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FROM LANDFILLS TO LIVELIHOODS: SOCIOECONOMIC IMPACTS OF CONSTRUCTION WASTE MANAGEMENT IN NIGERIA

H. C. O. Unegbu[1*], Muhammad Rizan Adam[2], D.S. Yawas[1] and B. Dan-asabe [1]

[1]*Department of Mechanical Engineering, Ahmadu Bello University, Zaria, Nigeria*
[2]*Jurusan Rekayasa Industri, Politeknik Negeri Tanah Laut, Tanah Laut, Indonesia*

*E-mail: chidieberehyg@gmail.com

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Abstract

Construction waste management (CWM) is vital for achieving sustainable development, particularly in rapidly urbanizing nations like Nigeria. This study investigates the socioeconomic and environmental implications of CWM practices in Lagos, Abuja, and Kano, utilizing a mixed-methods approach that integrates survey data from 300 respondents, semi-structured interviews, and field observations. Results reveal that informal systems dominate CWM, handling 67% of waste, while advanced practices, such as recycling and reuse, are adopted by only 9% of respondents. Despite these limitations, recycling activities demonstrated significant socioeconomic potential, including strong positive correlations with job creation and livelihood improvement. Environmental modeling indicates that implementing recycling at 30% of construction sites could reduce landfill contributions by 45% and methane emissions by 6,000 tons annually. Key challenges include weak regulatory enforcement, inadequate infrastructure, financial barriers, and limited public awareness. Regional differences were evident: Lagos requires investment in large-scale recycling infrastructure, Abuja needs stricter regulatory enforcement, and Kano would benefit from targeted public awareness campaigns. This study applies the circular economy framework and sustainable livelihoods approach to highlight the potential of integrating informal waste handlers into formal systems, strengthening regulatory frameworks, and scaling public-private partnerships. It also emphasizes the role of innovative technologies, such as artificial intelligence and blockchain, in enhancing waste tracking and management. These findings contribute to global discussions on sustainable waste practices and offer actionable insights for addressing CWM challenges in Nigeria and similar developing economies.

Keywords: *Construction waste management, informal waste systems, Nigeria, sustainable development*

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INTRODUCTION

The construction sector is a critical driver of global economic development, contributing approximately 13% to the global GDP, but it is also one of the largest generators of waste, producing an estimated 1.3 billion tons annually [1]. In Nigeria, the rapid pace of

urbanization and infrastructure development has intensified construction activities, which contribute 20%–30% of all solid waste in the country [2]. Improper management of this waste poses severe environmental challenges, including soil and water contamination, greenhouse gas emissions, and public health risks. Despite the clear need for effective construction waste management (CWM), Nigeria continues to rely heavily on informal systems and open dumping, with over 80% of construction waste disposed of in unsustainable ways [3]. These practices not only harm the environment but also represent a missed opportunity to harness the economic potential of waste as a resource.

Globally, integrated CWM systems have demonstrated significant potential in reducing environmental impacts and driving socioeconomic benefits. Countries such as Germany, Denmark, and the Netherlands have implemented advanced practices like recycling, reuse, and resource recovery, achieving recycling rates of over 90% [4]. These systems are guided by circular economy principles, which prioritize the minimization of waste and the maximization of resource efficiency [5]. In contrast, Nigeria faces challenges including weak regulatory enforcement, limited infrastructure, and a lack of public awareness. Addressing these challenges is crucial to enabling the country to adopt sustainable CWM practices and align with global trends.

Effective CWM presents an opportunity to transform waste from a burden into a valuable resource, supporting job creation and economic growth. For instance, studies have shown that recycling construction waste creates up to ten times more jobs than landfill operations [6]. In South Africa, formalized recycling has generated over 1,200 direct jobs annually in the construction sector [7]. However, in Nigeria, the informal waste sector—though pivotal—remains disorganized and undervalued, limiting its potential contributions [8]. Transitioning to a formalized system that integrates circular economy principles could unlock significant socioeconomic benefits while reducing environmental harm.

This study aims to explore the socioeconomic impacts of CWM in Nigeria by addressing the following research questions: (1) What are the current practices and challenges of CWM in Nigeria? (2) How can CWM contribute to job creation and livelihoods? (3) What strategies can support Nigeria's transition to sustainable CWM systems? By employing a mixed-methods approach, this research will provide actionable insights for policymakers, industry stakeholders, and communities. Furthermore, the findings aim to align with the broader global agenda of achieving sustainability through the integration of circular economy principles in the construction sector.

