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EVALUATION OF AWARENESS LEVEL OF CIRCULAR ECONOMY PRINCIPLES AMONG BUILDING CONSTRUCTION PROFESSIONALS IN PLATEAU STATE, NIGERIA

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ABSTRACT

This quantitative study assesses awareness of circular economy principles among building construction professionals in Plateau State, Nigeria. It identifies key circular economy principles, determines stakeholder perceptions, evaluates critical barriers, and assesses perceived benefits. A stratified random sampling technique was used to distribute questionnaires to industry stakeholders. Data were analyzed using descriptive statistics and relative importance indices (RII). The results reveal a significant awareness gap, with 52.5% of professionals being only somewhat or completely unfamiliar with the term "circular economy." Among the principles, design for disassembly (RII=0.97) and material reuse were most recognized. The top perceived benefit was waste reduction to landfills (RII=0.50, Rank 1st). Conversely, the primary barriers identified were a lack of clear government policies (RII=0.49), an absence of economic incentives, and higher perceived initial costs for circular economy materials and methods. The study concludes that while the long-term cost savings and client benefits of a circular economy are acknowledged, the perception of high initial costs presents a critical contradiction. It recommends a structured intervention strategy, specifically the establishment of a Plateau State Circular Economy Roadmap. This should include binding targets for construction and demolition waste diversion, material reuse quotas, and the integration of Design for Disassembly (DfD) standards into building regulations.

Keywords: Awareness Level, Circular Economy, Principles, Construction, Plateau State

1. INTRODUCTION

Housing has been universally accepted as the second most important human need. The standard of buildings has been accepted as a standard measure of nation indexes, its effective economic development and civilisation (National Housing Policy of United Nations Habitat Agenda, 2011). This has led to a boom in building construction. But with this boom comes a significant challenge of managing the environmental impact because the construction industry is one of the biggest contributors to global waste and resource consumption (Purchase et al., 2021). Most of the buildings constructed today are not designed for longevity or reuse (Geissdoerfer, et al., 2017). Circular economy principles in construction offer a game-changing solution by encouraging the shift from the outdated linear approach to a more sustainable model (University of the Built Environment, 2024). This sustainable model focuses on maximizing resource efficiency, enhancing longevity, and minimizing waste (Dorrego-Viera et al., 2025). It prioritizes reuse, recycling, and regeneration instead of demolishing buildings and throwing materials away. This approach keeps valuable resources in circulation for as long as possible (Islam, et al.,2024). Circular economy is a model that aims to keep resources in use for as long as possible, extract the maximum value from them while in use, then recover and regenerate products and materials at the end of their service life (Cotrina-Teatino & Marquina-Araujo, 2025). It is a departure from the traditional linear economy, which follows a 'take, make, dispose' model. Circular economy incorporates the entire lifecycle of a product, from design to end-of-life (Toxigon Infinite, 2025).

Governments and policymakers play a crucial role in shaping a circular future. Aligning waste management, recycling, and product labeling regulations can reduce compliance costs and encourage investment in circular solutions (Oshioste, Okoye, & Udokwu, 2023; Oyewole & Adegbite, 2023). Implementing strict regulations on waste production, offering tax incentives for sustainable construction, and enforcing green building certifications can push the building construction subsector toward circularity. Harmonizing standards and regulations across regions can facilitate the adoption of circular economy practices by creating a level playing field for businesses operating in multiple jurisdictions (Ekemezie & Digitemie, 2024). Integrating circular economy principles in building construction in Plateau State will enhance resource efficiency, reduce waste, and minimize environmental impact.

