Baltic Journal of Real Estate Economics and Construction Management
ISSN: 2255-9671 (online)
2025, *13*, 196–213
https://doi.org/10.2478/bjreecm-2025-0015
https://content.sciendo.com

RIGA TECHNICAL UNIVERSITY

EVALUATION OF THE IMPLEMENTATION OF CIRCULAR ECONOMY AND SUSTAINABLE CONSTRUCTION PRACTICES IN THE NIGERIAN CONSTRUCTION INDUSTRY

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Received 20.07.2025; accepted 12.09.2025

Abstract. Construction activities in Nigeria will continue to affect the environment until sustainable building practices and the circular economy are completely adopted. To identify gaps and areas for improvement and provide practical recommendations that will support the implementation, this study is aimed to evaluate the implementation status of circular economy and sustainable construction practices within the Nigerian construction industry. To accomplish the aims of the study, a structured survey questionnaire was created, validated, and sent online via a Google Form as part of a quantitative research approach. The six portions of this instrument are A, B, C, D, E, and F. The research main conclusions demonstrated that respondents had a high degree of awareness and comprehension of the circular economy and sustainable construction principles; it also emphasised the notable gaps in the use of sustainable building materials, low-level adoption rates of recycling facilities, low-level adoption rates of more advanced technologies such as recycled water, rainwater harvesting systems, and passive solar design. The findings also highlight the strong commitment of the construction industry to easily implemented and cost-effective waste management strategies, energy conservation, and water conservation strategies. The study further emphasises a lack of strict governmental rules and regulations as the main barrier impeding wider adoption of circular economy and sustainable construction methods in the Nigerian construction industry. It is recommended that the government, through various ministries, should play a bigger role in the establishment of policy, incentives, and education, while construction professionals should assume a greater role to empower their clients with knowledge and awareness of the environmental benefits and potential cost savings associated with the circular economy and sustainable construction practices.

Keywords: *Circular economy, construction industry, implementation, Sustainable construction.*

INTRODUCTION

The construction industry is a broad and diverse sector, which involves planning, construction, maintenance and renovation of building structure structures (Çelik et al., 2017). It has been recognised for nearly thirty years that construction industry takes in more than 40 % of natural resources and produces almost three billion tons of waste annually (Weerakoon et al., 2023). The construction sector contributes significantly to the economic growth of a country by providing the socioeconomic infrastructure required, including homes, roads, hospitals, schools, and other basic and upgraded services, thereby enhancing the quality of life for its population. However, being a resource-intensive sector, the environment is significantly impacted by the construction sector as almost all of its projects are designed in a traditional or linear process without considering the environment and natural resources, which results in a significant depletion in water sources, soil erosion, deforestation and increased carbon footprints, which cause global warming (Hussin et al., 2013).

Through the completion of infrastructure projects throughout the nation, the Nigerian construction industry has demonstrated its ability to boost the country's economy, significantly influencing the GDP and providing a significant number of job opportunities for its citizens. However, its operations have also been shown to have detrimental effects on the ecosystem (Akindele et al., 2023). This led to the proposal of Sustainable Construction, which aims to make construction more socially, economically, and environmentally responsible, without limiting the need for development and allowing future generations to satisfy their demand (Oke et al., 2019). Developed nations have been the primary implementers of the concept of sustainable construction. The current problem is that developing nations, like Nigeria, are not following suit.

The Nigerian construction industry has historically used a linear, non-sustainable economic model of construction that is founded on the "take, make, dispose of" principle, which prohibits the recycling, reuse, and disassembly of built facilities. Consequently, when the facility's useful life is up, they become outdated (Ghufran et al., 2022). However, with the emphasis on sustainability and worldwide greening programs, this traditional construction approach needs to evolve. The idea of the Circular Economy has since gained recognition in many nations worldwide as a sustainable alternative to the conventional linear model. Its objective is to foster a more sustainable economy by promoting product reuse and recycling, thereby making them "circular" (Qu et al., 2021). Since the circular economy has gained recognition as a means of managing waste and conserving resources in a sustainable manner, its implementation in the construction sector can help the industry make the transition to sustainable construction.