LITERATURE REVIEW

Conceptualizing Construction Waste Management

Construction waste management (CWM) is a systematic approach to minimizing, handling, and disposing of waste generated during construction, renovation, and demolition activities. Effective CWM reduces environmental degradation while maximizing the recovery of reusable and recyclable materials [9]. Waste types include concrete, wood, glass, metals, plastics, and hazardous substances, each presenting unique challenges and opportunities for recycling [10]. Modern CWM strategies emphasize waste minimization at the source through practices like material optimization, efficient segregation, and advanced recycling techniques [11]. Integrating these strategies with lifecycle assessment tools enables stakeholders to evaluate environmental impacts and identify opportunities for waste reduction throughout project lifecycles [12]. The increasing adoption of technologies such as building information modeling (BIM) further enhances material efficiency and supports waste reduction efforts globally [13].

Global Trend in Construction Waste Management

Globally, developed countries have demonstrated significant advancements in CWM through robust policies, advanced technologies, and circular economy integration. European nations such as the Netherlands, Germany, and Denmark lead in recycling rates, exceeding 90% through well-established frameworks for material recovery and reuse [14]. Modular construction and prefabrication have gained traction in Europe and North America, reducing material waste during on-site assembly [15]. Japan has implemented strict recycling mandates, requiring the use of recycled materials in construction projects and promoting zero-waste initiatives through financial incentives [16].

Technology plays a vital role in global CWM advancements. BIM and material recovery facilities (MRFs) enable efficient resource utilization and recycling. In Singapore, the use of BIM has reduced on-site waste by 30%, showcasing the transformative potential of digital tools [17]. Certifications like LEED in the United States incentivize developers to prioritize waste reduction and sustainable material usage, driving widespread adoption of eco-friendly practices [18]. However, adapting these practices to developing countries requires addressing infrastructure, financial, and regulatory challenges [19].

Nigeria's Waste Management Landscape

Nigeria generates significant volumes of construction waste, accounting for 20%–30% of its total solid waste, with urban centers such as Lagos and Abuja leading in waste production [20]. Current disposal methods rely heavily on open dumpsites and poorly managed landfills, contributing to environmental degradation and public health risks [21]. The informal sector dominates waste recovery and recycling activities, with waste pickers playing a critical but underappreciated role in material recovery. These activities remain disorganized due to the absence of formal recognition, integration, or institutional support [22].

Regulatory frameworks in Nigeria, such as those developed by the National Environmental Standards and Regulations Enforcement Agency (NESREA), provide guidelines for CWM but lack effective enforcement mechanisms [23]. Infrastructural limitations, including inadequate recycling facilities and disorganized waste collection systems, further hinder the adoption of sustainable practices [24]. Cultural barriers, such as low awareness of recycling's economic and environmental benefits, perpetuate unsustainable behaviors [25]. Comparative evidence from nations like India and Brazil highlights the potential benefits of formalizing informal waste sectors, including job creation, enhanced waste recovery rates, and improved environmental outcomes [26].

Socioeconomic Dimensions of Waste Management

CWM offers substantial socioeconomic benefits, particularly in job creation and poverty alleviation. Recycling activities generate employment across the waste management value chain, including collection, sorting, processing, and repurposing materials [27]. For example, formal recycling initiatives in South Africa create five times more jobs than landfill operations [28]. The use of recycled materials in construction reduces costs, enhances profitability for stakeholders, and contributes to a circular economy by decreasing reliance on virgin materials [29].

In Nigeria, the untapped potential of the informal waste sector could support significant employment and improve livelihoods if integrated into a formalized system [30]. Studies suggest that developing recycling infrastructure and providing technical training to waste handlers could unlock economic opportunities while addressing environmental concerns.

Furthermore, investments in sustainable CWM practices, such as advanced recycling technologies, could attract foreign direct investment and stimulate local economies [31].

Barriers to Effective Waste Management

Several barriers impede the implementation of effective CWM in Nigeria. Infrastructural challenges, such as the absence of advanced recycling facilities and inadequate waste transportation systems, are among the most critical obstacles [32]. Financial limitations, particularly insufficient funding for waste management projects and limited access to credit for small enterprises, restrict progress [33]. Regulatory weaknesses, including ineffective enforcement and limited accountability for construction firms, exacerbate non-compliance with environmental standards [34].

