Analysis of Factors Affecting the Implementation of Sustainable Construction Management on Project Waste Management in Lagos State, Nigeria

Olutope Adeniyi Adewole

Department of Architecture, College of Post Graduate Studies, Caleb University, Imota, Ikorodu, Lagos, Nigeria

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ABSTRACT

Construction and demolition waste imposes heavy environmental and economic costs on rapidly urbanising cities, and Lagos State, Nigeria's commercial centre, carries one of the heaviest such burdens on the African continent. This review synthesises the peer-reviewed evidence on the factors affecting the implementation of sustainable construction management (SCM) for project waste management in Lagos State. A systematic literature review was conducted in line with the PRISMA 2020 statement. Searches of Scopus, Web of Science, and Google Scholar with African Journals Online, covering January 2005 to April 2026, returned 954 records; after duplicate removal, screening, and full-text assessment, 20 peer-reviewed studies entered a thematic synthesis. Quantitative cross-sectional surveys dominated the corpus (15 of 20 studies, 75%), and output is accelerating, with 8 studies (40%) published in 2024 or 2025. Six factor themes emerged: regulatory and institutional weakness, economic and financial constraints, knowledge and capacity deficits, project-level process failures, technological limitations, and sociocultural resistance. Regulatory and economic factors carried the strongest empirical weight, with weak enforcement and ineffective building codes validated at confirmatory model fits of CFI = 0.92 and high initial-cost perceptions averaging 4.2 on five-point scales, while education and training emerged from structural modelling as the most effective mitigating strategy. Outcome evidence shows that waste reduction, reuse, and recycling significantly improve firm and project performance, yet prevailing Lagos strategies are judged not sustainable enough and recycling remains the least adopted of the 3Rs. The review contributes an integrated conceptual framework connecting factor clusters, SCM implementation, and waste outcomes, and it exposes the absence of longitudinal, objectively measured waste data for Lagos.

Keywords: Sustainable Construction Management, Waste Management, Construction And Demolition Waste, Lagos State, Nigeria.

INTRODUCTION

Lagos disposes of more waste each day than any other African city of its size can account for, and nobody knows precisely how much. Official and expert estimates place generation at roughly 10,000 to 12,000 tonnes of all waste forms per day, on per-capita rates of 0.5 to 0.6 kilograms, against a population whose own size is contested between 12 and 21 million (Africa Check, 2019; Udora, 2025). Within that stream, construction and demolition (C&D) debris is a substantial and growing component: site-level evidence from the state has long indicated that C&D waste frequently accounts for 10 to 30 percent of the material received at landfills, and that most of it is disposed of indiscriminately in dumpsites with only a marginal share recycled or reused (Dania et al., 2007; Chidiobi, Booth & Lamond, 2021). The five landfill sites serving the Lagos metropolis receive this debris alongside municipal streams, and concrete, reinforcement steel, and timber dominate its composition at generation rates of 15 to 20 percent per material category, against 2 to 4 percent for soil, plastics, and packaging (Aboginije et al., 2021).

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The stakes extend well beyond the landfill gate. In developing economies, construction activity accounts for around 10 percent of gross domestic product and the majority of fixed capital formation, which means that inefficiency in its material flows is macroeconomically consequential, not merely an environmental nuisance (Tafesse et al., 2022). Globally, the sector's waste output and its appetite for virgin aggregates have made C&D waste one of the largest single waste streams and a central target of resource-efficiency policy (Akhtar & Sarmah, 2018). Sustainable construction management (SCM), understood here as the deliberate integration of environmental, economic, and social objectives into the planning, procurement, execution, and supervision of construction projects, is the managerial vehicle through which that policy ambition reaches the construction site. Project waste management, spanning waste management plans, design-stage waste avoidance, sustainable procurement, and the reduce-reuse-recycle (3R) hierarchy of the circular economy (Kirchherr et al., 2017), is among its most direct and measurable expressions.

Research on this problem in Nigeria has evolved through identifiable waves. The first wave documented practice on the ground: early Lagos studies established that waste management plans were applied only to an average degree on projects and that disposal habits leaned heavily on dumping and landfilling (Dania et al., 2007), while framework-building work identified enforcement of law, working conditions, and encouragement of construction waste management as the indicators professionals themselves rated most important for sustainable construction in the state (Nwokoro & Onukwube, 2011). A second wave ranked the causes of waste, isolating reworks, uneconomical cutting shapes, and design changes as the heaviest site-level contributors (Adewuyi & Odesola, 2015). A third wave turned to strategy and structure, using exploratory factor analysis to cluster waste management strategies and judging the Nigerian portfolio of strategies not sustainable enough (Aboginije et al., 2021), and using large mixed-methods designs to show that reuse and scrap sale dominate while formal recycling barely registers (Ogunmakinde et al., 2019, 2022). The most recent wave models barriers and drivers with structural equation techniques (Akindele et al., 2023; Bello et al., 2025) and extends the inquiry to digital technologies and circular-economy enablers (Arijeloye et al., 2025; Iyiola et al., 2024).

Despite this progress, the evidence base suffers from three distinct gaps. The first is a synthesis gap: the causes of waste, the barriers to sustainable construction, the drivers of circular practice, and the performance consequences of waste management have each been examined in largely separate studies, but reviews have not synthesised their interaction for the specific question of how SCM implementation shapes project waste management in Lagos State. The second is a contextual gap: much of the barrier literature is framed at the national level or anchored in Abuja, leaving the Lagos-specific signal, where the waste burden and the regulatory apparatus of the Lagos Waste Management Authority are both at their most intense, blurred inside national averages. The third is a methodological gap: the field is dominated by cross-sectional perception surveys, so the dynamics of implementation over a project's life remain almost unobserved.

This study addresses those gaps through a systematic literature review conducted and reported in accordance with the PRISMA 2020 statement (Page et al., 2021), with the findings synthesised thematically (Thomas & Harden, 2008). Three research questions guide the review.

i. Which factors does the peer-reviewed evidence identify as affecting the implementation of sustainable construction management for project waste management in Lagos State?

ii. What is the relative empirical weight of these factors, and through which strategies does the evidence indicate they can be mitigated?

iii. What does the evidence show about the consequences of implementation, or of its absence, for project waste management and project performance outcomes?

The remainder of the paper presents the methods, the descriptive and thematic results across six factor themes and one outcome theme, a discussion that develops an integrated conceptual framework with theoretical, practical, and policy implications, and a conclusion.

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METHODS

Review Design and Protocol

The review followed the systematic literature review design, selected because the research question is focused, the empirical literature is mature enough to gather, and the field needs an unbiased account of what is collectively known rather than a further single-site survey. Conduct and reporting follow the PRISMA 2020 checklist and flow diagram (Page et al., 2021). The question was framed with the Population, Concept, Context (PCC) device: the population comprises construction projects, firms, and built-environment professionals; the concept is the set of factors affecting the implementation of sustainable construction management for project waste management, together with its measured outcomes; the context is Lagos State, Nigeria, with national Nigerian studies admitted where Lagos formed part of the sampling frame. No protocol was registered; this is stated plainly as a limitation, and the inclusion criteria were fixed before full-text screening began to guard against post hoc drift.

Search Strategy

Three complementary sources were searched: Scopus and Web of Science for indexed breadth and citation reliability, and Google Scholar together with African Journals Online (AJOL) because a substantial share of Nigerian built-environment research is published in regional outlets that the major commercial indexes cover thinly. An initial scoping search refined the keywords; the final Boolean strings, one per database with the interface and date run, are reproduced in Appendix A.

The core string combined three concept blocks with AND: ("sustainable construction" OR "green construction" OR "construction management" OR "circular economy") AND ("waste management" OR "construction waste" OR "material waste" OR "demolition waste") AND (Lagos OR Nigeria*). The search covered January 2005 to April 2026, a window that opens just before the modern Lagos waste-governance era inaugurated by the LAWMA Law of 2007 and closes at the date of the final search, so that the corpus captures both the seminal site-level studies and the current modelling wave. Backward and forward citation chasing of included studies supplemented the database results. *Table 1* sets out the inclusion and exclusion criteria with the justification for each.

