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Journal of Behavioral Informatics
Digital Humanities & Development Research
Vol 12, No 3, September, 2026 Series

Waste Management Practices In Building Construction Projects In Ibadan, Oyo State, Nigeria.

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ABSTRACT

This study looked at the sustainable waste management practices that are being used in building construction projects in Ibadan, Oyo State, Nigeria. It used a quantitative research approach, and data were gathered from construction professionals through a structured questionnaire. The study explored the waste management practices that are currently in place on construction sites to see how much they are being used in support of sustainable construction. The findings showed that proper material storage, just-in-time material delivery, waste segregation, and reuse of construction materials were some of the most commonly used sustainable waste management practices. On the other hand, recycling of construction waste was found to be one of the least used practices, which suggests that there is limited application of circular economy principles in the area studied. The study concludes that while construction professionals in Ibadan have adopted several basic waste reduction practices, there is a need for more advanced sustainable waste management approaches to receive more focus. The study suggests that there should be better awareness among stakeholders, stronger support from institutions, improved recycling infrastructure, and effective implementation of policies to promote broader use of sustainable waste management practices in the construction industry.

Keywords: Building Construction, Construction Waste, Sustainable Waste Management, Nigeria, Ibadan, Oyo State, Waste Management Practices

Journal Reference Format:
Areoye S.O. & Leo-Olagbaye, F. (2026): Waste Management Practices In Building Construction Projects In Ibadan, Oyo State, Nigeria.. Journal of Behavioural Informatics, Digital Humanities and Development Res. Vol. 12 No. 3. Pp 1-12.
https://www.isteams.net/behavioralinformaticsjournal. dx.doi.org/10.22624/AIMS/BHI/V12N3P1x

I. INTRODUCTION

The construction industry plays a significant role in economic growth by providing housing, commercial facilities, transportation infrastructure, and jobs. Even with its important contributions to national development, the industry is known as one of the largest producers of solid waste due to the high consumption of construction materials and the waste generated during construction, renovation, and demolition processes (Aboginije et al., 2021; Lee et al., 2024). Construction and demolition waste includes materials such as concrete, timber, bricks, steel, plastics, glass, packaging materials, and excavated soil, with much of this waste being disposed of without sufficient recovery or recycling.

This leads to environmental damage, depletion of natural resources, and increased pressure on landfill sites (United Nations Environment Programme, 2023; Unegbu and Yawas, 2024). There are growing worries regarding climate change, resource scarcity, and environmental sustainability, which have heightened the necessity for sustainable waste management within the construction industry. Sustainable waste management refers to the implementation of strategies that reduce waste generation while encouraging the reduction, reuse, recycling, recovery, and responsible disposal of construction materials throughout the entire project lifecycle (Ghisellini et al., 2016; Aule et al., 2025). These strategies enhance resource efficiency, lower project costs, decrease environmental pollution, and assist in the shift towards a circular economy within the construction sector (Bao et al., 2023; Ferriz Papi et al., 2024).

Presently, sustainable waste management practices are more frequently incorporated into project planning, procurement, design, and site management activities. Approaches such as just-in-time material delivery, appropriate material storage, waste segregation, material reuse, prefabrication, modular construction, and digital waste monitoring have been acknowledged as effective methods for minimising material losses and enhancing construction efficiency (Ajayi et al., 2017; Kim et al., 2022; Li and Wang, 2024; Zhang et al., 2025). Additionally, Building Information Modelling and other digital technologies have improved waste prediction, monitoring, and material recovery, which in turn enhances sustainable construction performance (Akanbi et al., 2018; Akinade et al., 2018).

Despite the global interest in sustainable waste management, its application is still inconsistent in many developing nations, including Nigeria. Construction projects often rely heavily on traditional waste disposal methods, while recycling, material recovery, and circular economy strategies are not sufficiently developed. Previous research has noted that inadequate regulatory enforcement, limited technical skills, insufficient recycling facilities, poor material management, and financial difficulties are significant obstacles to the effective implementation of sustainable waste management in the Nigerian construction sector (Ajayi et al., 2015; Akinradewo et al., 2023; Unegbu et al., 2025). Similar issues have been observed in other developing countries where weak institutional frameworks continue to obstruct the adoption of sustainable construction practices (Windapo and Moghayedi, 2020; Hossain and Ali, 2024).

