

Sustainable Waste Management Practices in the Nigerian Construction Industry: A Study of Osogbo, Osun State

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ABSTRACT

The construction industry generates large volumes of solid waste that, when poorly managed, degrade soil, pollute water bodies, obstruct drainage and threaten public health. This study assessed sustainable waste management practices among construction stakeholders in Osogbo, Osun State, Nigeria, with a view to determining their implications for the local ecosystem. A descriptive survey research design was adopted, guided by four objectives: identifying the major waste types generated on site, examining current management practices, evaluating stakeholder awareness of sustainable practices, and assessing perceived ecosystem effects. Using the Krejcie and Morgan (1970) table for sample size determination, a structured questionnaire was administered to construction stakeholders in Osogbo and 108 valid responses were retrieved and analysed in SPSS using frequencies, percentages, mean, standard deviation and the Relative Importance Index (RII). The instrument returned excellent internal consistency (Cronbach's Alpha = 0.995). Findings show that masonry debris, packaging materials and finishing waste are the most prevalent waste types; component reuse and open dumping are the dominant management practices; awareness is strongest around practical storage and safety benefits but weaker around statutory regulation; and environmental health risk from open burning is the most keenly perceived ecosystem effect. The study concludes that construction waste management in Osogbo is characterised by a persistent gap between stakeholder awareness and actual site practice, sustained by cost-consciousness and weak enforcement rather than ignorance. Recommendations include phased material procurement, mandatory designated waste bays, stronger local enforcement of waste bye-laws, and cost-incentive schemes to close the awareness-practice gap and support Nigeria's green growth agenda.

Keywords: sustainable construction; construction waste management; Relative Importance Index; ecosystem effects; Osogbo, Nigeria

INTRODUCTION

Construction activities are central to infrastructural development and urban growth in Nigeria, but they simultaneously generate large quantities of construction and demolition waste (CDW), including concrete, timber, metals, packaging and plastics. Poor and largely unregulated handling of this waste, particularly indiscriminate dumping and open burning, poses serious threats to ecosystems by degrading soil, polluting water bodies, reducing air quality and obstructing drainage. As urban development in Nigeria continues to accelerate, the environmental and ecological consequences of construction waste become more significant, underscoring the need for sustainable waste management practices (Ajayi and Oyedele 2020, Akinade et al 2022, Aboginije et al 2021).

In Nigeria, rapid urbanisation, weak enforcement of environmental regulations and limited recycling

infrastructure combine to encourage indiscriminate disposal of construction waste, contributing to soil degradation, water and air pollution, and disruption of natural ecosystems (Ajayi and Oyedele 2020, Aboginije et al 2021, Eze and Idiake 2023). Effective waste management, anchored on reduction, reuse and recycling, remains essential for protecting ecosystems and advancing sustainable development (Akinade et al 2022). Despite the growing volume of construction activity, however, waste management on Nigerian sites remains poorly structured: many sites lack formal waste management plans, resulting in indiscriminate dumping that blocks drainage, contaminates soil and water, and degrades air quality and natural habitats. If left unaddressed, these impacts may translate into long-term ecological damage, increased flooding and elevated public health risk.

This study therefore assessed sustainable waste management practices in the Nigerian construction industry, using Osogbo, Osun State, as a case study, with a view to determining their implications for the local ecosystem. Specifically, the study sought to: (i) identify the major types of waste generated from construction activities; (ii) examine current construction waste management practices; (iii) evaluate the level of awareness of sustainable waste management practices among construction stakeholders; and (iv) assess the effects of construction waste management practices on the ecosystem.

LITERATURE REVIEW

Sustainability in construction rests on the "triple bottom line" of environmental, economic and social sustainability, requiring the industry to reduce its carbon footprint and resource consumption while remaining commercially and socially viable (Unegbu et al 2025). Construction and demolition waste is understood as surplus or damaged material arising from site preparation, execution and finishing, whose sustainable handling follows a hierarchy of reduction, reuse, recycling, recovery and, as a last resort, disposal (Aboginije et al 2021, Olanrewaju and Ogunmakinde 2024). Empirical studies of the Nigerian industry consistently identify concrete, timber, reinforcement off-cuts and sandcrete blocks as the dominant physical waste streams, arising mainly from poor cutting practice and breakage during handling, alongside "invisible" losses such as material over-ordering and rework driven by design changes and late client variations (Ogunmakinde et al 2019, Wahab and Lawal 2011, Omer et al 2025).