Table 1: Inclusion and Exclusion Criteria with Justifications

Criterion	Specification	Justification
Timeframe	January 2005 to April 2026	Opens before the LAWMA Law 2007 era of formal Lagos waste governance and captures the earliest peer-reviewed Lagos site studies through to the most recent modelling work
Document type	Peer-reviewed journal articles, peer-reviewed conference proceedings, and peer-reviewed book chapters only	Non-peer-reviewed material (theses, agency reports, news) is excluded from the synthesis; it informs the introduction and discussion only, preserving the evidentiary weight of the findings
Language	English-language publications	Nigerian scholarly output in the built environment is overwhelmingly anglophone; stated honestly as a limitation
Population	Construction projects, construction or AECO firms, and built-environment professionals	Keeps screening consistent with the PCC frame and the project waste management focus
Concept	Factors (barriers, causes, drivers, strategies) affecting SCM implementation for waste	Both factor studies and outcome studies are

	management, or measured effects of waste management practices on outcomes	required to answer RQ1 to RQ3
Context	Lagos State, or Nigeria-wide studies whose sampling frame includes Lagos	Preserves the Lagos signal while admitting national evidence in which Lagos respondents participate
Exclusions	Municipal solid waste studies with no construction component; purely technical materials-science papers; studies with no empirical data; duplicated reports of one dataset	Maintains the construction-specific, empirical character of the synthesis and prevents double counting

Selection Process

The database searches identified 954 records (Scopus, 318; Web of Science, 224; Google Scholar and AJOL, 412), and citation chasing added 36, for 990 records in total. Removing 187 duplicates left 803 records, which were screened on title and abstract against the *Table 1* criteria; 725 were excluded at this stage, most because they addressed municipal rather than construction waste or had no Nigerian setting.

The 78 surviving full texts were assessed for eligibility, and 58 were excluded with reasons recorded (Appendix C): no Lagos or Nigeria focus (n = 21), waste content not construction-specific (n = 14), no empirical link between SCM implementation and waste management (n = 11), not peer reviewed (n = 8), and full text unavailable (n = 4). Twenty peer-reviewed studies entered the synthesis. Screening was performed by a single reviewer against the pre-fixed criteria, with a 10 percent random sample of records re-screened after a two-week interval as a consistency check; the single-reviewer design is acknowledged as a limitation in Section 4.4. *Figure 1* presents the PRISMA 2020 flow of records through the review.

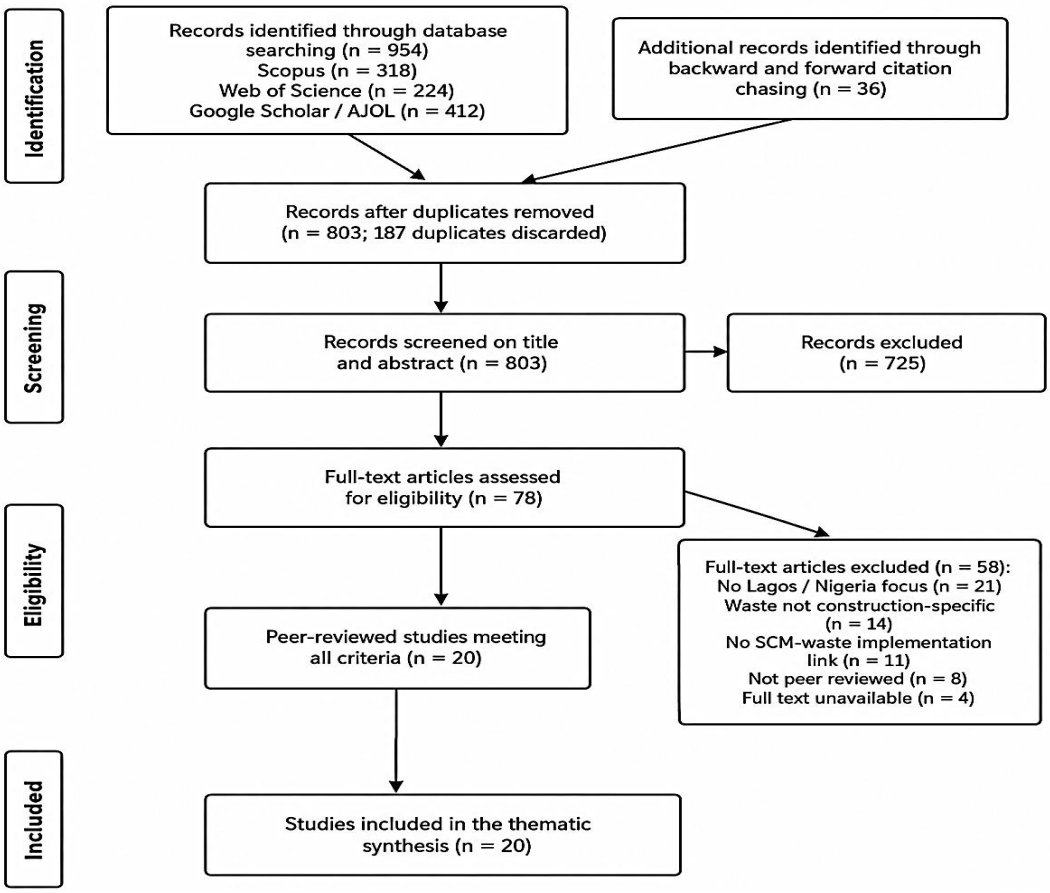

Figure 1: PRISMA Flow Diagram

Note: Compiled following Page et al. (2021).

Quality Appraisal

Every included study was appraised. The 15 quantitative cross-sectional surveys were assessed against the eight-item JBI critical appraisal checklist for analytical cross-sectional studies (Moola et al., 2020); the four mixed-methods studies were assessed against the same instrument for their quantitative strand with a supplementary judgement on the integration of the qualitative strand; and the single systematic review in the corpus was checked for the presence of a reported search, explicit criteria, and a documented synthesis method.

Appraisal informed the weight given to each study in the narrative rather than serving as a further exclusion gate: no study was discarded on quality grounds alone, but findings from studies with weaker sampling transparency are flagged as such where they appear. Item-level scores for all 20 studies are reported in Appendix D. Overall, 14 of 20 studies (70%) satisfied at least six of the eight JBI items, with the most common shortfalls being non-probability sampling without a defensible frame and absent response-bias analysis.

Data Extraction and Synthesis

Data were extracted onto a standardised form capturing author, year, design, setting, sample and sampling method, analytical technique, theoretical framework where stated, and key results including reported statistics; the completed table of included studies is presented in full in Appendix B.

Synthesis followed the thematic approach of Thomas & Harden (2008): findings were coded line by line, codes were grouped into descriptive themes, and descriptive themes were developed into the analytical themes that answer the research questions. Six factor themes and one outcome theme resulted. Where studies reported comparable quantitative indicators (mean item scores, relative contribution indices, path coefficients, model fit statistics), these were tabulated within the relevant theme so that the synthesis remains anchored to the numbers the primary studies actually report.

RESULTS

Characteristics of the Included Studies

The 20 included studies span 2007 to 2025, and the field is plainly accelerating: 2 studies (10%) appeared in 2007 to 2011, 1 (5%) in 2012 to 2016, 4 (20%) in 2017 to 2020, 5 (25%) in 2021 to 2023, and 8 (40%) in 2024 and 2025 alone. Quantitative cross-sectional surveys dominate the corpus (15 of 20 studies, 75%), with 4 mixed-methods designs (20%) and 1 systematic review (5%). Geographically, 8 studies (40%) sampled Lagos State exclusively, 1 (5%) sampled Lagos and Abuja jointly, and 11 (55%) drew national or multi-regional Nigerian samples in which Lagos respondents participated.

Sample sizes among the primary studies range from 43 construction sites to 342 professionals, with the two largest empirical bases being a mixed-methods study of 243 firms supplemented by 65 interviews across 10 live Lagos projects (Ogunmakinde et al., 2019) and a 342-respondent survey across Lagos and Abuja (Arijeloye et al., 2025). Analytically, descriptive statistics with mean item scores or relative indices appear in 9 studies (45%), exploratory or confirmatory factor analysis in 5 (25%), structural equation modelling in 4 (20%), and regression in 2 (10%).