Although some construction companies have started to adopt sustainable waste management practices, there is a lack of empirical data regarding the specific practices that construction professionals are currently implementing in building projects in the city. Understanding these practices is crucial for identifying existing strengths, weaknesses, and opportunities for enhancing sustainable waste management performance. In light of this context, this study evaluates the current sustainable waste management practices employed in building construction projects in Ibadan, Oyo State, Nigeria. The results are anticipated to provide empirical data that will aid construction professionals, policymakers, and other interested parties in reinforcing sustainable waste management practices and enhancing environmental sustainability within the Nigerian construction industry.

2. LITERATURE REVIEW

Construction waste management refers to the systematic procedures used to handle waste materials generated during the lifecycle of a building project, from planning and procurement through construction, renovation, and demolition. Effective waste management aims to reduce the volume of waste that ends up in landfills while promoting safer disposal practices, efficient resource use, and the integration of recycling and reuse. However, the approaches used vary considerably across regions and project types, reflecting differences in regulatory frameworks, economic priorities, technological capacity, and industry culture. This section explores the current state of construction waste management, first focusing on international practices and emerging trends, then on the Nigerian context, and finally on evidence from urban construction centers like Ibadan. The goal is to highlight both best practice models and local realities to underscore the need for improved integration of sustainable waste management strategies.

Global Practices and Emerging Trends

Worldwide, the construction sector has seen an increasing focus on sustainable waste management driven by environmental policies, corporate sustainability goals, and rising landfill disposal costs. In many developed countries, waste management practices have evolved from basic disposal methods to comprehensive systems that prioritize waste reduction, segregation, recycling, and material recovery. In Europe, for instance, countries like Germany, Sweden, and the Netherlands have advanced waste management systems supported by strong regulations and enforcement mechanisms. Construction waste is often required to be separated at the source, and high recycling rates are achieved through efficient sorting facilities and well-established material recovery markets (Eurostat, 2024). In the Netherlands, the Construction Materials Decree mandates the separation and treatment of construction waste according to material type, promoting recycling and reuse before disposal (EU Commission, 2023).

The adoption of digital technologies has become a significant trend in advanced construction waste management. Tools like Building Information Modeling (BIM), RFID tagging, and waste tracking software assist project teams in quantifying waste generation in real time, optimizing material quantities, and enhancing on-site segregation efficiency (Zhang et al., 2025). In Australia and Singapore, digital platforms allow contractors to electronically monitor waste streams, improving transparency and accountability in waste handling (Li and Wang, 2024; Zhang et al., 2025). Another emerging trend is the adoption of circular economy principles in construction. This approach goes beyond traditional waste management by designing projects to enable material reuse and value recovery at the end of a building's life. Circular strategies include designing for disassembly, using modular construction systems, and prioritizing materials that are highly recyclable. Research indicates that circular economy approaches can reduce construction waste by up to 50% compared to conventional practices (Geng et al., 2024).

2.1 Waste Management Practices in Developing Contexts

Despite these global advancements, waste management practices in many developing countries are still evolving. In Africa, Asia, and Latin America, construction waste management is often hampered by limited infrastructure, weak regulatory enforcement, and low levels of stakeholder awareness. In Nigeria and other sub-Saharan nations, construction waste is frequently disposed of in open dumps or mixed with municipal solid waste due to inadequate waste sorting and recycling facilities (Akinradewo et al., 2023). Contractors often view waste management as a secondary issue and prioritize construction speed and cost savings over environmental considerations (Musa et al., 2024). Furthermore, the regulatory environment in many developing contexts is fragmented, with unclear guidelines on waste segregation, recycling standards, and enforcement mechanisms.

Studies in Ghana and Kenya have reported similar challenges, with waste segregation at the source being rare, recycling markets being underdeveloped, and most construction sites lacking systematic waste management plans (Boateng et al., 2024). These conditions lead to high volumes of waste being sent directly to landfills, undermining resource efficiency and increasing environmental risks.

2.2 Nigerian Construction Waste Management Practices

In Nigeria, the subject of construction waste management has gained scholarly attention in recent years, with research highlighting both shortcomings and opportunities for improvement in the sector. Projects in major urban centers like Lagos, Abuja, and Port Harcourt show common patterns of waste handling, including inadequate segregation, limited recycling, and reliance on low-cost disposal methods. A study by Unegbu et al. (2025) on construction sites in Lagos found that most contractors manage waste by dumping mixed waste at unregulated sites due to low disposal costs and weak enforcement of environmental regulations. The study indicated that few sites had structured waste management plans, and waste segregation was largely absent. Similarly, Ogunseye et al. (2024) noted that on-site sorting of construction waste was limited to larger contractors with explicit sustainability commitments, while smaller firms tended to treat waste management as optional.