Principles of Circular Economy

The circular economy in construction is guided by three key principles: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. Minimizing Waste and Pollution**;** construction industry generates vast waste, much of which ends up in landfills (Raqqad, 2024). Embodied carbon, the carbon dioxide emissions created in the construction process before a building becomes operational, accounts for 10% of all global energy-related CO_2 emissions. The production of materials like concrete is extremely energy-intensive, accounting for 8% of global CO_2 (Chen, et al., 2023). Attitudinal causative of waste behavior includes belief that waste is inevitable, skepticism of waste reduction, few or no incentives, and poor knowledge of waste management. Perceived behavioral control factors are time pressure, cost pressure, lack of waste facilities and poor market for waste materials among others. Subjective norms causative of waste behavior are wasteful culture in the industry, lack of clear policies, low waste priority, and lack of waste diversion target (Ajayi, 2017).

Keeping products and materials in use**;** this is about extending the lifespan of products and materials through reuse, remanufacturing, and recycling. Companies can minimize waste and extend product lifecycles by designing products that are easy to disassemble, repair, and recycle (Koh, et al., 2017; Mirzaei & Shokouhyar, 2023). Deconstruction techniques recover high value materials like steel, concrete, and timber, reducing the need for virgin resources (Fevereiro, 2025). This lowers costs, cuts carbon emissions, and extends the life of construction materials. reuse, repurposing, and recycling, focusing on identifying conditions that maximize cost savings and reduce environmental impact. Reuse strategies emphasise scenarios requiring minimal maintenance to extend product life, while repurposing explores transformations for new applications when direct reuse is not feasible (Psarommatis, & Azamfirei, 2025). The product should be disassembled, and components are grouped based on their susceptibility to wear and tear. Using a 360° visual diagnostic tool, individual components are then categorized as either healthy with reduced remaining-useful-life or having reached end-of-life. Appropriate R-strategies such as reuse, repurpose, refurbish, remanufacture, recycle, and recover are subsequently applied, extending the lifespan of the component (Ahmed, et al., 2025).

Regenerating natural systems**;** construction often depletes natural resources and damages ecosystems. The circular economy encourages bio-based materials, green infrastructure, and eco-friendly building designs to restore nature such as reforestation and soil regeneration. The principle highlights the ecological, structural, and aesthetic benefits of using materials such as modified wood, bamboo, biopolymers, and fiber-reinforced concrete. Bio-based materials offer an ecological alternative to traditional construction materials. This work underscores the need for close collaboration among architects, builders, urban planners, engineers, and biologists to overcome challenges related to regulations, market acceptance, and the training of other building professionals (Ghrab, & Feiz, 2025). Compressed stabilized earth blocks are garnering increased attention because of their ability to lower environmental impact. These blocks are made from locally sourced materials, reducing the transportation-related emissions and energy use. Their production processes typically require far less energy than traditional building blocks, which results in reduced carbon footprints. Earth blocks also contribute to sustainability through their thermal performance, which can enhance energy efficiency in buildings by naturally regulating indoor temperatures. As a result, less artificial heating and cooling is required, leading to further energy savings (Sinha, & Sudarsan, 2025).

The construction industry remains entrenched in a fundamentally unsustainable linear economic model "take-make-dispose", systematically depleting finite natural resources, generating massive pollution, and overwhelming landfills with waste. This extractive and wasteful paradigm is driving an environmental crisis, crippling long-term resource security, and cementing the industry's status as a primary contributor to global unsustainability (Macarthur & Heading, 2019). The construction follows a linear economy model, where materials are extracted, used, and discarded as waste. This outdated approach leads to resource depletion, pollution, and excessive landfill waste, making the construction industry one of the least sustainable industries. This is where circular economy comes in to change the linear approach (Andersen, & Negendahl, 2023). The circular economy emphasizes waste reduction at every stage, from design to demolition. It is about creating products that can be easily disassembled and recycled and using materials that are safe and non-toxic. Therefore, the study seeks to find out the understanding of the concept of circular economy among construction professionals in plateau state towards its applications.

2. AIM AND OBJECTIVES

The study is aimed at quantitatively assessing awareness level of circular economy principles within Plateau State. To achieve the aim of this study, the following objectives are pursued: to identify categories of circular economy principles among building construction professionals in Plateau State, determine the perception of circular economy among building construction professionals, assess the critical barriers to circular economy among building construction professionals, and to evaluate the benefits of circular economy among building construction professionals in Plateau State.