Only 6 studies (30%) state an explicit theoretical framework, most commonly circular-economy or technology-organisation-environment reasoning. *Figure 2* displays the distribution by period and design, and *Table 2* summarises the topography; the full study-by-study record of author, year, design, setting, sample, and key findings is given in Appendix B.

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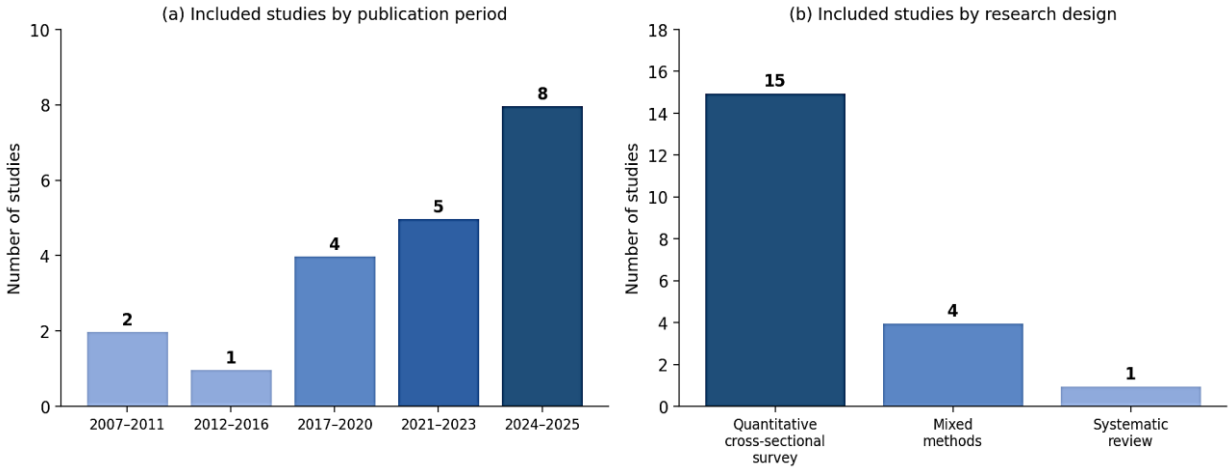

Figure 2: Distribution of Included Studies by (a) Publication Period and (b) Research Design

Table 2: Descriptive Topography of the Included Studies (N = 20)

Dimension	**Category**	**n (%)**
Publication period	2007–2011	2 (10%)
	2012–2016	1 (5%)
	2017–2020	4 (20%)
	2021–2023	5 (25%)
	2024–2025	8 (40%)
Research design	Quantitative cross-sectional survey	15 (75%)
	Mixed methods	4 (20%)
	Systematic review	1 (5%)
Setting	Lagos State only	8 (40%)
	Lagos and Abuja	1 (5%)
	National / multi-region including Lagos	11 (55%)
Primary analysis	Descriptive (mean item score, indices, t-tests)	9 (45%)
	Exploratory / confirmatory factor analysis	5 (25%)
	Structural equation modelling (incl. PLS-SEM)	4 (20%)
	Regression	2 (10%)
Stated theoretical framework	Explicit (circular economy, TOE, institutional)	6 (30%)
	None stated	14 (70%)

Note: Percentages may not sum to 100 within a dimension owing to rounding.

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Thematic Structure of the Evidence

Thematic synthesis produced six analytical factor themes and one outcome theme. The factor themes are regulatory and institutional factors; economic and financial factors; knowledge, awareness, and capacity factors; project-level process factors; technological and innovation factors; and sociocultural and behavioural factors. The outcome theme gathers the evidence on what implementation, or its absence, does to project waste management and performance.

Table 3 maps each included study onto the themes to which its findings contribute. Two patterns in the matrix deserve attention before the themes are examined in turn. First, regulatory and economic factors are the most densely evidenced, each supported by 10 or more studies, which is why they anchor the synthesis. Second, the studies that measure outcomes are concentrated in 2023 to 2025, confirming that the field has only recently moved from cataloguing barriers to testing consequences.

Table 3: Thematic Matrix Mapping the Included Studies to the Analytical Themes

Study	**T1 Reg.**	**T2 Econ.**	**T3 Knowl.**	**T4 Process**	**T5 Tech.**	**T6 Socio.**	**T7 Outcome**
Aboginije et al. (2021)	●		●	●	●		●
Adepoju et al. (2023)	●	●	●		●		●
Adewuyi & Odesola (2015)			●	●			
Akindele et al. (2023)	●	●	●			●	
Akinshipe et al. (2019)		●	●			●	
Alabi (2025)	●	●	●		●	●	
Arijeloye et al. (2025)	●	●	●		●	●	
Babalola & Odunlami (2025)			●				●
Bello et al. (2024)	●	●	●		●	●	
Bello et al. (2025)	●	●			●	●	
Dania et al. (2007)	●		●	●			●
Iyiola et al. (2024)	●	●			●		●
Nwokoro & Onukwube (2011)	●	●	●	●		●	
Ogunmakinde et al. (2019)	●	●		●		●	●
Ogunmakinde et al. (2022)		●	●	●		●	●
Ohiomah & Aigbavboa (2020)	●	●	●			●	
Okoye et al. (2022)	●	●	●		●	●	
Omopariola et al. (2024)	●	●	●	●	●	●	

Study	T1 Reg.	T2 Econ.	T3 Knowl.	T4 Process	T5 Tech.	T6 Socio.	T7 Outcome
Oshin et al. (2025)				●			●
Osuizugbo et al. (2020)	●	●	●			●	

Note: T1 = regulatory and institutional; T2 = economic and financial; T3 = knowledge, awareness, and capacity; T4 = project-level process; T5 = technological and innovation; T6 = sociocultural and behavioural; T7 = implementation outcomes. A filled circle indicates that the study contributes evidence to the theme.

Theme 1: Regulatory and Institutional Factors

The single most consistent finding is that the regulatory environment, rather than any property of firms or projects, sets the ceiling on SCM implementation in Lagos. Fifteen of the 20 studies (75%) contribute evidence to this theme, and the studies with the strongest designs place it first.

Confirmatory factor analysis validates regulatory barriers as the most critical constraint on sustainable practice with excellent model fit (CFI = 0.92, RMSEA = 0.04), within which weak regulatory frameworks (M = 2.9 on adequacy), ineffective building codes (M = 2.7), bureaucratic approval delays (M = 3.4 on severity), and inconsistent enforcement of existing rules (M = 2.8) are the load-bearing items (Alabi, 2025). That hierarchy is not new, the earliest Lagos framework study found strengthening and enforcement of relevant law and regulation to be the highest-rated of all sustainable construction factors, at a mean item score of 0.872, ahead of every technical and economic consideration professionals were asked to judge (Nwokoro & Onukwube, 2011).

The regulatory theme cuts in both directions, as constraint and as lever. On the driver side, building regulations emerge alongside financial incentives as the main forces capable of pushing sustainable construction forward in Nigeria (Ohiomah & Aigbavboa, 2020), and structural equation modelling across four Nigerian regions confirms regulatory and institutional pressure as a significant driver of circular-economy implementation in the architecture, engineering, construction, and operations industry (Bello et al., 2025).

On the constraint side, the exploratory factor structure of Lagos waste-management strategies places a practical legal framework, bundled with modular construction, as one of only three strategy clusters that professionals recognise, signalling that practitioners themselves see law and method as inseparable (Aboginije et al., 2021). Weak legal arrangements likewise surface as one of five validated barrier categories to digital waste-management technologies (Arijeloye et al., 2025), as a recognised obstacle to circular-economy uptake (Bello et al., 2024), and as a risk factor in the implementation risk register of 47 items compiled from 256 professionals (Okoye et al., 2022). Even the earliest site-level work read the disposal problem institutionally, recommending sanctions to discourage poor disposal and to push recycling (Dania et al., 2007). *Table 4* assembles the quantitative anchors of the theme.