In the circular economy concept, construction projects that have exceeded their useful lifespans should be recycled and their parts and components disassembled to create material banks for new construction, ensuring that the resources and components remain in a closed loop. (Wahyu Adi & Wibowo, 2020). Sustainability and the circular economy are related because they both focus on environmental issues and their solutions. Circular economy seeks to transform people's perceptions of the linear economy by lowering resource consumption and environmental effect while increasing industry-wide efficiency (Ghisellini et al., 2016). The emergence in circular economy and sustainable building methods has been viewed by experts, scholars, and policymakers as the most appropriate and effective approach to the construction industry.

A growing amount of research acknowledges that the building industry's environmental impact and greenhouse gas emissions might be significantly reduced by using sustainable construction methods and the circular economy. A recent study by Rahla et al. (2021) attempts to shed light on how to encourage the circular economy in buildings, which would eventually lead to larger cities that are healthier, more effective, and more sustainable. The suggested framework focuses on three cutting-edge areas: intelligent resource management, building design methodologies, and the digitisation of the building sector. It also considers circular economy implementation tactics throughout the building's lifecycle. A conceptual framework for implementing sustainability principles in the construction industry was developed by Akadiri et al. (2012), based on the sustainable triple bottom line principles of resource conservation, cost effectiveness, and design for human adaption. Similarly, research by Bello and Idris (2023) describes 19 circular economy adoption methods for the Nigerian construction sector and considers how important and successful these tactics are thought to be.

To identify gaps and areas for improvement, the existing construction activities in Nigeria's construction industry will be compared with international best practices and standards in this research project. Additionally, it will evaluate how well the circular economy and sustainable construction methods are being applied in Nigeria's construction sector and provide actionable recommendations to practitioners, industry stakeholders, and policymakers to promote the adoption of these methods in the country's construction sector.

1. REVIEW OF RELATED LITERATURE

1.1. The Concept of Circular Economy

The concept of circular economy has recently received a lot of interest in the scientific, political, and economic spheres, especially in China and Europe. As a result, governments and academics have begun developing several sets of guidelines for its implementation. The European Commission defines the circular economy as an economic framework in which "the value of products and materials is maintained for as long as possible". To reduce waste and resource consumption, products are recycled when their useful lives are coming to an end. "The circular economy is a general term for the reduction, reuse, and recycling activities carried out in the process of production, circulation, and consumption" (Liu et al., 2017).

The circular economy is a comprehensive and useful substitute for the extraction, production and disposal strategy of the conventional linear economy that promotes economic growth without compromising ecological and social values. In the 20th century, the concept initially came up to emphasise the development of the ecological industry and a sustainable way to reduce reliance on the extraction of resources (Blomsma & Brennan, 2017). The circular economy is a modern technique for attaining sustained growth, which emphasises resource recovery, recycling, reuse, and waste reduction (Mele & Poli, 2015). According to MacArthur (2013), the circular economy is a restorative industrial system that emphasises renewable energy, minimises, monitors, and completely eradicates the use of hazardous chemicals, and efficiently disposes of waste. The circular economy is a cyclical process that minimises emissions and waste production while optimising the use of raw materials through refurbishing, recycling, reusing, and repair (Geissdoerfer et al., 2017). The primary objective of the concept is to minimise waste production while increasing the economic worth of materials, resources, and products.

Circular economy principles are incredibly relevant to the construction industry, with the construction industry being characterised as the world's principal user of natural resources (Türkeli et al., 2018). The shift from a linear economy to a circular economy cannot be accomplished unless the circular economy concept is incorporated into the whole value chain of buildings, which takes responsibility to design and manage buildings throughout their lifecycle. The circular economy is derived from several schools of ideology. In 2020, the Ellen MacArthur Foundation put forth three principles of circular economy:

1. Designing out Waste and Pollution: Reducing waste and emissions is a key component of the circular economy in the building industry. Stahel (2016) emphasizes that waste is largely a design flaw, and by rethinking how products are conceived, manufacturers can significantly reduce waste. Circular design requires product development that facilitates ease of repair, reuse, and disassembly, ensuring that materials remain within the economy. This is complemented by eco-design, which integrates sustainability into the product's lifecycle (Bocken et al., 2016).
2. Keeping Products and Materials in Use: The main objective of the principle is to keep products and materials in use by increasing their lifespan. It reduces our reliance on fresh and finite resources like energy by enabling us to extend the life of components, and materials in the system.
3. Regenerating Natural Systems: This principle stresses the need to restore and regenerate natural ecosystems. The circular economy is closely tied to biomimicry, where production systems imitate nature's processes, ensuring that materials either biodegrade or are continually cycled through technical loops (Geissdoerfer et al., 2017). This contributes to ecological balance by reducing reliance on resource extraction and minimising environmental degradation.