On management practice, the literature reports a heavy reliance on final disposal, chiefly open dumping and landfilling, driven by the high cost of alternative sustainable methods and the near-absence of subsidised recycling infrastructure (Unegbu and Yawas 2024). Technologies such as Building Information Modelling (BIM), though empirically shown to mitigate waste at the design stage, remain confined largely to high-end design offices and have yet to be integrated into site-level waste management protocols (Omer et al 2025), and most Nigerian firms are found to operate without a formal, written waste management policy, leaving reuse and disposal decisions to the discretion of site personnel (Dania et al n.d.).

This is compounded by a persistent "value-action gap": stakeholders are broadly familiar with sustainability terminology and the "3Rs" (Reduce, Reuse, Recycle), yet this awareness does not reliably translate into practice, and a related "regulatory awareness gap" leaves stakeholders less conscious of the statutory framework governing disposal than of its immediate practical and safety implications (Unegbu et al 2025, Unegbu and Yawas 2024, Dania et al 2008).

On ecosystem effects, mismanaged construction waste has been linked to ecological imbalance and aesthetic degradation, with illegal dumping in drainage channels identified as a direct driver of urban flooding (Ogunseye et al 2023), while open burning of debris is linked to air pollution and the leaching of toxic substances into soil and groundwater (Ogunmakinde et al 2019).

Structural equation modelling further suggests that "waste management" as currently practised in Nigeria has an insignificant effect on overall environmental performance, largely because industry effort remains concentrated on moving waste away from site rather than reducing it at source (Onubi et al 2020). Taken together, the reviewed literature points to a well-documented awareness-practice gap in the Nigerian construction industry, but with limited locally grounded, quantitative evidence from secondary urban centres such as Osogbo — a gap this study addresses.

METHODOLOGY

This study adopted a descriptive survey research design, which is well suited to capturing the perceptions and practices of a defined population of construction stakeholders at a given point in time. The study was situated in Osogbo, the capital of Osun State, Nigeria, selected on account of its status as a rapidly urbanising administrative and commercial centre with significant ongoing construction activity.

The study population comprised formal and informal construction stakeholders active in Osogbo, categorised into registered professionals (Architects, Builders, Engineers and Quantity Surveyors), artisans (masons, carpenters, plumbers and other tradespersons directly involved in material handling), and project owners/private developers. A purposive sampling technique was adopted, and the sample size was determined using the Krejcie and Morgan (1970) formula:

$$S = X^2NP(I-P) \div [d^2(N-1) + X^2P(I-P)]$$

For an estimated population of 150 active construction stakeholders in Osogbo, this yielded a minimum required sample size of 108 ($S = 144.04 \div 1.3328 \approx 108$), which was adopted as the target for questionnaire administration.

Data were collected through a structured questionnaire in five sections: (A) demographic profile; (B) frequency of waste types observed on site, on a 5-point scale (1 = Never to 5 = Very Often), addressing Objective 1; (C) frequency of use of current waste management practices, on the same scale, addressing Objective 2; (D) a 5-point Likert scale of agreement (1 = Strongly Disagree to 5 = Strongly Agree) measuring awareness of sustainable practice, addressing Objective 3; and (E) a matching Likert scale measuring perceived ecosystem effects, addressing Objective 4. The instrument was subjected to content validity review and, prior to substantive analysis, its internal consistency was tested using Cronbach's Alpha.

Data collection followed a double-track approach, combining hand delivery to accessible construction sites with remote administration to registered professionals. A total of 108 valid responses were retrieved and analysed in the Statistical Package for the Social Sciences (SPSS) using frequencies and percentages for demographic data, and mean, standard deviation and the Relative Importance Index (RII) for Sections B to E. The RII for each item was computed as:

$$RII = \sum W \div (A \times N)$$

Where W is the weighting assigned by each respondent (1 to 5), A is the highest weight (5), and N is the total number of respondents (108); items were subsequently ranked in descending order of RII within each objective.