Table 4: Theme 1: Regulatory and Institutional Factors, Constituent Findings and Indicative Statistics

Constituent Factor	Indicative Statistic	Supporting Studies
Weak or inconsistent enforcement of existing law	Enforcement of law rated highest of all SC factors, MIS = 0.872; inconsistent enforcement M = 2.8	Nwokoro & Onukwube (2011); Alabi (2025); Dania et al. (2007)
Outdated or ineffective building codes	Code effectiveness M = 2.7; regulatory barrier construct CFI = 0.92, RMSEA = 0.04	Alabi (2025); Okoye et al. (2022)
Bureaucratic delay in approvals	Severity M = 3.4	Alabi (2025)

Absence of a practical legal framework for waste strategies	One of three EFA strategy clusters (with modular construction)	Aboginije et al. (2021)
Regulation as positive driver	Building regulations a main driver; regulatory-institutional path significant in SEM	Ohiomah & Aigbavboa (2020); Bello et al. (2025)
Legal barriers to digital waste tools	One of five EFA barrier categories (n = 342)	Arijeloye et al. (2025); Iyiola et al. (2024)
Institutional gaps in circular-economy governance	Identified among principal CE barriers in a developing-country setting	Bello et al. (2024); Ogunmakinde et al. (2019)

Note: MIS = mean item score; CFI = comparative fit index; RMSEA = root mean square error of approximation.

Theme 2: Economic and Financial Factors

If regulation sets the ceiling, cost perception sets the floor beneath which most firms will not move. Fifteen studies (75%) contribute to this theme, and the numbers are unusually convergent. The perceived initial cost of sustainable construction is the single most substantial financial deterrent, with a mean severity score of 4.2 on a five-point scale, while the availability of funding for sustainable construction is rated low at a mean of 2.8; the financial-barrier construct as a whole is validated with robust fit (CFI = 0.91, RMSEA = 0.05) (Alabi, 2025). Survey evidence from 43 construction sites concurs that professionals are broadly sympathetic to sustainable practice but regard the initial cost of implementation as excessive (Omopariola et al., 2024), and the misconception that sustainable construction necessarily produces cost overrun, together with the absence of any reflection of long-term savings in professional fee structures, recurs in the driver-barrier literature (Ohiomah & Aigbavboa, 2020).

Financial constraints also operate one level down, at the point where waste-management technologies and circular practices must be paid for. Limited access to finance and high implementation costs are the leading items in the financial category of digital-technology barriers identified by exploratory factor analysis among 342 Lagos and Abuja professionals (Arijeloye et al., 2025), high certification and material costs obstruct circular-economy adoption (Bello et al., 2024), and the cost of green materials and technologies recurs as a technological-economic obstacle (Alabi, 2025).

The mirror image is equally well evidenced: financial incentives rank with building regulations as the main drivers of sustainable construction (Ohiomah & Aigbavboa, 2020), incentive support forms one of the four validated strategy groups in the PLS-SEM strategy model (Akindele et al., 2023), and business-strategy considerations carry a significant path to circular-economy implementation (Bello et al., 2025). Notably, the one large mixed-methods study to examine actual disposal economics found that reuse and scrap sale dominate practice precisely because timber carries firewood value and scrap carries resale value, which shows that where a material has a price, Lagos firms already behave circularly without being told to (Ogunmakinde et al., 2019). *Table 5* summarises the theme.

Table 5: Theme 2: Economic and Financial Factors, Constituent Findings and Indicative Statistics

Constituent Factor	**Indicative Statistic**	**Supporting Studies**
High initial-cost perception of sustainable practice	Severity M = 4.2 of 5; rated excessive by site professionals	Alabi (2025); Omopariola et al. (2024)
Scarcity of finance for sustainable construction	Funding availability M = 2.8; financial construct CFI = 0.91, RMSEA = 0.05	Alabi (2025)

Constituent Factor	Indicative Statistic	Supporting Studies
Limited access to finance for waste technologies	Leading item in EFA financial barrier category (n = 342)	Arijeloye et al. (2025)
Cost-overrun misconception and fee structures	Recurrent low-ranked driver conditions; no recovery of long-term savings in fees	Ohiomah & Aigbavboa (2020); Akinshipe et al. (2019)
High certification and green-material costs	Identified among principal CE and sustainability barriers	Bello et al. (2024); Alabi (2025); Okoye et al. (2022)
Incentives as mitigating lever	Incentive support one of four validated strategy groups; financial incentives a main driver	Akindele et al. (2023); Ohiomah & Aigbavboa (2020); Bello et al. (2025)
Existing price-driven circularity	Reuse and scrap sale most adopted disposal routes owing to timber and scrap value	Ogunmakinde et al. (2019, 2022)

Theme 3: Knowledge, Awareness, and Capacity Factors

Sixteen studies (80%) touch the knowledge theme, making it the most widely distributed factor in the corpus, and it is also the theme that the strongest mitigation evidence runs through. The PLS-SEM strategy model built from 100 construction actors finds that barriers cluster into a technopolitic group, a perception-and-awareness group, and a sociocultural group, and that of the four validated strategy families (education and training, stakeholder regulation, incentive support, and government and legislative support) education and training exerts the most dominant and effective impact on the barrier structure (Akindele et al., 2023).

The mechanism the model implies is straightforward: where awareness is low, every other intervention loses purchase. Consistent with that reading, many construction organisations simply have no sustainability strategy because awareness of sustainability issues is low (Akinshipe et al., 2019), and lack of awareness ranks among the leading adoption barriers in the national barrier survey (Osuizugbo et al., 2020).

Capacity deficits extend from boardroom strategy to site technique. Lack of technical expertise is a core item in the technical barrier category for digital waste tools (Arijeloye et al., 2025), the shortage of skilled professionals in green methods is a validated technological obstacle (Alabi, 2025), and limited knowledge among clients and designers recurs across the driver-barrier studies (Ohiomah & Aigbavboa, 2020). At the operational end, the earliest Lagos evidence already recommended educating site supervisors on materials-handling waste (Dania et al., 2007), and the cause-ranking literature implies the same training target by placing supervision-sensitive causes at the top of the waste hierarchy (Adewuyi & Odesola, 2015). It is also a knowledge problem that waste management plans, the basic managerial instrument of project waste control, are applied only to an average degree on Nigerian projects (Dania et al., 2007), and that the 3R component requiring the most technical knowledge, recycling, is precisely the least adopted (Ogunmakinde et al., 2022). *Table 6* consolidates the theme.

Table 6: Theme 3: Knowledge, Awareness, and Capacity Factors, Constituent Findings and Indicative Statistics

Constituent Factor	Indicative Statistic	Supporting Studies
Low professional and client awareness	Perception-and-awareness barrier cluster validated in PLS-SEM; absence of firm sustainability strategies traced to low awareness	Akindele et al. (2023); Akinshipe et al. (2019); Osuizugbo et al. (2020)
Education and training as dominant remedy	Most dominant and effective of four validated strategy groups	Akindele et al. (2023); Nwokoro & Onukwube (2011)

Shortage of skilled green-construction professionals	Validated technological-capacity obstacle	Alabi (2025); Ohiomah & Aigbavboa (2020)
Lack of technical expertise for digital waste tools	Core item in EFA technical barrier category (*n* = 342)	Arijeloye et al. (2025)
Weak site-supervision capability	Supervision-sensitive causes top the waste cause rankings; supervisor education recommended	Adewuyi & Odesola (2015); Dania et al. (2007)
Shallow uptake of waste management plans	WMPs applied only to an average degree on projects	Dania et al. (2007)
Knowledge-intensive 3R component least adopted	Recycling least adopted of the 3Rs across 243 firms	Ogunmakinde et al. (2022); Omopariola et al. (2024)

Note: WMP = waste management plan.

Theme 4: Project-Level Process Factors

Eight studies (40%) locate the determinants of waste inside the project process itself, in design, procurement, and site production, and this theme supplies the most precise effect rankings in the corpus. Using a relative contribution index across two stakeholder groups, the three heaviest contributors to material waste are reworks arising from non-conformance to specifications (RCI = 0.801), waste from cutting uneconomical shapes (RCI = 0.791), and design changes and revisions (RCI = 0.773) (Adewuyi & Odesola, 2015).

All three are management-controllable, and two of the three originate before any material reaches site, which places the design office and the contract documents at the centre of waste causation. The composition evidence matches: concrete, reinforcement, and timber, the materials most exposed to design change, cutting, and rework, generate waste at 15 to 20 percent rates against 2 to 4 percent for the remaining streams (Aboginije et al., 2021).