1.2. Sustainable Construction

Sustainability has been defined differently by different school of thought; for the economist – sustainability is an increased income without lowering the opportunities for future earnings; for the environmentalist – sustainability is all about conserving biodiversity and protecting the environment, meanwhile the sociologist treats sustainability as everything that is concerned with development that upholds equality, humanity, and society (Ciegis et al., 2009). The concept of sustainability in construction methods has been developed over the decades, shifting from the original focus, moving on how to solve the issue of inadequate resources to technical issues, such building materials, components, and design principles (Balasubramanian & Shukla, 2017). According to Hasan and Zhang (2016), sustainable construction is a way of building that can minimise negative environmental effects, maximise resource conservation, and ensure other essential needs. According to Landman (1999), sustainable construction is always defined as the process of designing and building a structure with material and resource efficiency that does not negatively impact the environment or the safety and comfort of the building's residents, construction workers, community members, or future generations. Nwokoro and Onukwube (2011) state that there are five basic methods that may be applied to achieve sustainable building: conserving energy, conserving land, sustainable use of materials, water conservation and emissions reduction. Construction professionals have been highly inspired by the idea of sustainable development to transform the design, construction, and management of buildings (Riley et al., 2003). Sustainable construction is fundamentally about balancing human needs with environmental protection, ensuring we do not exceed critical ecological limits while also upholding social equity and basic human rights, including the right to development (Du Plessis, 2002).

As environmental protection becomes more significant, building professionals around the world are giving this issue more attention. Adopting sustainable construction methods has been recommended as a means of reducing environmental effect of construction industry, while promoting economic development in the sector. The application of sustainable principles in construction must begin at the conception stage and continue through the deconstruction stage (Daniel et al., 2018).

Key principles of sustainable construction practices are as follows:

1. Resource Efficiency: the core principles of sustainable construction are to minimise resource usage, for example, land, water, energy and materials. Sustainable construction seeks to use resources more efficiently at building projects' conception, development, maintenance, and dismantling.
2. Cost Efficiency: The goal of applying the notion of sustainability to building construction is to minimise costs and maximise efficiency and protection of the environment. Numerous organisations, both public and private, are found to largely base their investment decisions in buildings on estimates of the initial cost of construction, with little to no attention paid to the expenses of ongoing operations and maintenance (Woodward, 1997). To achieve cost efficiency in construction projects, the initial cost, operational cost and recovery cost should be considered.
3. Enhancing Human Health and Comfort: Sustainable construction also emphasises the well-being of building occupants by creating environments that promote health, comfort, and productivity. Buildings should be designed not only to be environmentally friendly but also to provide spaces that enhance physical and psychological health. To achieve a healthy and well-built environment, the designer should maximise the air quality, thermal comfort, acoustic comfort and natural day lightening of the structure.

1.3. Barriers to Sustainable Construction Practices and Circular Economy

Sustainable construction is a method of technology that guarantees people's basic needs and maximises the use of available resources, while minimising its negative effects to achieve environmental protection (Hasan and Zhang, 2016). A lack of previous records and blueprints for those involved in construction to build upon and learn from is one of the main barriers to circular economy and sustainable construction methods in developing nations (Oke et al., 2019). A substantial amount of literature acknowledges that implementation of circular economy and sustainable construction methods can lead to a significant decrease in carbon dioxide emissions from the building sector, reduce waste, and promote cost efficiency and environmental protection. Although it holds significant importance, the practice of sustainable construction and circular economy principles has largely been overlooked in developing nations like Nigeria. According to a study by Ayyash et al. (2011), the main obstacles to sustainable construction methods in Nigeria are thought to be a lack of demand, a lack of strategies to encourage sustainable construction, and a lack of skills.