RESULTS AND DISCUSSION

Instrument Reliability and Respondent Profile

The 34-item Likert-scaled instrument returned a Cronbach's Alpha coefficient of 0.995, indicating excellent internal consistency and confirming the instrument's suitability for the analyses that follow. Figure 1 summarises the demographic profile of the 108 respondents.

The sample was dominated by male respondents (74.1%) and by a youthful cohort aged 18–30 years (73.1%). Registered professionals accounted for 80.6% of respondents, lending particular credibility to the data on site-level practice, while most respondents (63.0%) had between one and five years of experience, indicating that the findings largely reflect the perspective of early-career practitioners rather than long-established senior professionals.

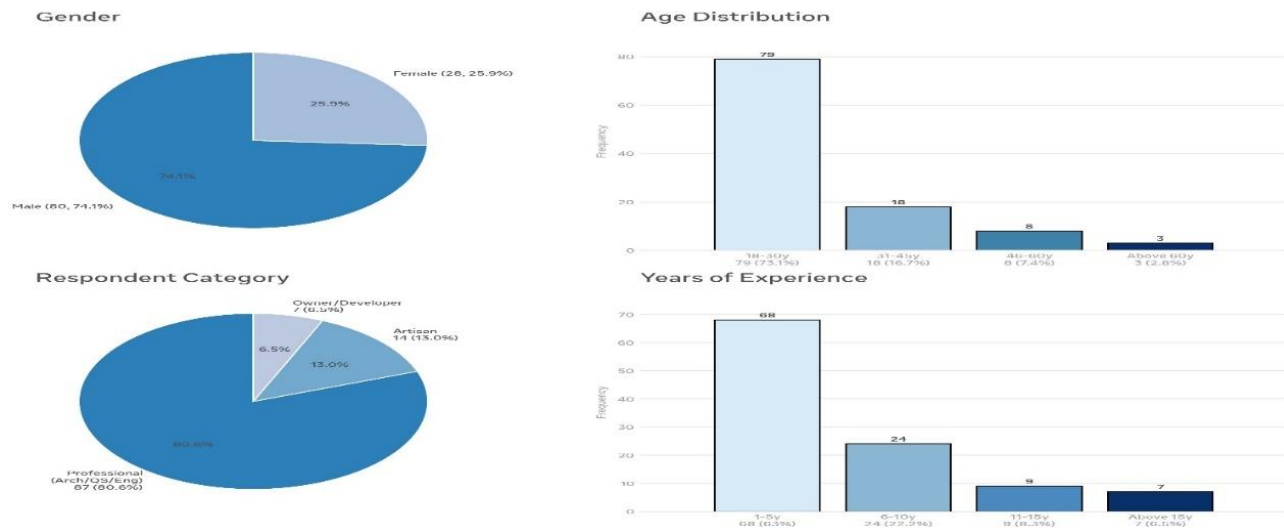


Figure 1. Demographic profile of respondents (N = 108)

Major types of waste generated on construction sites (Objective 1)

Figure 2 show that, masonry debris ranked highest (Mean = 3.69, RII = 0.738), followed by packaging materials (RII = 0.720) and finishing waste (RII = 0.712), while glass recorded the lowest relative importance (Mean = 2.93, RII = 0.586). The dominance of masonry debris is unsurprising within Osogbo's construction landscape, where sandcrete block production and laying remain the principal walling technique, so that breakages during handling, cutting and mortar preparation are routine and largely unavoidable under prevailing site practices. The comparatively low ranking of glass reflects its restricted use, confined mainly to finishing-stage window installation, handled in a more controlled, low-volume manner than masonry or packaging waste.

This finding is consistent with prior Nigerian studies identifying concrete, timber, reinforcement off-cuts and sandcrete blocks as the primary physical waste components on site, arising from poor cutting practice and breakage during handling and offloading (Ogunmakinde et al 2019). The comparatively high ranking of finishing waste (RII = 0.712) also supports evidence that design complexity and late-stage design changes drive rework, since finishing-stage materials are especially vulnerable to client-driven variation (Wahab and Lawal 2011, Omer et al 2025).

