian Journal of Managerial Science, 11(1), 8–16. https://doi.org/10.51983/ajms-2022.11.1.3087

Tekpe, E., Ansah, S. K., & Akomah, B. B. (2022). Appropriate technology and design: A solution for sustainable and affordable housing delivery in major cities of Ghana. Journal of Engineering Research and Reports, 23(8), 18–29. https://doi.org/10.9734/jerr/2022/v23i8739

Wuni, I. Y. (2022). Burden of proof beyond the triple bottom line: Mapping the benefits of circular construction. Sustainable Production and Consumption, 34, 528–540. https://doi.org/10.1016/j.spc.2022.10.006

Zemanová, V. (2023). Circular economy implementation from the perspective of benefits and barriers. Proceedings of the 16th International Conference Liberec Economic Forum 2023. https://doi.org/10.15240/tul/009/lef-2023-31

Zhang, N., Han, Q., & De Vries, B. (2021). Building circularity assessment in the architecture, engineering, and construction industry: A new framework. Sustainability, 13(22), 12466. https://doi.org/10.3390/su132212466

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