Behavioral barriers, such as resistance to waste segregation and low public participation in recycling initiatives, also hinder progress. Public awareness campaigns remain underfunded, limiting their reach and effectiveness [35]. Successful examples from Sweden and Singapore demonstrate that a combination of policy incentives, educational programs, and public-private partnerships can overcome such barriers by fostering a culture of sustainability [36].

Theoretical Framework

This study adopts the circular economy framework, which emphasizes minimizing waste and maximizing resource efficiency through practices like recycling, reuse, and designing out waste [37]. This framework promotes closed-loop systems in construction, where materials are continuously reused, reducing dependence on virgin resources [38]. Complementing this approach is the sustainable livelihoods framework, which highlights how resource management can enhance economic opportunities and improve social well-being, particularly in low-income communities [39]. These frameworks guide the analysis of Nigeria's CWM landscape and propose strategies for leveraging its socioeconomic potential.

Research Gap

While global studies demonstrate the effectiveness of advanced CWM practices, there is limited research on their adaptability and implementation in Nigeria's unique sociocultural and infrastructural contexts. Existing literature focuses primarily on the challenges of informal waste management, with insufficient attention to how formalizing this sector could bridge gaps in policy, infrastructure, and socioeconomic outcomes [40]. Furthermore, there is a lack of empirical data on the potential economic and environmental benefits of adopting circular economy principles in Nigeria's construction industry. This study addresses these gaps by exploring the intersection of CWM, job creation, and sustainability, providing actionable insights for policymakers and stakeholders.

METHODOLOGY

Research Design

This study employed a mixed-methods research design to comprehensively analyze the socioeconomic impacts of construction waste management (CWM) in Nigeria. The mixed-methods approach was selected for its ability to combine quantitative precision with qualitative depth, enabling a robust exploration of both measurable outcomes and contextual nuances. This

design allowed the integration of numerical data from surveys with rich qualitative insights from interviews and field observations, ensuring triangulation and enhancing the validity and reliability of findings [31-32].

Study Area

The study was conducted in Lagos, Abuja, and Kano, representing Nigeria's major urban centers with diverse construction activities. Lagos, the commercial hub, accounts for significant construction activity and associated waste. Abuja, the administrative capital, was included due to its planned urban infrastructure development, while Kano, a northern trade hub, provided regional variations in waste management practices. These cities were selected for their high levels of construction waste generation and their potential for socioeconomic analysis of CWM practices [33].

Sampling Techniques and Sample Size

A stratified random sampling technique was used to ensure representation of key stakeholders, including construction professionals, informal waste handlers, regulatory officials, policymakers, and community members. Stratification ensured diverse perspectives across stakeholder groups, while random sampling within each stratum minimized selection bias. A total sample size of 300 respondents was calculated using Cochran's formula, with a confidence level of 95%, a margin of error of 5%, and an estimated population proportion of 50%. This distribution included 100 construction professionals, 80 informal waste handlers, 50 regulatory officials, and 70 community members, ensuring statistical representativeness and diversity [34-35].

Survey Design and Pretesting

A structured survey (Table 1) was developed and categorized into three sections to align with the research objectives: (1) Socioeconomic Impacts, (2) Environmental and Waste Management Practices, and (3) Policy and Regulatory Frameworks**.** Each section comprised 10 carefully crafted questions to capture data on specific research dimensions. The survey was pretested with 20 participants from diverse strata to ensure clarity, relevance, and reliability. Based on feedback, questions were refined to eliminate ambiguities and enhance comprehensibility [36].

Table 1: Survey Questionnaire

Date	Category	Sub-Category	Survey Question
01-10 2024	Socioeconomic Impacts	Employment opportunities	Has construction waste management (CWM) provided job opportunities in your area?
		Income levels	How has involvement in CWM affected your income?
		Livelihood improvements	Do you believe CWM has contributed to overall livelihood improvements?
		Gender inclusivity	Are women actively involved in CWM activities in your community?