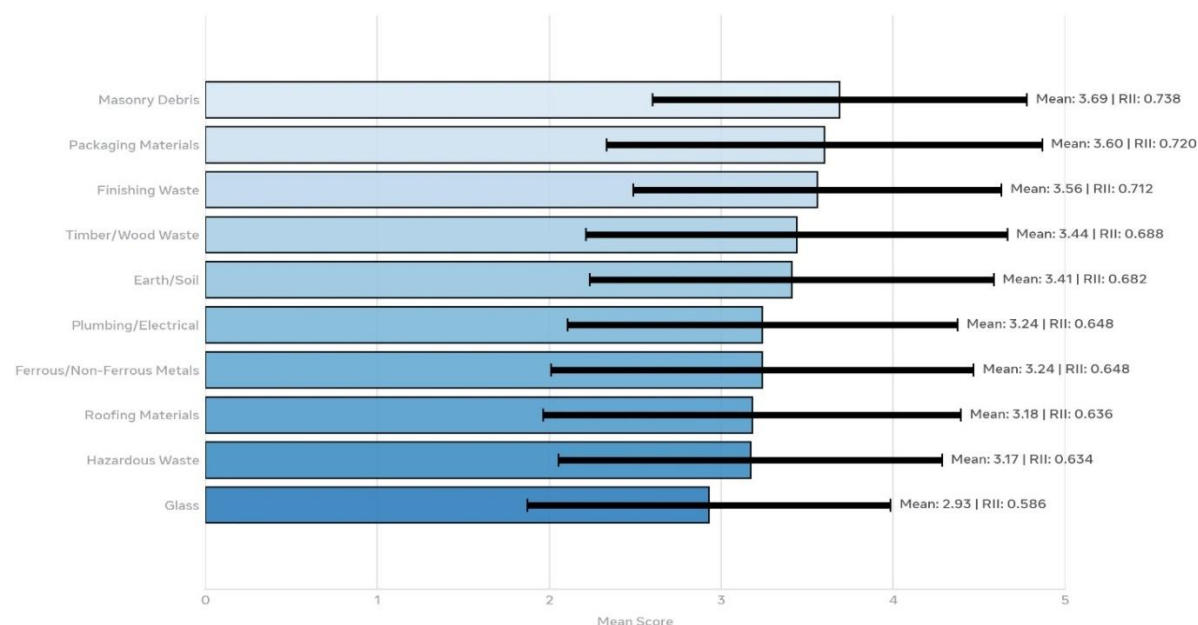


Figure 2. Mean, SD and RII of waste types generated on construction sites

Current construction waste management practices (Objective 2)

Component reuse recorded the highest relative importance (Mean = 3.73, RII = 0.746) as shown in figure 3, followed closely by open dumping (RII = 0.724), while sub-surface burial ranked lowest (Mean = 3.02, RII = 0.604). The high ranking of component reuse, particularly the salvaging of timber formwork for subsequent project cycles, reflects the cost-consciousness of small and medium-sized contractors in Osogbo, for whom formwork represents a recurring and relatively expensive input. That open dumping simultaneously ranks second-highest, however, points to the persistence of informal, unregulated disposal on adjacent undeveloped plots, a behaviour enabled by the limited availability of designated waste collection points within the study area.

This result is consistent with reports that the default practice for Nigerian firms remains a heavy reliance on landfilling and unauthorised open dumping, necessitated by the cost of alternative sustainable methods and the near-total absence of subsidised recycling infrastructure (Unegbu and Yawas 2024). That component reuse simultaneously ranks first reinforces evidence that most Nigerian construction companies operate without a written material waste management policy, such that reuse occurs informally at the discretion of site personnel rather than as part of a structured site waste management plan (Dania et al n.d.).