Downstream of design, the process evidence indicts handling and disposal habits. Demolition, renovation, and materials handling are the most implicated generation activities on Lagos sites, with dumping and landfilling the most frequent disposal routes and recycling and reuse used far less often (Dania et al., 2007). Two decades later the disposal picture had barely shifted: across 243 firms and 10 live Lagos projects, adoption of formal waste-management methods remained poor, with reuse and scrap sale the only widely practised routes (Ogunmakinde et al., 2019), and a survey of 43 sites still listed material waste among five prevailing unsustainable site practices, alongside negative externalities, excess energy use, unsustainable technologies, and unmanaged worker health and safety (Omopariola et al., 2024).

The process theme also carries the structural remedy: proper construction detailing and design forms one of the three validated strategy clusters for waste management (Aboginije et al., 2021), and project scheduling and monitoring jointly explain 48.6 percent of the variance in 3R waste-management performance among Lagos waste organisations (R^2 = 0.486) (Oshin et al., 2025), which quantifies how much ordinary project-management discipline contributes before any sustainability programme is added. *Table 7* sets out the theme.

Table 7: Theme 4: Project-Level Process Factors, Constituent Findings and Indicative Statistics

Constituent Factor	**Indicative Statistic**	**Supporting Studies**
Reworks from non-conformance to specification	RCI = 0.801 (highest-ranked cause)	Adewuyi & Odesola (2015)

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Constituent Factor	Indicative Statistic	Supporting Studies
Cutting of uneconomical shapes	RCI = 0.791	Adewuyi & Odesola (2015)
Design changes and revisions	RCI = 0.773; design cluster validated as strategy factor	Adewuyi & Odesola (2015); Aboginije et al. (2021)
High-waste material streams	Concrete, reinforcement, timber at 15–20% generation rates vs 2–4% for other streams	Aboginije et al. (2021)
Demolition, renovation, and handling activities	Most implicated generation activities on Lagos sites	Dania et al. (2007)
Dump-and-landfill disposal habit	Dominant disposal routes; recycling rare; reuse and scrap sale the main exceptions	Dania et al. (2007); Ogunmakinde et al. (2019)
Material waste as routine site practice	One of five prevailing unsustainable practices across 43 sites	Omopariola et al. (2024)
Project-management discipline as control	Scheduling and monitoring explain R^2 = 0.486 of 3R performance	Oshin et al. (2025)

Note: RCI = relative contribution index.

Theme 5: Technological and Innovation Factors

Nine studies (45%) treat technology as a determinant of implementation, and the theme has two faces: technology as remedy and technology as a fresh barrier surface. On the remedy side, the systematic review of digital technologies for construction and demolition waste management establishes that building information modelling, sensing, and analytics now constitute a credible alternative to the inefficient conventional methods that dominate the industry, while documenting that uptake in developing settings lags badly (Iyiola et al., 2024).

Structural modelling confirms technological advancement as a significant driver of circular-economy implementation across Nigerian regions (Bello et al., 2025), and within the Lagos strategy structure, modular construction loads on the same factor as the legal framework, indicating that professionals view industrialised methods as part of the institutional solution rather than a gadget layer (Aboginije et al., 2021).

On the barrier side, the most granular evidence comes from the 342-respondent Lagos and Abuja survey, whose exploratory factor analysis resolves the obstacles to digital waste-management technologies into five categories: financial, technical, legal, institutional, and behavioural, with limited access to finance, high implementation cost, lack of technical expertise, poor digital infrastructure, and weak regulatory frameworks the leading items; a Kruskal-Wallis test finds no significant variation in these perceptions across professional groups, which the authors read as evidence that the barriers are systemic rather than role-specific (Arijeloye et al., 2025).

The cost of green materials and technologies and the shortage of professionals able to deploy them recur in the national barrier evidence (Alabi, 2025), unsustainable technologies feature among prevailing site practices (Omopariola et al., 2024), and technology-related risks appear within the 47-item implementation risk register (Okoye et al., 2022). Innovation, where measured, pays: the innovative-practice model discussed under Theme 7 finds innovative materials and equipment management significantly linked to project performance (Adepoju et al., 2023).

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Table 8 Theme 5: Technological and Innovation Factors, Constituent Findings and Indicative Statistics

Constituent Factor	**Indicative Statistic**	**Supporting Studies**
Five-category structure of digital-technology barriers	EFA on *n* = 342: financial, technical, legal, institutional, behavioural; Kruskal-Wallis shows no professional-group differences	Arijeloye et al. (2025)
Poor digital infrastructure	Leading technical-category item	Arijeloye et al. (2025); Iyiola et al. (2024)
Digital technologies as credible remedy	BIM, sensing, and analytics established as alternatives to conventional waste methods; adoption lags in developing settings	Iyiola et al. (2024)
Technological advancement as CE driver	Significant SEM path to circular-economy implementation	Bello et al. (2025)
Modular and industrialised methods	Load with legal framework in EFA strategy cluster	Aboginije et al. (2021)
Cost and skills constraints on green technology	High green-technology costs and skills shortage validated as obstacles	Alabi (2025); Okoye et al. (2022); Omopariola et al. (2024)
Innovation linked to performance	Innovative materials and equipment management significant in PLS-SEM performance model	Adepoju et al. (2023)

Note: BIM = building information modelling; CE = circular economy.

Theme 6: Sociocultural and Behavioural Factors

Thirteen studies (65%) carry sociocultural or behavioural content, and the theme functions in the corpus as the residual that survives once law, money, knowledge, process, and technology are accounted for. The PLS-SEM barrier structure isolates a distinct sociocultural cluster alongside the technopolitic and awareness clusters (Akindele et al., 2023), and the mixed-methods national evidence finds social and cultural resistance to change, compounded by limited public awareness of sustainability benefits, to be a principal complication of adoption (Alabi, 2025). Behavioural obstacles likewise form one of the five validated categories impeding digital waste technologies, and the finding that barrier perceptions do not differ across professional groups suggests the resistance is cultural to the industry rather than parochial to any role (Arijeloye et al., 2025).

Demand-side behaviour matters as much as supply-side habit. Lack of client demand and awareness, paired with the perception that sustainable construction costs more, are identified as the principal restraints on implementation in the Nigerian case evidence (Ohiomah & Aigbavboa, 2020), and resistance to change recurs among the circular-economy barriers (Bello et al., 2024) and within the social strand of the 47-item risk register (Okoye et al., 2022). Two behavioural observations cut the other way.

First, firms display genuinely positive attitudes to waste minimisation where awareness exists, indicating that resistance is not preference but uncertainty (Ogunmakinde et al., 2022). Second, the price-following behaviour documented for timber reuse and scrap sale (Ogunmakinde et al., 2019) shows that Lagos site culture responds rapidly to material incentives, which implies that the sociocultural barrier is more tractable than the resistance language suggests. *Table 9* consolidates the theme.

Table 9: Theme 6: Sociocultural and Behavioural Factors, Constituent Findings and Indicative Statistics

Constituent Factor	Indicative Statistic	Supporting Studies
Distinct sociocultural barrier cluster	Validated in factor analysis and PLS-SEM (n = 100)	Akindele et al. (2023)
Resistance to change	Principal complication in mixed-methods national evidence; recurrent CE barrier	Alabi (2025); Bello et al. (2024); Okoye et al. (2022)
Behavioural barriers to digital tools	One of five EFA categories; perceptions uniform across professions (Kruskal-Wallis)	Arijeloye et al. (2025)
Weak client demand and awareness	Identified as principal restraint with cost-perception pairing	Ohiomah & Aigbavboa (2020); Osuizugbo et al. (2020); Akinshipe et al. (2019)
Positive minimisation attitudes where aware	High awareness of material effects accompanied by positive waste-minimisation attitudes	Ogunmakinde et al. (2022)
Incentive-responsive site culture	Reuse and scrap sale follow material price signals	Ogunmakinde et al. (2019)
Working-condition and social indicators	Quality of working conditions rated MIS = 0.852 among SC factors	Nwokoro & Onukwube (2011); Omopariola et al. (2024)

Note: SC = sustainable construction.