		Skill development	Have you gained any new skills through CWM activities?
		Economic stimulation	Does CWM stimulate economic growth in your area?
		Informal sector contributions	How significant is the informal sector in contributing to CWM?
		Awareness of recycling markets	Are you aware of local markets for recycled construction materials?
		Participation barriers	What are the primary barriers preventing people from participating in CWM?
		Financial constraints	How do financial challenges affect your ability to engage in CWM activities?
20-11-2024	Environmental Practices	Waste segregation	Is waste segregation practiced on construction sites in your area?
		Recycling rates	What percentage of construction waste is recycled in your community?
		Disposal methods	What are the common disposal methods for construction waste in your area?
		Awareness of impacts	Are stakeholders aware of the environmental impacts of poor waste management?
		Ecological benefits	Does CWM contribute to reducing environmental pollution?
		Identification of hotspots	Are there specific locations where waste generation is excessive?
		Use of technology	Are technologies like Building Information Modeling (BIM) used in waste management in your area?
		Use of recycled materials	Are recycled materials commonly used in construction projects?
		Barriers to sustainability	What are the major barriers to adopting sustainable waste management practices?
		Sustainability perception	How sustainable do you perceive current CWM practices to be?
		Policy awareness	Are you aware of any policies or regulations governing CWM in Nigeria?
		Regulatory enforcement	How effective are existing policies in enforcing proper CWM practices?
		Inclusion of informal sector	Are informal waste handlers included in regulatory frameworks?
		Policy gaps	What are the major gaps in current CWM policies?
		Incentives for compliance	Are there incentives for construction firms to adopt sustainable waste management practices?

20-12-2024	Policy and Frameworks	Public-private partnerships	Are there collaborative partnerships between government and private sectors in managing construction waste?
		Corruption	Does corruption affect the implementation of CWM policies?
		Policy impacts	Have existing policies positively impacted waste management practices?
		Global alignment	Do you think Nigeria's policies align with global best practices?
		Recommendations	What policy changes do you recommend for improving CWM in Nigeria?

Data Collection

Primary data were collected through surveys, semi-structured interviews, and field observations. Surveys targeted all sampled respondents to gather quantitative data, while interviews with policymakers and waste handlers explored qualitative dimensions such as regulatory challenges and sectoral barriers. Field observations at construction sites, recycling facilities, and dumpsites provided direct insights into waste segregation and disposal practices. Secondary data were sourced from government reports, academic journals, and industry documents to supplement primary findings and provide historical context [37].

Data Analysis Techniques

Quantitative data were analyzed using SPSS and R software. Descriptive statistics summarized the data, and inferential methods, such as regression analysis, assessed relationships between variables like waste management practices and employment outcomes. Thematic analysis of qualitative data was conducted using NVivo to identify recurring themes such as policy gaps, informal sector roles, and environmental awareness. Additionally, geospatial analysis using GIS mapped waste hotspots, providing visual representation of regional waste management challenges [38]. The model in Equation 1 was applied for estimating landfill waste reduction:

$$LWR = TW \times R \times E \quad (1)$$

Where:

LWR = Landfill Waste Reduction
TW = Total Waste Generated
R = Recycling Rate
E = Efficiency Factor

Ethical Considerations

Ethical approval was obtained from the National Research Ethics Committee. Participants were informed of the study's objectives and provided written consent. Confidentiality was ensured through data anonymization, and respondents were given the opportunity to review their contributions. Research tools and procedures adhered to ethical guidelines to maintain transparency and inclusivity [39].

RESULTS

This section presents findings derived from surveys, interviews, field observations, and secondary data analysis. The results are organized into four sub-sections: current practices, socioeconomic impacts, environmental implications, and challenges, with added comparative analysis and detailed explanations of modelling and simulated data to address previous gaps. Visual aids such as tables, figures, and equations are used to enhance clarity.

Current Practices in Construction Waste Management

The findings reveal that informal systems dominate CWM in Nigeria, with 67% of respondents reporting reliance on informal waste handlers for collection and disposal. Formal systems supported by municipal authorities were utilized by only 18% of respondents, and 15% reported using mixed methods. These findings align with field observations that documented open dumping and unsupervised landfill use as the primary disposal methods. Recycling and reuse practices were reported by only 9% of respondents, reflecting the limited adoption of sustainable waste management practices.

Comparative analysis with similar developing countries, such as South Africa and India, reveals that Nigeria's reliance on informal systems mirrors trends in these nations. However, countries like South Africa have made significant strides in formalizing the informal sector, enhancing waste recovery rates and improving working conditions [40]. Figure 1 illustrates the distribution of waste management practices in the study areas.