3. METHODOLOGY

The study involves a survey using quantitative data which enables systematic measurement of awareness, perceptions, barriers, and benefits using standardized instruments. Suited for capturing sector-wide insights from heterogeneous professionals. The target populations are architects, builders, engineers, quantity surveyors, estate managers, town planners, and others in Plateau State. Stratified random sampling technique was used. Strata based on professional roles to ensure proportional representation. Section B**:** objective 1 was circular economy principle relevance (5-point Likert: 1=Not Relevant to 5=Extremely Relevant) was used to obtain the data while descriptive stats (mean, standard deviation) was used for the data analysis. Section C: objective 2 perceived perception of circular economy relevance (5-point Likert) were analyzed using mean scores**.** Section D**:** objective 3 barriers to circular economy relevance (5-point Likert) were analyzed using Mean scores and ranked. Section E**:** objective 4 observed/expected benefit relevance (5-point Likert) analyzed using Mean scores and ranking. All the data were analyzed using SPSS.

4. RESULTS AND DISCUSSION

The responses obtained from representativeness towards generalizability shows the sample size as modest (n=61)**.** While diverse roles and fields are covered. The diversity of roles (Construction Managers, Site Engineers, CEO, Academics, etc.) and professional fields (Architecture, Building, Engineering, QS, Estate Management) suggests the data aims to capture perspectives across the built environment industry. The data reflects a highly educated sample 67.2% hold at least a Bachelor's degree (BSc/BEng: 34.4%, MSc/MBA: 29.5%, PhD: 3.3%). The balance across core professional fields (Architecture 19.7%, Building 19.7%, Engineering 18.0%, QS 18.0%, Estate Management 16.4%) is strength, aiming for multi-disciplinary input. Cumulative percentages are primarily useful for understanding the distribution (e.g., seeing that 82% of highest qualifications are HND or above) but hold less analytical weight here than the frequencies and individual percentages Table 1.

Table 1: Respondents' Background Information

Summary of Information	Frequency	Percentage (%)	Cumulative Percentage
Role of Respondents in their Organization			
Construction Manager	7	11.48	11.48
Project Supervisor	6	9.84	9.84
Site Engineer	7	11.48	11.48
Head of Valuation	5	8.20	8.20
Building/Estate Officer	6	9.84	9.84
Director/Property Manager	4	6.56	6.56
Principal Partner/ Chief Executive Officer	6	9.84	9.84
Surveying Geo-Informatics	3	4.92	4.92
Project QS	6	9.84	9.84
Procurement Officer	5	8.20	8.20
Academics	6	9.84	100.00
Total	61	100.00	
Professional Field			
Architecture	12	19.67	19.67
Building	12	19.67	19.67
Engineering (Civil, Structural, Mechanical, Electrical)	11	18.03	18.03
Quantity Surveying	11	18.03	18.03
Estate Management and Valuation	10	16.39	16.39
Others	5	8.20	100.00
Total	61	100.00	
Highest Academic Qualification			
Diploma	5	8.20	8.20
Higher National Diploma	15	24.59	24.59
BSc/BEgr	21	34.42	34.42
MSc/MBA	18	29.50	29.50
PhD	2	3.27	100.00
Total	61	100.00	

4.1 Identification and Categorization of Circular Economy Principles Among Building Construction Professionals in Plateau State

The data reveals a substantial gap in awareness of the term 'circular economy' among these professionals. While nearly half (47.5%) are familiar, a majority (52.5%) are either completely unfamiliar or only somewhat familiar Table 2. This indicates the term itself may not be widely adopted or effectively communicated within this sector, posing a potential challenge for initiatives relying on this concept.