The primary barriers to the adoption of sustainable construction in the Nigerian construction industry, according to Osuizugbo et al. (2020), are low requests from clients for sustainable construction, inadequate governmental support, shortage of knowledge about sustainable construction, high initial costs involved in implementing sustainable construction, and the absence of suitable laws and regulations to encourage circular and sustainable construction methods. According to some authors, several barriers stand in the way of Nigeria's full adoption of circular economy and sustainable construction practices. Hence, early detection of any retarding factors is crucial for the successful implementation of sustainable building and the circular economy.

2. RESEARCH METHODOLOGY

The research embraced a quantitative study design approach. The data collected in quantitative research are always in numerical form, where the researchers use structured tools like surveys, questionnaires, or experiments to gather data, which can then be analysed using statistical data tools to draw conclusions (Muijs, 2011).

The study was conducted in Nigeria, covering Abuja (the federal capital) and all 36 states across the country's six geopolitical zones. Purposive sampling was employed, targeting 100 project or construction managers from the construction sector across all zones in Nigeria. This method ensures the selection of respondents with relevant characteristics to meet the study objectives.

The data were collected through an online *Google Form*, using a closed-ended survey questionnaire entitled "Construction Managers' Insights on the Implementation of Circular Economy and Sustainable Building Practices in the Nigerian Construction Sector". The questionnaire was divided into six sections and analysed using Microsoft Excel and Statistical Package for Social Sciences (SPSS), employing frequency, mean, and percentage analyses to interpret the results.

3. RESEARCH FINDINGS

3.1. Background Information of the Respondents

The study results indicated that most participants were between 31 and 40 years old, reflecting the intended targeted mean age group. The findings revealed that most of the survey participants were male, with only 8 % of the respondents being female. The lower number of female respondents highlights the ongoing gender gap in the construction industry, which might be attributed to factors such as workplace culture, historical impediments to admission for women, or fewer women pursuing careers in construction. The survey results demonstrate a wide range of educational backgrounds: 78 % of respondents have a Bachelor's degree, 6 % have a Master's degree, 9 % have a diploma, and 6 % have a higher national diploma. This presents the opinion of construction managers with good educational background. The survey results also showed that respondents' average years of experience are fairly respectable, with 66 % of respondents having 6–years of expertise in the building sector. This suggests that participants have the necessary level of education and experience to provide meaningful answers to the survey questions.

3.2. Awareness and Understanding of Circular Economy and Sustainable Construction

Construction managers' level of awareness and understanding must be sufficient for the circular economy and sustainable construction techniques to be successfully implemented in the construction industry. As Table 1 demonstrates, all participants are familiar with designing out of waste or reducing principle of circular economy, which suggests that minimising resource use and waste generation is a well-understood and recognised concept among the construction managers. The fact that 98 % of the respondents are familiar with keeping the products and materials in use or reusing principle of circular economy demonstrates that most participants also understand the importance of building components, products and materials more than once, thereby extending their lifecycle, reducing waste, and landfills. The lower familiarity with the recycling principle or regeneration of natural systems (72 %) suggests that while recycling is important, it may be less clearly understood, less accessible, or seen as more complex than the reducing principles of the circular economy among construction or project managers. This could indicate a knowledge or infrastructure gap that might limit recycling efforts compared to reducing or reusing techniques.

Table 1. Respondents' Familiarity Level with Circular Economy Principles (developed by the author)

Circular Economy Principles	Frequency	Per Cent	Per Cent of Cases
Minimising Resource Use (Reduce)	66	36.9 %	100 %
Keeping Materials in Use (Reuse)	65	36.3 %	98.5 %
Regenerating Systems (Recycle)	48	26.8 %	72.7 %
Grand Total	**66**	**100.00 %**	**271.2 %**

The findings obtained from the study further revealed the high familiarity level of the respondents with sustainable construction principles of energy conservation, water conservation and waste reduction, which indicates that the principles are well understood by most of the participants and are well integrated into common knowledge or practice within the participants' contexts. It could be suggested that these areas have received substantial focus in education, policies, or industry standards. The lower level of familiarity with sustainable design and indoor environmental quality principles indicates a significant gap in understanding or awareness. This could reflect a lack of exposure to design-related education or practices within the respondents' professional or academic experience, or it could indicate that sustainable design is not yet prioritized in their respective industries. The moderate familiarity with sustainable building materials suggests that there is an increasing recognition of using materials that minimise environmental impact, though there is still room for improvement.