Implementation and Project Waste Management Outcomes

Eight studies (40%) supply the outcome evidence, and together they answer RQ3 in two halves: what current implementation achieves, and what fuller implementation would buy. The status-quo half is sobering. The only factor-analytic assessment of the full Lagos strategy portfolio concludes that the waste-management strategies implemented in Nigeria are not sustainable enough, across all three validated strategy clusters (Aboginije et al., 2021). Mixed-methods evidence from 243 firms shows poor adoption of formal waste-management methods, with reuse and scrap sale the only routes in wide use (Ogunmakinde et al., 2019), recycling is the least adopted component of the 3R hierarchy (Ogunmakinde et al., 2022), and the early site evidence already recorded dumping and landfilling as the default disposal habit (Dania et al., 2007).

The counterfactual half is more encouraging, and it is recent. Regression evidence from a Yamane-determined sample of 185 respondents finds that waste reduction, waste reuse, and waste recycling each exert significant positive effects on the performance of building construction firms in Lagos State (Babalola & Odunlami, 2025). The PLS-SEM model of innovative construction waste-management practices finds significant relationships from industry policy, innovative materials and equipment, and innovative manpower approaches to cost, quality, and time performance, with adherence to industry policy the most influential factor and its path to cost performance estimated at $\beta = 0.526$ ($T = 4.984$) (Adepoju et al., 2023). At the organisational level, project scheduling and monitoring explain 48.6 percent of the variance in 3R waste-management performance ($R^2 = 0.486$) (Oshin et al., 2025), and the digital-technology review documents measurable waste-traceability and recovery gains where tools are actually deployed (Iyiola et al., 2024). Read together, the two halves define the implementation gap precisely: practices proven to improve performance are exactly the practices the strategy assessments find under-implemented. *Table 10* assembles the outcome evidence.

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Table 10: Theme 7: Evidence Linking SCM Implementation to Waste Management and Performance Outcomes

Outcome Relationship	Indicative Statistic	Supporting Studies
Current strategy portfolio judged inadequate	All three EFA strategy clusters assessed as not sustainable enough (n = 168, 84% response)	Aboginije et al. (2021)
Recycling the least adopted 3R component	Across 243 firms and 65 interviewed professionals on 10 Lagos projects	Ogunmakinde et al. (2022, 2019)
Dump-and-landfill default persists	Dominant disposal routes from the earliest Lagos site evidence	Dania et al. (2007)
Reduction, reuse, recycling improve firm performance	Significant positive regression effects (n = 185, Yamane sampling)	Babalola & Odunlami (2025)
Industry-policy adherence improves cost performance	β = 0.526, T = 4.984 in PLS-SEM; materials, equipment, and manpower paths also significant	Adepoju et al. (2023)
Project-management discipline drives 3R performance	Scheduling and monitoring jointly explain R^2 = 0.486	Oshin et al. (2025)
Digital deployment yields traceability and recovery gains	Documented across the systematic review evidence base	Iyiola et al. (2024)

DISCUSSION

Summary of Findings

This review provides a comprehensive synthesis of two decades of peer-reviewed research on the factors affecting SCM implementation for project waste management in Lagos State, and it yields three central insights. First, in answer to RQ1, the factors resolve into six themes, but they are not of equal standing: regulatory-institutional and economic-financial factors are the most densely evidenced and the only themes validated with confirmatory model fit, while knowledge, process, technological, and sociocultural factors operate largely through them. Weak enforcement, ineffective codes, and bureaucratic delay (Alabi, 2025; Nwokoro & Onukwube, 2011) and the 4.2-of-5 initial-cost perception against a 2.8-of-5 funding reality (Alabi, 2025) jointly explain why awareness campaigns and technology pilots have not, on their own, moved practice.

Second, in answer to RQ2, the mitigation evidence is unambiguous about where leverage lies. Education and training is the single most dominant and effective strategy in the only structural model to test strategy-barrier impacts directly (Akindele et al., 2023), with regulation and incentives forming the supporting pair (Bello et al., 2025; Ohiomah & Aigbavboa, 2020). The relative weight of factors also has a clear within-project hierarchy: among proximate causes, reworks (RCI = 0.801), uneconomical cutting (RCI = 0.791), and design changes (RCI = 0.773) dominate (Adewuyi & Odesola, 2015), meaning that perhaps the cheapest waste interventions available in Lagos are contractual and design-stage rather than site-stage.

Third, in answer to RQ3, the outcome studies convert the implementation question from an environmental obligation into a business case: reduction, reuse, and recycling significantly improve firm performance (Babalola & Odunlami, 2025), industry-policy adherence carries a β = 0.526 path to cost performance (Adepoju et al., 2023), and nearly half the variance in 3R performance is explained by ordinary scheduling and monitoring discipline (Oshin et al., 2025). The field's own verdict that current strategies are not sustainable enough (Aboginije et al., 2021) therefore describes forgone profit as much as environmental failure.

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Theoretical Contribution

The synthesis carries the literature beyond barrier cataloguing toward an explanatory account, and two theoretical lenses organise it. Through the technology-organisation-environment framework (Baker, 2012), the six themes map cleanly onto the three contexts: technological factors onto the technology context; knowledge, process, and sociocultural factors onto the organisation context; and regulatory and economic factors onto the environment context. The corpus then supplies an ordering the framework itself does not: in Lagos, the environment context dominates, because the two environmental themes are the only ones validated at confirmatory fit and because the Kruskal-Wallis finding of uniform barrier perception across professions (Arijeloye et al., 2025) is exactly the signature one expects when constraints are environmental rather than organisational. Where the constraint binds at the field level, individual roles stop disagreeing about it.

In line with DiMaggio & Powell (1983), institutional theory sharpens the mechanism. Coercive pressure, the channel that operates through regulation and resource dependence, is the deficient channel: laws exist but enforcement is inconsistent (Alabi, 2025; Nwokoro & Onukwube, 2011), so the isomorphic pull toward sustainable waste practice is weak. Normative pressure, operating through professional education and standards, is precisely the channel the strategy modelling identifies as most effective (Akindele et al., 2023), which explains why education and training outperforms exhortation: it builds the professional norm that weak coercion has failed to impose. Mimetic pressure, imitation under uncertainty, is visible in the price-following circularity of timber reuse and scrap sale (Ogunmakinde et al., 2019): firms copy what visibly pays. The theoretical claim this review advances is therefore that SCM implementation for waste management in Lagos is institutionally rationed, and that the binding institution is enforcement-plus-finance rather than information alone, with professional norm-building the highest-yield substitute while coercive capacity matures.

Figure 3 integrates these findings into a conceptual framework, the signature contribution of the review. The five factor clusters (regulatory-institutional, economic-financial, knowledge-capacity, project-process, and a combined technological-sociocultural cluster) feed the implementation of SCM, operationalised as waste management plans, 3R strategies, sustainable procurement, and design-stage waste control. Implementation drives two outcome families, waste-management outcomes proper (lower generation, higher landfill diversion, reduced disposal cost) and project-performance outcomes (cost, time, quality, competitiveness), with the waste outcomes partially feeding the performance outcomes. The moderating band records what the Lagos context adds: enforcement intensity, urbanisation pressure, and the informal salvage markets whose price signals already produce circular behaviour. The framework is testable: each arrow corresponds to a path for which the corpus supplies at least one estimate, and Section 4.4 specifies the designs needed to test the rest.