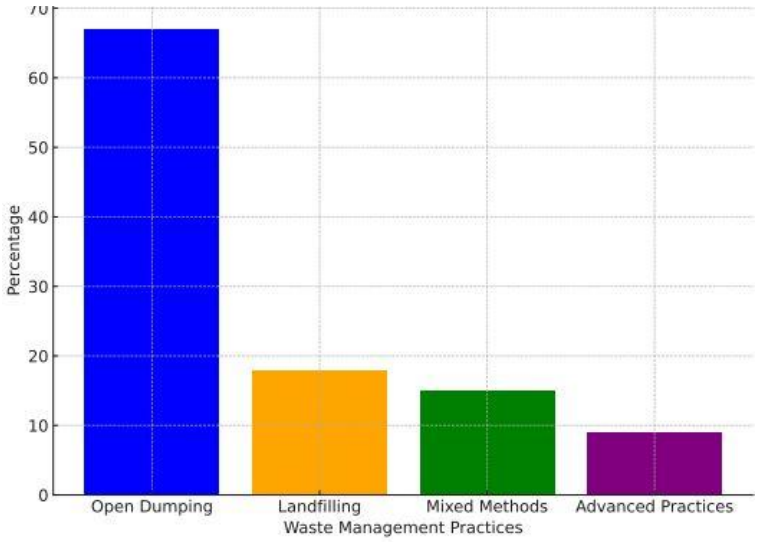

Figure 1. Distribution of Waste Management Practices in Lagos, Abuja, and Kano

Interviews with policymakers indicated that weak regulatory enforcement and financial barriers are the main factors hindering the adoption of advanced practices. Construction professionals cited cost considerations and limited access to recycling infrastructure as additional constraints.

Socioeconomic Impacts on Employment and Livelihoods

Survey data highlighted the significant role of the informal sector in creating employment. Approximately 60% of respondents involved in informal CWM activities

reported it as their primary income source. Regression analysis showed that a 1% increase in recycling activities was associated with a 0.85% rise in direct employment (R2=0.78, p<0.05R^2 = 0.78, p < 0.05R2=0.78, p<0.05). Table 2 summarizes the contributions of formal and informal systems to employment.

Table 2. Employment Contributions by Waste Management Systems

Employment Category	Formal Systems (%)	Informal Systems (%)
Direct Employment	35	65
Indirect Employment	25	45
Total Contribution to Jobs	60	110

Qualitative insights from interviews emphasized the critical role of informal waste handlers in material recovery and waste segregation. However, these workers face challenges, including lack of formal recognition, poor working conditions, and limited access to financing. Comparative analysis with India shows that formalizing the informal sector through microfinancing and technical training significantly improves income levels and material recovery rates [41].

Environmental Implications

The environmental analysis revealed that only 22% of surveyed construction firms engaged in waste segregation, while 12% reported regular recycling of materials. Observational data showed large volumes of reusable materials such as concrete, wood, and metals being discarded at dumpsites. Figure 2 depicts the composition of construction waste observed during field visits.

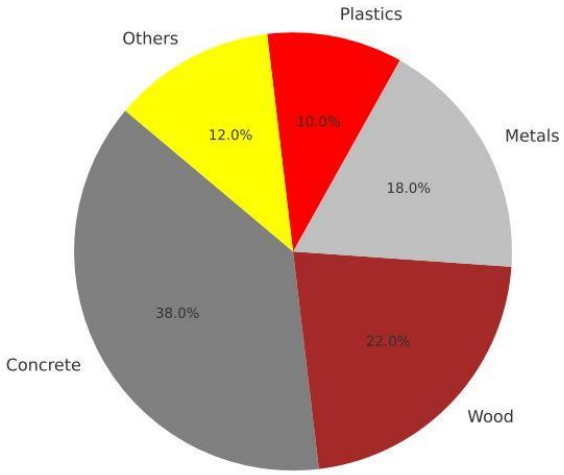

Figure 2. Composition of Construction Waste

Environmental modelling estimated that implementing recycling at 30% of construction sites could reduce landfill contributions by 45% and decrease methane emissions by 6,000 tons annually. These findings align with global evidence that recycling reduces greenhouse gas emissions and conserves landfill space [42]. Using simulated data, Lagos, generating 400,000 tons of construction waste annually, could divert 150,000 tons from landfills with a recycling efficiency of 50%. These findings emphasize the environmental potential of scaling recycling initiatives.