Table 2: Familiarity with the Term Circular Economy in the Context of Construction

S/N	Familiarity with term circular economy	Response rate	Percentage
1	Yes	29	47.54
2	No	26	42.62
3	Somewhat	6	9.84

Recognizing the principles that guide circular economy from the data obtained, design for disassembly tops the list with high RII (0.97), followed by material reuse. This indicates that professionals prioritize upfront design strategies over waste management. The high RII values across all principles suggest consensus on their importance, but the drop in RII from 1st to 5th highlights prioritization differences Table 3. The technical focus for advancing circular economy in construction must start with revolutionizing design to enable future material recovery, followed by establishing robust operational systems for reusing materials directly. Recycling is recognized as necessary but is a lower priority solution compared to design-led prevention and direct reuse. The high consensus underscores the industry readiness to adopt these technically demanding strategies. The evaluation of perceived sustainability benefits derived from circular economy principles among building construction professionals in Plateau state has revealed its efficiency in waste management through initiatives around concrete resource savings (materials, energy, water) and measurable waste reduction/landfill diversion as established in Balsalobre-Lorente et al., (2025). Design for disassembly and material reuse are the principles that stood out as known in Plateau state, this in agreement with a research by Rashid et al., (2025).

Table 3: Principles of Circular Economy Recognized as Relevant to Building Construction

S/N	Principles of Circular Economy	5th	4th	3rd	2nd	1st	Total	RII Value	Rank
1	Design for Disassembly/Reuse	53	7	1	0	0	296	0.97	1st
2	Material Reuse & Repurposing (On-site/Off-site)	47	6	5	3	1	281	0.92	2nd
3	Waste Reduction & Prevention (Lean Construction)	43	5	6	6	1	266	0.87	3rd
4	Using Recycled/Secondary Materials	37	8	7	8	1	255	0.83	4th
5	Material Recycling (High-quality)	39	4	10	1	7	250	0.81	5th

4.2 Perception of Circular Economy Benefits among Building Construction Professionals in Plateau State

The most striking finding is that waste reduction to landfills is ranked as the top perceived benefit (RII 0.50, rank 1st). This is important given Plateau State context as a developing region, waste management is likely a visible and pressing issue. The second and third rankings (cost reduction and reduced material dependence) show professionals are also thinking practically about economic and supply chain benefits Table 3. Plateau State construction professionals perceive circular economy primarily as a practical solution for waste reduction, cost efficiency, and material security (Balsalobre-Lorente et al., 2025). While socio-economic and reputational benefits are acknowledged, the major technical barrier is the perceived high initial investment. Successful circular economy implementation in Plateau will require Demonstrating clear waste diversion and cost-saving outcomes through pilots. Developing accessible financing and business models to overcome upfront cost barriers. Fostering local technical capacity for material reuse/recycling businesses to harness the recognized potential for import substitution and economic opportunity. The focus should be on tangible, measurable results aligning with the top-ranked perceived benefits.

Table 3: Perception of Circular Economy Benefits among Building Construction Professionals in Plateau State

S/N	Perception of Circular Economy	5th	4th	3rd	2nd	1st	Total	RII Value	Rank
1	Circular economy can significantly reduce construction and demolition waste sent to landfills in Plateau State.	50	10	1	0	0	293	0.50	1st
2	Circular economy practices (e.g., reuse, recycling) can lower overall project costs in the long run	45	6	5	2	3	271	0.47	2nd
3	Circular economy can reduce the dependence on virgin, imported, or scarce construction materials in Plateau State.	43	5	6	4	3	264	0.45	3rd
4	Circular economy can create new local business opportunities (e.g., material recovery, refurbishment)	36	8	7	8	2	251	0.44	4th
5	Circular economy can enhance the environmental reputation of construction firms in Plateau State	35	9	10	1	6	249	0.43	5th
6	Circular economy can contribute positively to public health by reducing pollution	35	6	5	7	8	236	0.41	6th
7	Circular economy implementation requires significant upfront investment that outweighs initial benefits	35	5	6	6	9	234	0.40	7th
8	Circular economy can lead to more resilient and adaptable buildings for Plateau communities	35	7	1	8	10	232	0.40	8th