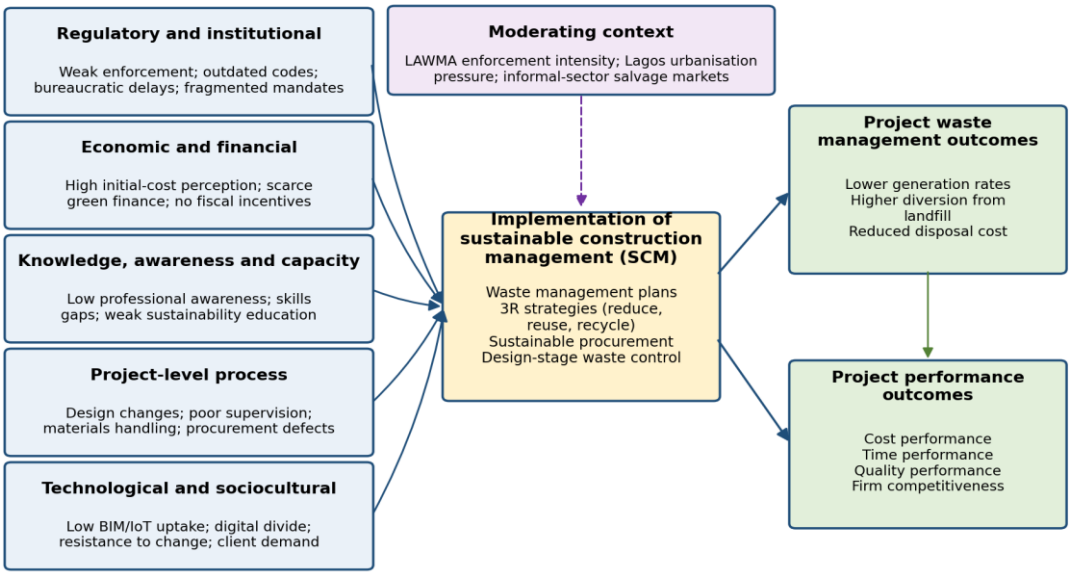

Figure 3: Integrated Conceptual Framework of Factors Affecting SCM Implementation on Project Waste Management in Lagos State

Practical and Policy Implications

For policymakers, the evidence points first at enforcement capacity, and the administrative record shows both the will and the gap. The Lagos Waste Management Authority served 343 contravention notices on construction sites in a single year, issued 354 introduction notices to construction firms, and carried out enforcement on 10 recalcitrant sites (Lagos Waste Management Authority, 2024). Set against a metropolis with thousands of concurrent sites, 10 physical enforcement actions per year is a sanction probability low enough to confirm the inconsistent-enforcement finding (Alabi, 2025) rather than refute it.

Policymakers should weigh three instruments the synthesis supports directly: making an approved project waste management plan a condition of the development permit, which targets the average-degree WMP uptake (Dania et al., 2007); attaching fiscal incentives (tax relief, expedited approvals) to verified diversion rates, which addresses both the 4.2-of-5 cost perception and the bureaucratic-delay score of 3.4 (Alabi, 2025); and investing in recycling infrastructure and a formal secondary-materials market, which would extend to concrete and steel the price signal that already makes timber circular (Ogunmakinde et al., 2019). The current European Union co-funded GROW programme on construction, demolition, and disaster waste skills in Lagos (Guardian Nigeria, 2026) is well aimed in this respect, because it operates on exactly the education-and-training channel the structural evidence ranks first (Akindele et al., 2023).

For managers and professionals, the evidence suggests a sequenced programme. The first sequence is contractual and design-stage: freezing designs earlier, pricing variation-driven rework explicitly, and coordinating dimensions to standard material sizes attacks the three top-ranked causes, whose combined relative contributions (RCI = 0.773 to 0.801) exceed anything achievable by site housekeeping alone (Adewuyi & Odesola, 2015). The second is managerial: instituting waste-explicit scheduling and monitoring, given that these routines explain R^2 = 0.486 of 3R performance (Oshin et al., 2025), and adopting written waste management plans with named accountability.

The third is commercial: treating reduction, reuse, and recycling as profit measures, on the regression evidence that they significantly improve firm performance (Babalola & Odunlami, 2025) and the PLS-SEM evidence that policy adherence improves cost outcomes (β = 0.526; Adepoju et al., 2023). For professional bodies, the mandate is continuing professional development in waste-conscious design, measurement, and digital tools, the capacity gaps that recur across the corpus (Alabi, 2025; Arijeloye et al., 2025). For technology vendors and adopters, the five-category barrier structure counsels bundling: financing, training, and compliance assurance must ship with the tool, because the obstacles are systemic and uniform across professions (Arijeloye et al., 2025).

Limitations and Future Research

Four limitations bound these conclusions, and each defines a research direction. First, the included studies are dominated by cross-sectional perception surveys (15 of 20 studies, 75%), so every factor weight reported here is a weight in professional judgement, not in measured tonnage; the corresponding direction is longitudinal, site-instrumented research that tracks actual waste generation and diversion across project phases in Lagos, ideally linked to Lagos Waste Management Authority weighbridge and contravention records to create the objective baseline the field lacks.

Second, the review admitted national studies whose samples include Lagos, which protects coverage but dilutes the Lagos-specific signal; future primary studies should report Lagos sub-samples separately, and a state-level structural model separating Lagos effects from national effects is overdue. Third, the review itself has procedural limits: the protocol was not registered, screening was performed by a single reviewer with only a consistency re-check, and the English-language and peer-review restrictions may exclude francophone West African comparisons and competent agency analyses; a registered update with dual screening and a Cohen's kappa would harden the evidence base as the field grows. Fourth, the outcome evidence, although consistent, rests on three primary models (Adepoju et al., 2023; Babalola & Odunlami, 2025; Oshin et al., 2025) whose effect sizes have never been pooled; once two or three further outcome studies accumulate, a meta-analysis of the practice-performance relationship becomes feasible and should be the field's next synthesis. Intervention

research is the final gap: no included study tests an implementation programme experimentally or quasi-experimentally, so the framework in *Figure 3,* like every model in the corpus, remains correlational until a Lagos pilot, for example a permit-linked waste management plan mandate evaluated against matched control sites, supplies causal evidence.

CONCLUSION

Twenty years of peer-reviewed evidence on Lagos State converge on a finding that is uncomfortable precisely because it is clear. The factors that decide whether sustainable construction management reaches the waste stream are not primarily technical, however, they are an enforcement apparatus that sanctions too rarely to change behaviour, a financing environment that leaves a 4.2-of-5 cost perception unanswered, and a professional formation system that the strongest structural model in the field identifies as the highest-yield point of intervention. Beneath them sit process causes, led by reworks, uneconomical cutting, and design changes, that are contractually controllable, and above them sits an outcome literature showing that the under-implemented practices are the profitable ones. What the field now knows, that it did not know when these studies stood apart, is that the Lagos implementation gap is an institutionally rationed gap with a quantified business case for closing it, and that the order of attack, norms first through education, then enforcement and incentives, then design-stage process control, then digital tooling, can be read directly from the weights the evidence assigns. The framework offered here turns that reading into testable form; the measurement, registration, and intervention work specified above is how the next review will improve on this one.

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APPENDIX

Appendix A: Full Search Strings

All searches were run on 30 April 2026. Strings were applied to title, abstract, and keyword fields where the interface allowed.

Table A1: Boolean Search Strings By Database

Database (interface)	Search string	Records
Scopus (Elsevier web interface)	TITLE-ABS-KEY((“sustainable construction” OR “green construction” OR “construction management” OR “circular economy”) AND (“waste management” OR “construction waste” OR “material waste” OR “demolition waste”) AND (Lagos OR Nigeria*)) AND PUBYEAR > 2004	318
Web of Science (Core Collection)	TS=((“sustainable construction” OR “green construction” OR “construction management” OR “circular economy”) AND (“waste management” OR “construction waste” OR “material waste” OR “demolition waste”) AND (Lagos OR Nigeria*)); Timespan 2005–2026	224
Google Scholar / AJOL (web interfaces)	(“sustainable construction” OR “construction management”) (“construction waste” OR “waste management”) (Lagos OR Nigeria); first 200 relevance-ranked Scholar results screened plus AJOL built-environment journals browsed by hand	412

Note: Citation chasing of included studies added 36 further records.