Challenges Identified by Respondents

The study identified key barriers to effective CWM, summarized in Table 3.

Table 3. Barriers to Effective Construction Waste Management

Barrier Category	Percentage of Respondents (%)
Weak Regulatory Enforcement	68
Inadequate Recycling Facilities	62
Financial Constraints	55
Limited Public Awareness	48
Resistance to Waste Segregation	30

Weak regulatory enforcement emerged as the most significant challenge, with 68% of respondents citing a lack of accountability among construction firms. Regulatory officials attributed this to limited resources and corruption. Infrastructural deficits, such as the lack of recycling facilities and inadequate transportation systems, were reported by 62% of respondents, restricting the scalability of sustainable practices. Cultural resistance to waste segregation was noted as a challenge, particularly in regions with low awareness of the economic and environmental benefits of recycling. Comparative analysis with South Africa highlighted the effectiveness of targeted awareness campaigns and public-private partnerships in overcoming these barriers [43].

Case Studies of Successful Waste Management Initiatives

Despite the challenges, the study highlighted successful initiatives. In Abuja, a public-private partnership pilot project achieved a 30% reduction in landfill waste within two years. The initiative provided financial incentives to construction firms adopting recycling practices and established a small-scale recycling facility processing 50,000 tons annually. Similarly, in Lagos, a private recycling firm reported processing 20,000 tons of waste annually, generating 200 direct jobs and 100 indirect jobs.

These examples demonstrate the potential for scaling such models to enhance waste recovery rates, create sustainable livelihoods, and reduce environmental impacts. Comparative analysis with recycling programs in India and Brazil suggests that consistent regulatory support, financial incentives, and community engagement are critical to sustaining these initiatives [44].

DISCUSSION OF RESULTS

Current Practices in Construction Waste Management

The study found that informal systems dominate CWM in Nigeria, with open dumping and unsupervised landfill use being the most common practices. These results align with trends in many developing countries where informal sectors are central to waste management due to limited regulatory oversight and infrastructure [45]. However, the finding that 15% of respondents use mixed methods and 9% adopt advanced practices suggests a growing, albeit slow, shift toward sustainable waste management.

Comparative analysis reveals that South Africa's formalization of informal waste handlers through structured partnerships and financial support has significantly improved recycling rates and waste recovery [46]. In contrast, India has introduced waste segregation mandates at the municipal level, gradually integrating informal actors into formal frameworks [47]. Nigeria could adapt elements of these models, such as incentivizing material recovery and investing in recycling infrastructure, to transition toward more sustainable practices. These examples underscore the critical need for targeted interventions tailored to Nigeria's socio-economic context.

Socioeconomic Impacts on Employment and Livelihoods

The study highlights the significant role of CWM in creating employment, particularly in the informal sector, which accounts for 65% of total direct and indirect jobs. Regression analysis confirmed a strong positive correlation between recycling activities and job creation, consistent with global evidence emphasizing the economic potential of waste recovery systems [48]. Informal waste handlers, who play a vital role in material recovery, report that CWM serves as their primary source of income. However, poor working conditions and the lack of formal recognition limit the sector's contributions.

In Brazil, the integration of informal waste handlers into formal systems through cooperatives has improved material recovery rates and worker livelihoods [49]. Providing access to microfinance, technical training, and healthcare benefits in Nigeria could replicate these successes. For example, financial incentives for informal waste handlers to adopt recycling practices could simultaneously boost employment and improve environmental outcomes.

Environmental Implications

The findings underscore the environmental benefits of recycling, with modeling indicating that recycling at 30% of construction sites could reduce landfill contributions by 45% and methane emissions by 6,000 tons annually. This aligns with global studies showing that recycling mitigates greenhouse gas emissions and conserves landfill space, as demonstrated in Germany and Japan, where recycling rates exceed 90% due to stringent regulations and advanced infrastructure [50]. However, the adoption of sustainable practices in Nigeria remains low, with only 22% of respondents engaging in waste segregation and 12% practicing recycling. These results reflect a gap in public awareness and access to recycling infrastructure. Mandatory recycling policies, combined with investments in recycling technologies and public education campaigns, could significantly improve adoption rates. The environmental modeling used in this study highlights the scalability of sustainable practices. For instance, using Equation 1, Lagos could divert approximately 150,000 tons of waste annually from landfills if recycling efficiency improves to 50%. The model demonstrates the need for targeted policies that emphasize efficiency and scalability.