Research by Itumo et al. (2025) in Abuja confirmed these findings, revealing that waste reduction strategies such as just-in-time delivery, accurate material estimation, and modular construction were rarely implemented, despite their acknowledged benefits for minimizing waste. The study pointed out that contractors often over-order materials to prevent stockouts, resulting in excess waste. Limited awareness of sustainable waste practices and a lack of incentives for resource recovery were identified as key factors influencing wasteful behavior.

2.3 Best Practices and Lessons from Comparative Models

Many cities that are developing still encounter substantial difficulties in achieving effective management of construction waste, and insights drawn from successful practices worldwide can provide useful guidance for enhancing local performance (Ajayi et al., 2017; Osmani, 2012).

Lessons taken from nations that have more developed waste management systems show that adopting organized and well-coordinated strategies can greatly improve efficiency, encourage recycling, and lessen negative environmental effects (Akinade et al., 2018; Adams et al., 2017). In the case of Ibadan, these lessons can offer a framework that may be tailored to local circumstances, taking into account limitations in regulations, infrastructure issues, and socio-economic factors (Akadiri et al., 2020; Windapo and Moghayedi, 2020). One of the key strategies seen in successful waste management systems is source segregation, which means separating various types of waste materials such as concrete, metals, plastics, and timber at the point where they are generated (Poon et al., 2001; Ajayi et al., 2015). By separating waste on-site, construction teams have the potential to notably increase recycling rates, cut down on contamination, and make it easier to reuse materials in other projects (Tam et al., 2007; Yuan, 2013). Furthermore, source segregation enables contractors to accurately measure the quantity of recyclable materials, which can enhance cost-efficiency and support the principles of a circular economy (Adams et al., 2017; Ghisellini et al., 2016). Implementing basic segregation practices on all licensed construction sites in Ibadan could serve as a practical initial step toward more sustainable waste management (Akinade et al., 2018; Ajayi et al., 2017).

Material Recovery Facilities, or MRFs, constitute another vital part of effective waste management systems. These facilities act as centralized locations for sorting, processing, and storing construction and demolition waste, which allows for greater recycling productivity and generates economic opportunities through the sale of recovered materials (Yuan, 2013; Adams et al., 2017). In developing urban areas like Ibadan, setting up localized recovery zones or collaborating with private recycling companies could allow for the benefits of MRFs without requiring significant investment (Ajayi et al., 2017; Akadiri et al., 2020). Such facilities would give contractors accessible locations to dispose of segregated materials and would promote the adoption of systematic recycling practices (Osmani, 2012; Tam et al., 2007).

Regulatory enforcement and incentive mechanisms are also important factors in sustainable waste management. In cities that have strong regulatory frameworks, compliance is supported not just through inspections and penalties but also through incentives such as tax reductions, grants, or recognition programs for contractors who adopt sustainable methods (Yuan, 2013; Ghisellini et al., 2016). In Ibadan, enhancing the enforcement of existing environmental regulations, combined with incentives for contractors who implement sustainable waste practices, could help foster a culture of accountability and underline the significance of proper waste management within the construction sector (Windapo and Moghayedi, 2020; Akinade et al., 2018).

The implementation of digital monitoring tools has become a useful way to track waste generation and apply necessary corrective measures. Building Information Modelling-enabled waste tracking systems, real-time reporting applications, and mobile data collection tools enable project teams to continuously monitor waste streams and respond proactively to problems such as excessive material waste or improper disposal (Zhang et al., 2025). Introducing digital monitoring, even in a basic form, could assist projects in Ibadan in gathering more precise data, enhancing decision-making, and optimizing the management of construction materials.

Training and awareness programs for contractors are also crucial for the effectiveness of sustainable waste strategies. Structured training initiatives for both site workers and project managers can increase understanding of proper waste segregation, handling, and disposal methods while reinforcing accountability in professional roles (Li and Wang, 2024). In the context of Ibadan, professional organizations such as the Nigerian Institute of Building and the Nigerian Society of Engineers could play an important role in offering ongoing workshops and certification programs, ensuring that construction workers have the knowledge and skills necessary for effective waste management.