Appendix B: Characteristics of the Included Studies

Table B1: Author, Year, Design, Setting, Sample, and Key Findings of the 20 Included Studies

Author (year)	Design	Setting	Sample	Key Findings
Aboginije et al. (2021)	Quantitative cross-sectional survey; EFA, Cronbach's alpha	Lagos metropolis	168 valid of 200 (84%); architects, QSs, engineers, builders, PMs	Waste strategies cluster into legal framework with modular construction, sustainable procurement and material optimisation, and proper detailing and design; portfolio judged not sustainable enough; concrete, steel, timber at 15–20% generation rates
Adepoju et al. (2023)	Quantitative survey; PLS-SEM	Lagos State	Construction professionals on building projects	Innovative practices (industry policy, materials and equipment, manpower) significantly affect cost, quality, time; industry policy strongest, $\beta = 0.526$, $T = 4.984$ to cost
Adewuyi & Odesola (2015)	Quantitative survey; RCI, Mann-Whitney, Kruskal-Wallis	Nigeria (incl. Lagos professionals)	Two stakeholder groups of professionals	Top waste causes: reworks from non-conformance (RCI = .801), uneconomical cutting (.791), design changes (.773)
Akindele et al. (2023)	Quantitative survey; factor analysis + PLS-SEM	Nigeria	100 construction actors	Barriers cluster as technopolitic, perception-awareness, sociocultural; education and training the most dominant and effective of four validated strategies
Akinshipe et al. (2019)	Quantitative survey	Nigeria	Construction organisations and professionals	Most organisations lack sustainability strategies because awareness of sustainability issues is low
Alabi (2025)	Mixed methods; cases, interviews, survey; CFA	Nigeria	Industry stakeholders (survey plus qualitative cases)	Regulatory barriers most critical (CFI = .92, RMSEA = .04): weak frameworks $M = 2.9$, codes $M = 2.7$, delays $M = 3.4$, enforcement $M = 2.8$; financial construct CFI = .91: initial cost $M = 4.2$, funding $M = 2.8$
Arijeloye et al. (2025)	Quantitative survey; EFA, Kruskal-Wallis	Lagos and Abuja	342 construction professionals	Five digital-technology barrier categories: financial, technical, legal, institutional, behavioural; no professional-group differences (systemic barriers)
Babalola & Odunlami (2025)	Quantitative survey; regression	Lagos State	185 (Yamane); purposive and random sampling	Waste reduction, reuse, and recycling each have significant positive effects on firm performance

Bello et al. (2024)	Quantitative survey	Nigeria (developing-country setting)	Built-environment professionals	Circular-economy implementation impeded by financial, regulatory, knowledge, and resistance-to-change barriers
Bello et al. (2025)	Quantitative survey; Kruskal-Wallis, SEM	Four Nigerian regions (incl. Lagos)	AECO professionals across four geopolitical zones	Five significant CE drivers: regulatory-institutional, supply chain collaboration, technological advancement, organisational support, business strategies
Dania et al. (2007)	Quantitative survey; descriptive and inferential	Lagos State	Construction professionals in Lagos firms	WMPs applied to an average degree; dumping and landfilling dominate disposal; supervisor education and sanctions recommended
Iyiola et al. (2024)	Systematic review; bibliometric, text-mining, content analysis	Global, developing-country emphasis	Peer-reviewed C&DWM digital-technology literature	Digital technologies credible remedies for C&D waste inefficiency; adoption lags in developing settings; traceability and recovery gains where deployed
Nwokoro & Onukwube (2011)	Mixed methods; survey (MIS) with focus groups	Lagos (Lekki, Yaba, Bariga)	85 registered professionals per group; FGDs	Top SC factors: enforcement of law (MIS = .872), working conditions (.852), encouraging construction waste management (.819)
Ogunmakinde et al. (2019)	Mixed methods; questionnaire and interviews	Lagos	243 firms (Cochran sample from 2,684-firm register); 65 professionals on 10 projects	Poor adoption of formal disposal methods; reuse and scrap sale most adopted owing to timber and scrap value
Ogunmakinde et al. (2022)	Mixed methods; questionnaire and semi-structured interviews	Lagos	243 firms; 65 professionals, 10 projects	Reduce and reuse most adopted 3R components, recycling least; CE applied in principle only; positive minimisation attitudes where aware
Ohiomah & Aigbavboa (2020)	Quantitative survey	Nigeria	Professionals, contractors, clients	Building regulations and financial incentives main drivers; lack of client demand and awareness, and cost perception, the main impediments
Okoye et al. (2022)	Quantitative survey	Nigeria	256 building professionals	47 risk factors of SC implementation identified across regulatory, financial, technological, and social domains
Omopariola et al. (2024)	Quantitative survey; mean score, t-test, Kruskal-Wallis	Nigeria; 43 of 50 sites	43 sites with professional respondents	Five prevailing unsustainable practices, including material waste; initial cost perceived as excessive

Oshin et al. (2025)	Quantitative survey; regression	Lagos State	Staff of selected solid waste management companies	Scheduling and monitoring jointly explain 48.6% of variance in 3R performance (R^2 = .486)
Osuizugbo et al. (2020)	Quantitative survey	Nigeria (incl. Lagos)	Built-environment professionals	Lack of awareness, education, and demand among leading barriers to SC adoption

Note: Compiled from the 20 included studies. EFA = exploratory factor analysis; CFA = confirmatory factor analysis; MIS = mean item score; RCI = relative contribution index; PM = project manager; QS = quantity surveyor; FGD = focus group discussion; SC = sustainable construction; CE = circular economy; C&DWM = construction and demolition waste management; WMP = waste management plan.

Appendix C: Full-Text Records Excluded at Eligibility, by Reason

Table C1: Categories of Full-Text Exclusion (n = 58)

Exclusion reason	**n**	**Typical examples**
No Lagos or Nigeria focus	21	Ghanaian, South African, Gulf, and East Asian barrier and waste studies retrieved by regional terms; multi-country reviews without a Nigerian sample
Waste content not construction-specific	14	Municipal solid waste, plastic, hospital, and e-waste studies set in Lagos with no construction or demolition stream
No empirical link between SCM and waste management	11	Green-building awareness and certification studies with no waste variable; purely conceptual sustainability essays
Not peer reviewed	8	Postgraduate theses, agency and consultancy reports, newspaper analyses
Full text unavailable	4	Conference papers indexed by abstract only after repository and inter-library requests

Appendix D: Quality Appraisal of the Included Studies

Quantitative and mixed-methods studies were appraised against the eight-item JBI checklist for analytical cross-sectional studies (Moola et al., 2020): (1) inclusion criteria clearly defined; (2) subjects and setting described in detail; (3) exposure measured validly and reliably; (4) objective, standard criteria used for measurement; (5) confounding factors identified; (6) strategies to deal with confounding stated; (7) outcomes measured validly and reliably; (8) appropriate statistical analysis used. Y = yes, N = no, U = unclear. The systematic review (Iyiola et al., 2024) was instead checked for a reported search, explicit criteria, and a documented synthesis, and satisfied all three.

Table D1: JBI Item-Level Appraisal of the 19 Primary Studies

Study	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Score /8**
Aboginije et al. (2021)	Y	Y	Y	Y	N	N	Y	Y	6
Adepoju et al. (2023)	Y	Y	Y	Y	Y	N	Y	Y	7

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Adewuyi & Odesola (2015)	Y	Y	Y	Y	N	N	Y	Y	6
Akindele et al. (2023)	Y	Y	Y	Y	Y	N	Y	Y	7
Akinshipe et al. (2019)	Y	U	Y	U	N	N	Y	Y	4
Alabi (2025)	Y	Y	Y	Y	Y	Y	Y	Y	8
Arijeloye et al. (2025)	Y	Y	Y	Y	Y	N	Y	Y	7
Babalola & Odunlami (2025)	Y	Y	Y	Y	N	N	Y	Y	6
Bello et al. (2024)	Y	Y	Y	Y	N	N	Y	Y	6
Bello et al. (2025)	Y	Y	Y	Y	Y	N	Y	Y	7
Dania et al. (2007)	Y	Y	U	U	N	N	Y	Y	4
Nwokoro & Onukwube (2011)	Y	Y	Y	Y	N	N	Y	Y	6
Ogunmakinde et al. (2019)	Y	Y	Y	Y	Y	Y	Y	Y	8
Ogunmakinde et al. (2022)	Y	Y	Y	Y	Y	Y	Y	Y	8
Ohiomah & Aigbavboa (2020)	Y	U	Y	Y	N	N	Y	Y	5
Okoye et al. (2022)	Y	Y	Y	Y	N	N	Y	Y	6
Omopariola et al. (2024)	Y	Y	Y	Y	N	N	Y	Y	6
Oshin et al. (2025)	Y	Y	Y	Y	N	N	Y	Y	6
Osuizugbo et al. (2020)	Y	U	Y	Y	N	N	Y	Y	5

Note: Appraisal performed using Moola et al. (2020). Fourteen of twenty included studies (70%), counting the systematic review as satisfying its design-appropriate check, met at least six quality items; common shortfalls were unaddressed confounding and non-probability sampling.