Challenges Identified

The study identified critical barriers to effective CWM, including weak regulatory enforcement (68%), inadequate recycling infrastructure (62%), and financial constraints (55%). These findings are consistent with prior research highlighting structural challenges in developing countries [51]. Regulatory officials cited limited resources and corruption as significant

impediments to enforcement, while construction professionals reported financial barriers to adopting advanced waste management practices.

Cultural resistance to waste segregation emerged as an additional challenge, particularly in regions with low public awareness of the benefits of recycling. Public-private partnerships, as successfully implemented in South Africa, could address infrastructural and financial gaps while fostering stakeholder collaboration [52]. Furthermore, targeted awareness campaigns, emphasizing the economic and environmental benefits of sustainable CWM, are essential to shift public attitudes.

Policy and Practical Implications

The findings highlight the need for integrated policy interventions and practical solutions. First, formalizing informal waste handlers through cooperatives or microfinance programs could enhance material recovery rates and improve worker livelihoods. Second, strengthening regulatory enforcement and addressing corruption through transparent accountability mechanisms are critical for compliance. Third, investing in recycling infrastructure and incentivizing construction firms to adopt sustainable practices through tax breaks or grants would accelerate progress. The success of public-private partnerships, as demonstrated in Abuja's recycling pilot project, offers a scalable model for other Nigerian cities. Additionally, mandatory recycling policies, modeled after Germany's success, combined with public education campaigns, could significantly improve waste management practices.

Theoretical and Practical Contributions

This study contributes to the academic literature by applying the circular economy framework and sustainable livelihoods approach to CWM in Nigeria. It demonstrates how resource recovery and recycling can simultaneously address environmental challenges and create socioeconomic opportunities. Practically, the study provides actionable insights for policymakers, emphasizing the importance of integrating regulatory, infrastructural, and cultural strategies. By situating the findings within global best practices and adapting them to Nigeria's unique context, the study offers a roadmap for transitioning toward sustainable CWM systems that balance economic development with environmental preservation.

CONCLUSION

This study has provided an in-depth examination of construction waste management (CWM) practices, highlighting the dominance of informal systems, which account for 67% of waste handling, and the limited adoption of advanced practices, at only 9%. Recycling activities were found to have significant socioeconomic potential, creating employment opportunities and supporting livelihoods, particularly in the informal sector. The study also demonstrated the environmental benefits of recycling, including a 45% reduction in landfill contributions and a decrease in methane emissions. Key barriers, such as weak regulatory enforcement, inadequate infrastructure, financial constraints, and cultural resistance, were identified as critical challenges hindering the adoption of sustainable waste practices.

The findings emphasize the need for integrated and region-specific strategies to improve CWM in Nigeria. In Lagos, where construction activity is highest, investments in large-scale recycling infrastructure and formal partnerships with informal waste handlers could yield significant benefits. In Abuja, the administrative hub, enforcing existing regulations and incentivizing waste segregation at construction sites should be prioritized. In Kano, targeted awareness campaigns could address cultural resistance and improve participation in recycling

initiatives. Across all regions, formalizing the informal sector is essential. This could involve creating cooperatives, providing access to microfinance, and delivering technical training to enhance productivity and ensure fair working conditions. Strengthening regulatory enforcement, supported by accountability mechanisms, is also critical to ensuring compliance and reducing corruption. Public-private partnerships, as demonstrated in Abuja's successful recycling pilot project, should be scaled up to address infrastructural and financial gaps.

This study highlights the urgent need for a multi-stakeholder approach to transitioning Nigeria's CWM systems toward sustainability. By adopting global best practices, such as formalizing informal sectors, investing in infrastructure, and leveraging public-private partnerships, Nigeria can create a system that balances environmental preservation with socioeconomic development. Regional adaptations and innovative solutions, supported by strong regulatory frameworks and public education, are key to achieving this vision. The path forward requires collective effort, but the potential benefits—job creation, resource conservation, and environmental sustainability—make it a compelling and achievable priority. With focused action and collaboration, Nigeria can transform its construction waste landscape into a model for sustainable development.

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