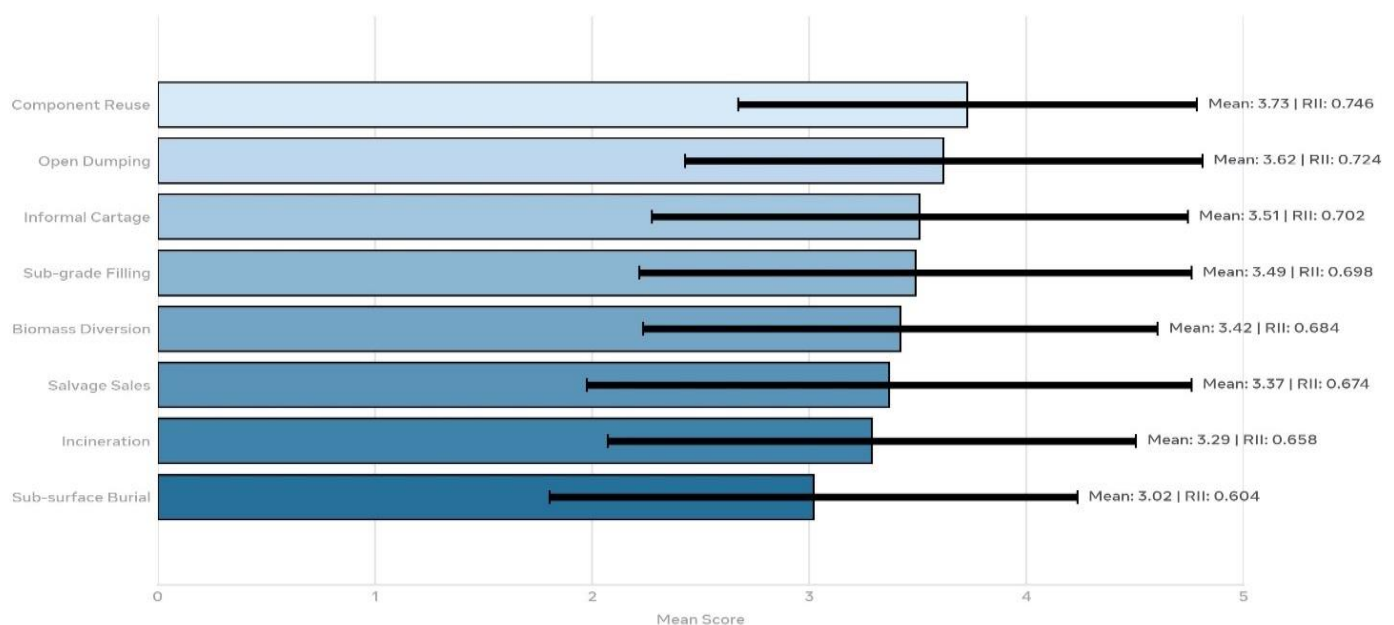


Figure 3. Mean, SD and RII of current waste management practices

Level of awareness of sustainable waste management practices (Objective 3)

Figure 4 show the awareness of storage management and occupational safety considerations jointly recorded the highest relative importance (Mean = 4.41, RII = 0.882), while awareness of statutory laws and regulations ranked lowest (Mean = 3.98, RII = 0.796), despite still reflecting general agreement. The strong awareness of storage and safety issues is consistent with the immediate, tangible consequences these factors have for day-to-day site operations, since improperly stored materials or debris-strewn sites directly affect workflow and worker safety. The comparatively lower awareness of statutory regulation reflects the historically weak visibility and enforcement of waste-related legislation within Osun State, leaving stakeholders less exposed to, and therefore less conscious of, the specific legal framework governing disposal.

This pattern corresponds with evidence that sustainable practice among Nigerian firms remains "moderate to weak" despite claimed familiarity with green concepts (Unegbu et al 2025), a value-action conflict attributed to professionals consistently prioritising project timeliness, quality and cost over environmental considerations (Dania et al n.d.). The comparatively low ranking of statutory awareness further corroborates reports of a "critical gap" between the existence of environmental regulation and stakeholders' actual

awareness of it, owing largely to weak enforcement and dissemination by regulatory bodies (Unegbu and Yawas 2024).