Table 2. Respondents' Familiarity Level with Principles of Sustainable Construction Practices (developed by the author)

Principles of Sustainable Construction	Frequency	Per Cent	Per Cent of Cases
Energy Conservation	63	24 %	95.5 %
Water Conservation	63	24 %	95.5 %
Waste Reduction	65	24.7 %	98.5 %
Sustainable Design	18	6.8 %	27.3 %
Sustainable Building Materials	35	13.3 %	53.0 %
Indoor Air Quality	19	7.2 %	28.8 %
Total	**263**	**100 %**	**398.5 %**

3.3. Sustainable Building Materials and Guidelines: The Current Status of Implementation

To assess the level of implementation of sustainable building materials and guidelines, construction managers were requested to assign a rating to the implementation using a five-point rating system, with 1 denoting "Mostly implemented" and 5 – "Not implemented". The results highlight areas where the construction industry is making strides towards sustainability, locally sourced materials and lean construction techniques seem to be the most widely implemented sustainable practices. Practices like the use of FSC-certified wood and low-VOC products are not as widely adopted. The moderate implementation of supplier selection based on environmental commitment suggests that sustainability is becoming a factor in procurement but has not yet become a top priority for many respondents. While the use of supplementary cementitious materials shows mixed results, indicating that while some respondents fully implement them, others may be less consistent in their use.

Table 3. Statistics of the Respondents' Ratings of the Industry Compliance with Sustainable Material Guidelines and Principles (developed by the author)

Guidelines and Principles	***N***	**Mean**	**Mode**
Use of Locally Sourced Materials or Indigenous Materials	66	1.88	1
Use of Low Volatile Organic Compounds in Paints, Adhesives, etc.	66	3.02	3
Use of FSC Certified Wood Material	66	4.12	5
Use of Supplementary Cementitious Materials	66	2.58	1
Selection of Supplier Based on Their Commitment to Environmental Protection	66	2.36	3
Lean Construction Techniques	66	2.36	1

Findings from the respondents' ratings on the utilisation level of selected sustainable building materials indicate that many of these materials are rarely or not utilised within the construction industry. It further reveals that the majority of these sustainable building materials, such as recycled steel, reclaimed steel, reclaimed stones, and broken tiles, are not widely utilised. Materials like reclaimed wood, bamboo, and laminated timber are more moderately utilised, though there is still significant room for improvement, as evidenced by their relatively high mean scores.

Table 4. Statistics of the Respondents' Ratings on the Utilisation Level of Some Selected Sustainable Building Materials (developed by the author)

Guidelines and Principles	***N***	**Mean**	**Mode**
Use of Reclaimed Wood	66	3.20	5
Use of Recycle Steel	66	4.95	5
Use of Reclaimed Steel	66	4.89	5
Use of Reclaimed Stones	66	4.83	5
Use of Bamboo usage	66	3.48	5
Use of Laminated Timber	66	3.52	5
Use of Broken Tiles	66	4.82	5

3.4. Waste Management and Recycling Systems: The Current Status of Implementation

To evaluate the extent to which waste management and recycling concepts are being implemented in the construction sector, survey participants were asked to choose from the outlined techniques and procedures. The results indicate a strong commitment to waste management practices, particularly in planning, sorting, and material storage. The high percentages for planning and sorting strategies reflect an understanding of their critical roles in minimising waste, while the low uptake of onsite recycling systems highlights potential areas for improvement, suggesting that while respondents are taking important steps in waste management, there may be gaps in implementation or infrastructure for more advanced recycling techniques.

Table 5. Respondents' Insights on Waste Management Strategies during Project Delivery (developed by the author)

Waste Management Strategies	Frequency	Per Cent	Per Cent of Cases
Waste Management Planning Before Construction	65	27.5 %	98.5 %
Onsite Waste Sorting and Selling to Recycling Industries	61	25.8 %	92.4 %
Proper Storage of Material	57	24.2 %	86.4 %
Onsite Recycling System	4	1.7 %	6.1 %
Order of the Proper Quantity of Materials	49	20.8 %	74.2 %
Total	**236**	**100 %**	**357.6 %**

Findings from the respondents' insight on how they recycle salvaged building materials and construction waste materials in their industry revealed that the reuse of salvaged building materials and construction waste is not a frequent practice in the construction sector. The relatively low percentage across all categories suggests that recycling and reuse efforts are underutilised, with various materials, such as bricks, steel, timber, and fixtures, being recycled or reused by only a small fraction of respondents.