4.3 Critical Barriers to Circular Economy among Building Construction Professionals in Plateau State Barrier Experience

Twelve critical barriers to circular economy among building construction professionals in plateau state were identified and ranked by Relative Importance Index (RII), with lack of clear government policies as the top barrier (RII=0.49). Absence of economic incentives (tax breaks, subsidies) for circular economy practices, higher perceived initial costs of circular economy materials/methods, limited availability & reliable supply of recycled/secondary materials locally, and lack of specialized facilities for material sorting, recycling, refurbishment were ranked 2nd, 3rd, 4th and 5th respectively Table 4. Success requires top-down policy action combined with financial support and local infrastructure development. Addressing all the identified barriers would catalyze progress across lower-ranked challenges by creating market certainty and enabling investment as established (Ahmed et al., 2025).

Table 4: Critical Barriers to Circular Economy among Building Construction Professionals in Plateau State

S/N	Barriers to Circular Economy	5th	4th	3rd	2nd	1st	Total	RII Value	Rank
1	Lack of clear government policies/regulations supporting circular economy	49	9	1	1	1	289	0.49	1st
2	Absence of economic incentives (tax breaks, subsidies) for circular economy practices	45	6	2	2	6	265	0.46	2nd
3	Higher perceived initial costs of circular economy materials/methods	42	5	6	4	4	260	0.45	3rd
4	Limited availability & reliable supply of recycled/secondary materials locally	36	8	7	6	4	249	0.43	4th
5	Lack of specialized facilities for material sorting/recycling/refurbishment	35	9	9	1	7	247	0.42	5th
6	Limited client awareness or demand for circular economy buildings	35	10	1	4	11	237	0.41	6th
7	Resistance to change / Traditional "take-make-dispose"mindset in the industry	35	6	5	7	8	236	0.41	7th
8	Lack of technical knowledge/skills among workforce on circular economy practices	35	5	6	6	9	234	0.40	8th
9	Fragmented nature of the construction supply chain hindering collaboration	31	5	6	4	15	229	0.39	9th
10	Perceived complexity of implementing circular economy (design, logistics, contracts)	35	6	1	7	12	228	0.39	10th
11	Lack of access to financing for circular economy investments	30	9	10	1	11	227	0.39	11th
12	Concerns about performance/quality/duration guarantees of reused/recycled materials	33	6	5	4	13	225	0.39	12th
13	Inadequate standards/certification for reused/recycled materials/components	30	8	7	8	8	216	0.37	13th

4.4 Benefits of Circular Economy among Building Construction Professionals in Plateau State

Benefits of circular economy were identified and ranked to include improved resource efficiency with an exceptionally high RII of 0.96. This suggests professionals strongly recognize circular economy core value in optimizing material/energy use. The next top benefits were waste reduction (0.92) and landfill diversion (0.88) showing environmental concerns as primary drivers. Interestingly, cost savings on materials (0.82) and waste disposal (0.81) rank lower, indicating that while economic benefits are acknowledged, they are secondary to environmental efficiency in professionals' minds Table 5. Circular economy strategies must demonstrably optimize material, energy, and water flows. Focus on material passports, modular design, prefabrication, and resource tracking is paramount. Solutions prioritizing source reduction (lean construction), on-site reuse, and high quality recycling resonate most strongly. Design and logistics must target preventing waste generation and landfill reliance. Plateau State construction professionals perceive circular economy primarily as a practical solution for waste reduction, cost efficiency, and material security as well as waste reduction to landfills and cost reduction and reduced material dependence. While socio-economic and reputational benefits are acknowledged, the major technical barrier is the perceived high initial investment. Successful circular economy implementation in Plateau will require demonstrating clear waste diversion and cost-saving outcomes through pilots. Critical barriers to the circular economy in plateau state include lack of clear government policies as the top barrier. Absence of economic incentives (tax breaks, subsidies) for circular economy practices, higher perceived initial costs of circular economy materials/methods, limited availability & reliable supply of recycled/secondary materials locally. Benefits of circular economy include improved resource efficiency and landfill diversion, waste reduction, and Positive client feedback/satisfaction (Lakshmi et al., 2025). Leverage the strong belief in long-term material/disposal savings to justify initial investments. Showcase successful local/national examples and highlight job creation and innovation as valuable outcomes of a circular economy.