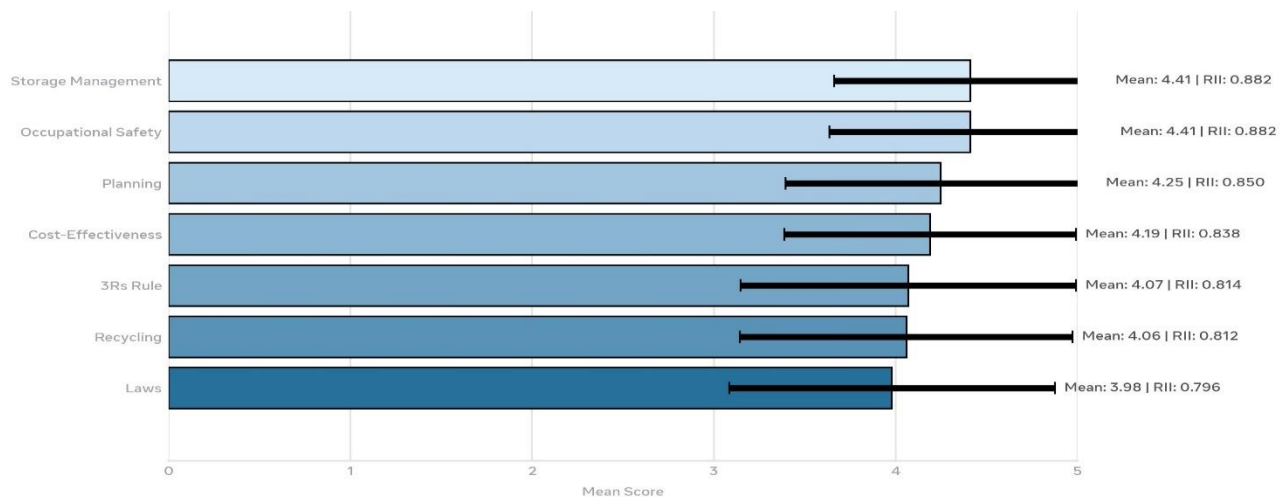


Figure 4. Mean, SD and RII of awareness of sustainable waste management practices

Perceived effects of construction waste on the ecosystem (Objective 4)

Environmental health risk from open burning ranked highest (Mean = 4.38, RII = 0.876), closely followed by occupational hazards from exposed sharp debris (RII = 0.874), while micro-climatic alteration ranked lowest (Mean = 4.11, RII = 0.822), though still within the agreement range as shown in figure 5. The prominence of environmental health and occupational hazard concerns reflects the immediacy and visibility of these risks to respondents, who directly witness smoke from on-site burning and personally risk injury from exposed metal and glass fragments. Drainage obstruction ranking third is particularly significant within Osogbo, a rapidly urbanising town where drainage channels are frequently narrow and already under strain, such that construction debris compounds an existing flood risk.