Table 6. Statistics of the Respondents' Ratings on the Utilisation Level of Some Selected Sustainable Building Materials (developed by the author)

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Use of Reclaimed Stones	66	4.83	5
Use of Bamboo Usage	66	3.48	5
Use of Laminated Timber	66	3.52	5
Use of Broken Tiles	66	4.82	5

3.5. Energy Efficiency and Water Conservation: The Current Status of Implementation

To assess the implementation status of strategies used in minimising the total energy and water consumed during project delivery, the survey participants were requested to choose among the outlined strategies and procedures, the results from the respondents' insight demonstrate a strong focus on easily implemented and cost-effective energy conservation measures, such as energy-efficient bulbs, fans and smart heating ventilation air conditioning systems. These technologies are widely adopted because of their clear and immediate benefits. The moderate adoption of clean energy sources shows progress toward sustainable energy use, though further adoption may be hindered by financial or infrastructural barriers. The lower adoption of strategies like passive solar design and sensor-based lighting suggests that these more advanced or specialised techniques are either less familiar to industry professionals or seen as more complex to implement.

Table 7. Respondents' Insights on Energy Conservation Strategies for Project Delivery (developed by the author)

Energy Conservation Strategies	Frequency	Per Cent	Per Cent of Cases
Use of Passive Solar Design	19	8.8 %	28.8 %
Use of Sensor Based Lightening	17	7.9 %	25.8 %
Use of Energy Efficient Bulbs and Fans	66	30.6 %	100 %
Use of Clean Energy Sources	50	23.1 %	75.8 %
Use of Smart Energy HVAC	64	29.6 %	97 %
Total	**216**	**100 %**	**327.3 %**

The findings further revealed the widespread adoption of low flow fixtures, sensor taps, and dual flush systems. This indicates a strong commitment to basic water conservation methods in the industry. Curing compounds and water-reducing admixtures show a moderate level of adoption, but these strategies have room for greater awareness and implementation to maximise water conservation efforts. The low adoption rates for recycled water and rainwater harvesting systems highlight areas where the industry is significantly lagging. These strategies require more advanced systems and infrastructure, which may not be readily available or affordable.

Table 8. Respondents' Insights on Water Conservation Strategies for Project Delivery (developed by the author)

Water Conservation Strategies	Frequency	Per Cent	Per Cent of Cases
Utilising Low-Flow Fixtures	66	27.1 %	100 %
Utilising Sensor Base Control Taps	50	20.6 %	75.8 %
Utilising Dual Flush Toilet/Piping	51	21 %	77.3 %
Use of Recycled Water	8	3.3 %	12.1 %
Use of Rain Water Harvesting	6	2.5 %	9.1 %
Use of Water Reducing Admixture	41	16.9 %	62.1 %
Use of Curing Compound	21	8.6 %	31.8 %
Total	**243**	**100 %**	**368.2 %**

3.6. Barriers in Adopting Sustainable Construction Practices and the Circular Economy

The study focused on the factors that impede the construction industry from implementing sustainable building practices and advancing the circular economy. The findings point to key areas that need to be addressed to promote a more sustainable approach in the sector. The most significant barriers identified are a lack of awareness and inadequate training, with most respondents acknowledging that this is the primary challenge to adopting sustainable practices. Cultural resistance and a poor regulatory framework are cited by over half of the respondents, suggesting that traditional construction practices and attitudes may be difficult to change and that current regulations are either insufficient, not well-enforced, or do not provide enough incentives or mandates to encourage the transition to more sustainable practices. High costs are still seen as a significant barrier for some respondents; this suggests that the initial investment required for sustainable construction, including eco-friendly materials or advanced technologies, may be perceived as too expensive by many, particularly in markets where cost competitiveness is critical.