Lastly, client-driven requirements have a significant impact on the adoption of sustainable practices. Projects that incorporate sustainability standards, like LEED certification or local green building codes, explicitly in their contractual obligations tend to show higher compliance with waste management protocols (USGBC, 2024). Clients and developers who demand the integration of sustainability requirements into project specifications encourage contractors to follow best practices, thereby creating a top-down reinforcement of responsible waste management. In Ibadan, the gradual introduction of client-focused sustainability criteria could assist in shifting industry standards toward more environmentally responsible actions.

By progressively adopting these strategies informed by global practices, construction projects in Ibadan and similar urban areas can achieve substantial improvements in waste management results. Initiatives such as mandatory on-site waste segregation, the establishment of local material recovery zones, partnerships with recycling firms, digital tracking systems, professional training initiatives, and client-driven sustainability requirements together create a comprehensive approach. Implementing these measures in a coordinated way will not only improve environmental performance but also promote resource efficiency, lower operational costs, and support broader goals for urban sustainability.

2.4 Roles of Stakeholders in Current Practices

Effective construction waste management relies on the coordinated efforts of many different stakeholders who each have their own distinct roles that are related to one another in the goal of minimizing waste, reusing materials, or properly disposing of waste during the entire project lifecycle. Each stakeholder's contribution is essential because if any one party is absent or weak, it can lead to fragmented waste management practices that result in inefficiencies in operations and negative impacts on the environment.

Clients and Developers have a significant impact on waste management because of their contractual requirements, design expectations, and funding priorities. Clients who make sustainability a priority in project briefs or tender documents encourage contractors to adopt better waste-handling practices such as separating materials, reducing over-ordering, and including recycling measures (Eze et al., 2024). Additionally, developers who focus on lifecycle costs and environmental performance promote the use of innovative waste reduction techniques that can greatly decrease the overall amount of waste generated by the project.

Design professionals, which include architects and engineers, have an important role in reducing construction waste before it is even created. By creating precise specifications, using modular or prefabricated designs, and planning for the reuse of materials, designers can greatly influence how materials are managed on the construction site (Kim et al., 2022). Careful design choices, like minimizing off-cuts or standardizing material sizes, can lead to less surplus material and help with the reuse and recycling of construction components, thus aiding sustainability goals. Contractors and project managers are key to the execution of waste management strategies on construction sites. They are in charge of coordinating activities on-site, enforcing protocols for segregation, training workers on how to handle materials properly, and communicating with waste handlers and recyclers. Their daily decisions have a direct effect on how efficient and effective waste management practices are. For example, arranging material deliveries to match what is actually needed on-site or overseeing waste disposal streams can help prevent unnecessary waste buildup and lower operational costs.

Regulatory bodies provide necessary oversight and ensure that environmental standards are followed. By enforcing regulations, issuing construction permits, and monitoring compliance with waste management requirements, these organizations create a legal framework that encourages responsible waste handling. The enforcement of regulations also makes sure that sustainability practices are required rather than optional, forcing stakeholders to align their operations with environmental goals. Lastly, waste recycling firms are vital in developing practical and economically viable solutions for construction waste. By providing facilities and markets for recovered materials, these firms make recycling a viable option and create incentives for contractors and clients to separate and recover waste instead of sending it to landfills. The collaboration between private recyclers and construction stakeholders helps to close the loop in material usage, which enhances circularity and promotes environmental sustainability.

3. METHODOLOGY

The study used a quantitative research design to evaluate the current sustainable waste management practices employed in building construction projects in Ibadan, Oyo State, Nigeria. A quantitative approach was seen as suitable because it allowed for the collection of measurable data from construction professionals about how much sustainable waste management practices are implemented on construction sites. The study population consisted of construction professionals engaged in building construction projects in Ibadan, including Builders, Quantity Surveyors, Architects, Civil Engineers, and Project Managers. These professionals were chosen because of their direct involvement in construction planning, management of materials, and operations on site, making them knowledgeable about waste management practices used during project execution. Primary data were gathered using a structured questionnaire that was designed based on the study objectives and relevant literature about sustainable waste management in construction. The data collected were analysed using descriptive statistical techniques, which included mean score, Relative Importance Index (RII), frequency, percentage, and ranking. These analytical methods were used to determine the level of adoption of the identified sustainable waste management practices and to rank them according to their relative importance. The findings are shown in Table 1 and discussed in relation to previous studies.