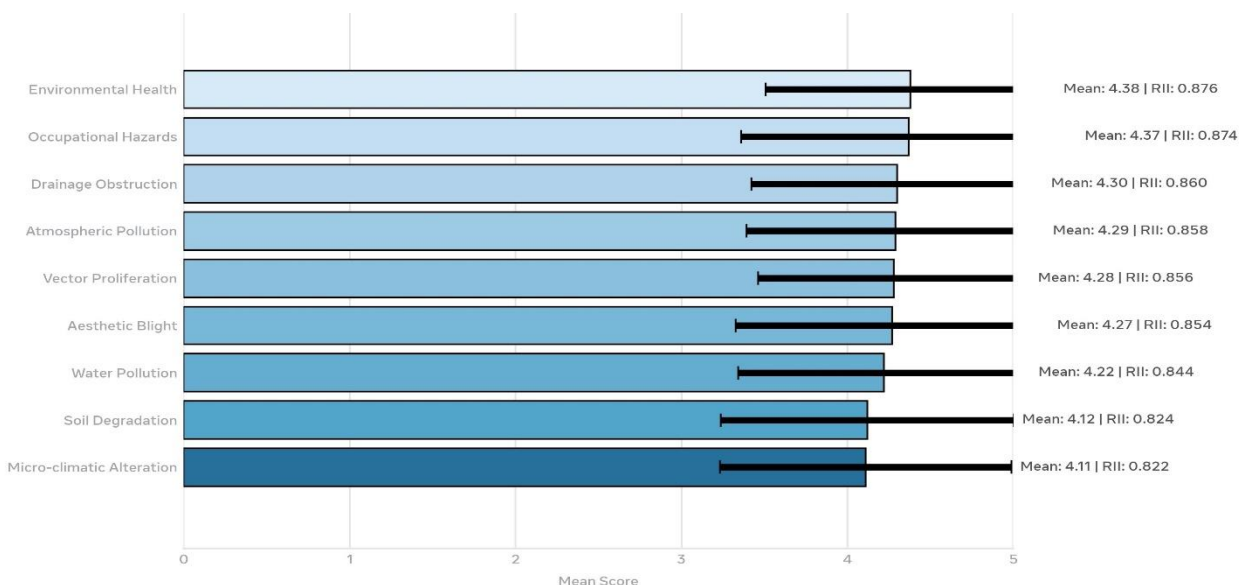


Figure 5. Mean, SD and RII of perceived ecosystem effects of construction waste

These findings correspond with evidence that mismanaged construction and demolition waste is a major driver of ecological imbalance, with illegal dumping in drainage channels identified as a direct cause of urban flooding (Ogunseye et al 2023). The high perceived risk of open burning corroborates evidence linking improper disposal, particularly burning of construction debris, to air pollution and the leaching of toxic chemicals into groundwater and soil (Ogunmakinde et al 2019). That respondents perceive ecosystem risk as

high despite existing, if informal, reuse and disposal practices is consistent with findings that current waste management in Nigeria has an insignificant effect on environmental performance, precisely because industry effort remains concentrated on moving waste away rather than reducing it at source (Onubi et al 2020).

CONCLUSION AND RECOMMENDATIONS

This study assessed sustainable waste management practices in the Nigerian construction industry, using Osogbo, Osun State, as the study area. Guided by the Krejcie and Morgan framework for sample size determination, 108 valid questionnaires were retrieved from construction stakeholders and analysed to address four objectives. The instrument demonstrated excellent reliability (Cronbach's Alpha = 0.995). Masonry debris and packaging materials emerged as the most significant waste types; component reuse and open dumping as the leading management practices; practical safety and storage knowledge as the strongest areas of awareness; and environmental health risk from open burning as the most keenly perceived ecosystem effect.

The findings show that construction waste management in Osogbo remains characterised by a persistent gap between stakeholder awareness and actual on-site practice. While respondents display strong practical knowledge of the operational benefits of waste management, particularly around storage, safety and cost, this awareness has not translated into the consistent adoption of formal, sustainable disposal methods. Instead, waste handling continues to rely heavily on informal and semi-regulated approaches such as open dumping and ad-hoc component reuse, driven more by cost-consciousness and convenience than by structured environmental policy. Construction waste in Osogbo therefore poses a real and well-perceived threat to the surrounding ecosystem, particularly through drainage obstruction, open burning, and soil and water contamination, and addressing this threat will require interventions that go beyond raising awareness to actively closing the gap between what stakeholders know and what they practise.

Arising from these findings, the study recommends: (i) improved on-site material take-off precision and phased procurement/delivery to reduce over-ordering and off-cuts, supported by contractor-level packaging return agreements with suppliers; (ii) mandatory designated waste bays and formal partnerships with licensed disposal and recycling operators, given the continued dominance of informal cartage and open dumping; (iii) stronger local enforcement of waste management bye-laws in Osogbo, complemented by cost-incentive schemes, since the evidence shows that knowledge of the "3Rs" and of safety benefits alone is not sufficient to drive behaviour change; and (iv) a ban-and-monitor approach to open burning near residential zones, together with mandatory drainage clearance clauses in building permit conditions. Given the study's geographic scope, cross-sectional design and reliance on self-reported Likert data, comparative studies across other Osun towns, or a longitudinal study tracking whether stronger enforcement actually closes the awareness-practice gap, are recommended for future research.

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