Table 9. Respondents' Insight on Barriers Hindering Circular Economy and Sustainable Construction Adoption (developed by the author)

Barriers	Frequency	Per Cent	Per Cent of Cases
Lack of Awareness	58	30.2 %	87.9 %
High Costs	19	9.9 %	28.8 %
Inadequate Training	46	24 %	69.7 %
Poor Regulatory Framework	33	17.2 %	50.0 %
Cultural Resistance	36	18.8 %	54.5 %
Total	**192**	**100 %**	**290.9 %**

The findings also point to several key challenges that are impeding the construction industry from implementing sustainable building practices and the circular economy. The overwhelming majority of respondents identified insufficient government support as the main challenge. This indicates that the lack of strong governmental policies, incentives, and regulations is a significant challenge impeding the broader implementation of sustainable building methods and the circular economy. Without effective government backing, the transition towards sustainability is much more challenging for industries to achieve, particularly in sectors where initial investments in sustainable practices may be high. A larger percentage of the respondents indicated a lack of technical expertise as another significant obstacle. This highlights a skills gap in the construction industry, where professionals may not have the necessary knowledge or technical know-how to implement circular economy models or sustainable construction practices. Although fewer respondents identified limited access to sustainable materials and recycling facilities as a challenge, this still points to an important logistical barrier. In regions where sustainable materials or recycling infrastructure are less accessible, it becomes more difficult for construction firms to adopt circular economy principles. This might be a larger issue in specific geographical areas or for smaller companies with limited resources.

Table 10. Respondents' Insight on Challenges Hindering Circular Economy and Sustainable Construction Implementation (developed by the author)

Challenges	Frequency	Per Cent	Per Cent of Cases
Lack of Client Demand	19	13.9 %	28.8 %
Insufficient Government Support	63	46 %	95.5 %
Lack of Technical Expertise	48	35 %	72.7 %
Limited Access to Sustainable Materials and Recycling Facilities	7	5.1 %	10.6 %
Total	**137**	**100 %**	**207.6 %**

CONCLUSION

The study offers insights into how the circular economy and sustainable building methods are implemented in Nigeria's construction sector. While there is a respectable degree of awareness and comprehension of sustainable principles among the study participants, this has not yet resulted in the broad adoption of advanced sustainable methods and materials. Important areas like the usage of sustainable building materials, recycling facilities, and advanced technology (including rainwater harvesting systems, recycled water, and passive solar design) are still underutilised, indicating substantial room for improvement.

Encouragingly, the sector has shown a strong commitment to easily implemented, cost-effective strategies for waste management, energy conservation, and water conservation. However, the lack of strong and enforceable government policies and regulations remains a major barrier to the broader acceptance of sustainable building methods and the concepts of the circular economy. Addressing these regulatory gaps could be transformative, enabling the industry to move from awareness to action and fostering a more sustainable built environment in Nigeria.

To drive this transition, the study suggests that policymakers give top priority to the creation of strong policies and financial incentives that encourage and reward the utilisation of environmentally friendly products, recycling facilities, and advanced conservation technology. With stronger regulatory support, the Nigerian construction industry can more fully embrace sustainable practices, reducing environmental impacts and contributing to long-term economic resilience.

RECOMMENDATIONS

The research conclusions have led to the development of the following recommendations to enhance the implementation of circular economy and sustainable construction methods in Nigeria's construction industry.

- Government, through the Ministry of Education Science and Technology, should formally include circular economy and sustainability modules in the Nigerian higher education programmes related to the constructions sector to increase the level of knowledge among construction professionals.
- Government, through the Ministry of Land, Housing, Urban Development, and Regional Planning, should provide regulations that embed circular economy and sustainability practices in building approval documents, and these documents ought to provide a solid foundation for approving construction projects.
- Government, through the Ministry of Land, Housing, Urban Development, and Regional Planning, should establish effective policies to incentivise and facilitate circular economy and sustainable construction in the Nigerian construction industry.
- Building professionals should be trained to apply circular economy principles and sustainability during project delivery through programmes, seminars, workshops, and conferences organised by professional organisations like the Council of Registered Builders of Nigeria, the Architect Registration Council of Nigeria, and the Council of Registered Engineers of Nigeria.
- Construction professionals should assume a greater role to empower their clients with knowledge and awareness of the environmental benefits and potential cost savings associated with the circular economy and sustainable construction practices.

ACKNOWLEDGEMENT

This study is part of my PhD Thesis in partial fulfilment of the requirements of the Master of Technology in Civil Engineering with specialisation in Construction Management. I wish to acknowledge the effort of Col. Vivek Mathur (Associate Professor), Department of Civil Engineering at Sharda University, India, for going through my research several times and offering constructive criticism, insightful advice, and guidance for the completion of the work.

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