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Digital Humanities & Development Research
Vol 12, No 3, September 2026 Series

4. RESULT AND DISCUSSION OF FINDINGS

The aim of this study was to determine how much construction professionals implement sustainable waste management practices to reduce construction waste, improve material use, and promote environmental sustainability. The findings are presented in **Table 1**.

Table 1: Mean, RII and Ranking of Current Sustainable Waste Management Practices

S/N	Practices	Mean	RII	Ranking
1	Just-in- time material delivery system	4.05	0.81	1st
2	Waste segregation on construction sites	3.95	0.79	2nd
3	Proper storage of materials to reduce damage and waste	3.95	0.79	2nd
4	Reuse of construction materials such as timber and steel	3.86	0.77	4th
5	Preparation and use of waste management plans	3.59	0.72	6th
6	Sorting of waste materials before disposal	3.59	0.72	6th
7	Use of licensed waste disposal contractors	3.50	0.70	8th
8	Monitoring and documentation of generated waste	3.50	0.70	8th
9	Adoption of prefabrication or modular construction methods	3.82	0.76	5th
10	Recycling of construction materials	3.32	0.66	10th

The results presented in Table 1 above indicated that a number of sustainable waste management practices are currently being adopted in building construction projects in Ibadan, but the degree of adoption differs among the various practices. The findings indicated that proper storage of construction materials, just-in-time delivery of materials, waste segregation, and reuse of construction materials were the most frequently adopted sustainable waste management practices among the respondents. This implies that construction professionals are increasingly acknowledging the importance of reducing material wastage through effective planning, handling of materials, and management of sites.

The significant adoption of proper material storage shows that construction organisations recognise the need to protect materials from adverse weather, theft, physical damage, and deterioration during the execution of projects. Effective storage of materials decreases unnecessary losses and contributes to better use of resources throughout the construction process. In a similar way, the adoption of just-in-time delivery of materials reflects the efforts of construction firms to minimise excessive procurement of materials and to lessen waste that arises from prolonged storage on construction sites.

These findings support earlier studies that reported that efficient planning and storage of materials are crucial elements of sustainable waste management because they enhance project efficiency while decreasing unnecessary waste generation (Lawal et al., 2024). The findings further indicated that waste segregation and reuse of materials were commonly practised by professionals in construction. Waste segregation allows for different types of construction waste to be separated at the source, which makes recovery, recycling, and responsible disposal of waste materials easier. Likewise, material reuse decreases reliance on new construction materials while reducing project costs and enhancing resource efficiency. These practices align with the principles of sustainable construction that promote the reduction, reuse, and recovery of construction materials throughout the lifecycle of projects (Unegbu et al., 2025; Aule et al., 2025).

However, the findings also showed that recycling of construction waste had a comparatively lower level of adoption when compared to other waste management practices. This implies that even though construction professionals have accepted basic strategies for waste reduction, the implementation of more advanced sustainable waste management practices is still limited in the study area. The relatively low rate of recycling may be due to a lack of adequate recycling facilities, limited investments in technologies for waste recovery, and insufficient institutional support for circular economy practices in the Nigerian construction industry. Similar observations were made by Unegbu et al. (2025) and Itumo et al. (2025), who noted that recycling practices are underdeveloped in many developing nations because of infrastructural and regulatory challenges.

Overall, the findings demonstrate that sustainable waste management practices are slowly being incorporated into building construction projects in Ibadan, especially through effective management of materials and strategies for waste reduction. Nevertheless, more emphasis should be placed on encouraging recycling and other advanced practices for resource recovery to enhance sustainable construction and improve environmental performance within the construction industry (Unegbu et al., 2025).

5. CONCLUSION

The study evaluated the current sustainable waste management practices being adopted in building construction projects in Ibadan, Oyo State, Nigeria. The findings indicated that construction professionals have accepted several sustainable waste management practices, particularly proper storage of materials, just-in-time delivery of materials, waste segregation, and reuse of construction materials. These practices help in reducing material wastage, improving utilisation of resources, and enhancing environmental performance during the delivery of projects. However, the study also showed that recycling of construction waste is still relatively underutilised even though its environmental and economic benefits are acknowledged.

This indicates that while basic practices for waste reduction are increasingly being included in construction activities, the implementation of more advanced strategies for sustainable waste management is still limited. Therefore, the construction industry in Ibadan has made progress towards sustainable waste management, but further efforts are needed to encourage comprehensive adoption of sustainable waste management practices throughout the construction process.

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