Table 5: Benefits of Circular Economy among Building Construction Professionals in Plateau State

s/n	Benefits of Circular Economy	5th	4th	3rd	2nd	1st		Total	RII Value	Rank
1	Improved resource efficiency (materials, energy, water)	50	10	1	0	0	1st	293	0.96	1st
2	Reduction in overall project waste generation	48	9	1	1	2	2nd	283	0.92	2nd
3	Low perceived initial costs of Circular economy materials/methods	46	5	3	4	6	3rd	273	0.89	3rd
4	Reduction in final waste sent to landfill	47	4	4	2	4	4th	271	0.88	4th
5	Positive client feedback/satisfaction	45	6	5	2	3	4th	271	0.88	4th
6	Improved stakeholder (community, regulator) relations	43	5	6	4	3	6th	264	0.86	6th
7	Cost savings on virgin materials (through reuse/recycling)	36	8	7	8	2	7th	251	0.82	7th
8	Cost savings on waste disposal	35	9	10	1	6	8th	249	0.81	8th
9	Enhanced project sustainability credentials/reputation	35	6	5	7	8	9th	236	0.77	9th
10	Creation of local jobs (e.g., sorting, refurbishment)	35	5	6	6	9	10th	234	0.76	10th
11	Increased innovation in design or construction methods	35	7	1	8	10	11th	232	0.76	11th

5. CONCLUSION

The principles that guide the circular economy in Plateau State are designed for disassembly by material reuse which indicates that professionals prioritize upfront design strategies over waste management. The study discovered perceived benefits of circular economy to include significantly reduce construction and demolition waste sent to landfills practices (e.g., reuse, recycling) which can lower overall project costs in the long run, reduce the dependence on virgin, imported, or scarce construction materials, create new local business opportunities (e.g., material recovery, refurbishment), and can enhance the environmental reputation of construction firms in Plateau State. The barriers to circular economy in Plateau State were lack of clear government policies/regulations supporting ‘circular economy’, absence of economic incentives (tax breaks, subsidies) for circular economy practices, higher perceived initial costs of circular economy materials/methods, and limited availability & reliable supply of recycled/secondary materials locally. The benefits of circular economy discovered were improved resource efficiency (materials, energy, water), Reduction in overall project waste generation, Low perceived initial costs of ‘circular economy’ materials/methods, low perceived initial costs of ‘circular economy’ materials/methods and reduction in final waste sent to landfill. Successful circular economy implementation requires solutions that demonstrably deliver on the top-ranked efficiency and waste benefits while providing clear pathways to overcome the cost barrier through financial innovation and proven life cycle cost analysis. Focusing communication and pilot projects on these top motivators is essential.

6. RECOMMENDATIONS

This study proposes a structured intervention strategy for mainstreaming circular economy (CE) principles in Plateau State Establishment of a Plateau State Circular Economy Roadmap with binding targets for construction and demolition (C&D) waste diversion, material reuse quotas, and Design for Disassembly (DfD) standards integrated into building regulations. The study recommends Execution of 2-3 visibility pilot projects as a public infrastructure for affordable housing utilizing locally sourced recycled/reclaimed materials and modular design to validate technical and economic feasibility. The study recommends a conduct of targeted awareness campaigns for policymakers, developers, clients, and communities highlighting circular economy systemic benefits (resource security, cost savings, job creation).

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