Technologique | 2026, Vol. 9, No.1, 13 – 26 | ISSN Online: 3028-1415 | ISSN Print: 3028-1407
DOI: https://doi.org/10.62718/vmca.tech-gjtdsi.9.1.SC-0726-016

OPEN ACCESS

Determinants of Sustainable Construction Waste Management Adoption in Iba, Zambales

Article History:

Initial submission:	30 July 2026
First decision:	08 August 2026
Revision received:	02 September 2026
Accepted for publication:	08 September 2026
Online release:	17 September 2026

Engr. Eloisa Belle C. Romulo, ORCID No. 0009-0001-6836-3743
Master of Science in Construction Management Polytechnic University of the Philippines, Sta. Mesa, Manila, Philippines

Abstract

This study examined the determinants influencing the adoption of Sustainable Construction Waste Management (SCWM) practices among construction professionals in the Municipality of Iba, Zambales. Specifically, the study investigated the influence of awareness and knowledge, perceived barriers, policy and regulatory support, community participation, and economic incentives and feasibility on SCWM adoption. A quantitative descriptive-correlational research design was employed involving 70 purposively selected construction professionals directly engaged in the planning, supervision, management, and implementation of ongoing construction projects. Data were gathered using a validated and reliable structured questionnaire and analyzed using frequency and percentage distributions, weighted mean, Pearson product-moment correlation, multiple linear regression, and analysis of variance (ANOVA). Findings revealed that respondents generally exhibited favorable perceptions toward the determinants of SCWM adoption, with awareness and knowledge obtaining the highest rating. Correlation analysis indicated that awareness and knowledge, policy and regulatory support, community participation, and economic incentives and feasibility were significantly associated with SCWM adoption. Regression analysis further identified awareness and knowledge, policy and regulatory support, and economic incentives and feasibility as significant predictors of SCWM adoption. The study concludes that strengthening environmental awareness, institutional support, and economic mechanisms can substantially enhance sustainable construction waste management practices. These findings served as the basis for developing a Sustainable Construction Waste Management Recommendatory Plan to support environmental sustainability within the local construction industry.

Keywords: sustainable construction waste management, construction professionals, policy support, environmental sustainability, waste management, Iba, Zambales

INTRODUCTION

The construction industry supports economic growth, infrastructure development, urbanization, and employment, but it also creates substantial environmental pressures through intensive material consumption, waste generation, and greenhouse gas emissions. The United Nations Environment Programme (UNEP, 2026) reported that buildings and construction account for approximately 37% of global carbon dioxide emissions and nearly 50% of global material extraction. Construction and demolition activities generate concrete, wood, metals, plastics, soil, packaging, and other residual materials that can increase landfill pressure, pollution, resource depletion, and demand for virgin materials when not properly recovered, reused, or recycled. These impacts reinforce the importance of Sustainable Construction Waste Management (SCWM) as part of environmentally responsible construction.

SCWM promotes waste prevention and reduction, segregation, reuse, recycling, recovery, and environmentally responsible disposal throughout the project life cycle. These practices reflect the Waste Management Hierarchy, which prioritizes prevention and reduction before reuse, recycling, recovery, and final disposal, and the Circular Economy, which seeks to retain materials and resources in productive use for as long as practicable.

Circular construction can reduce construction and demolition waste, improve resource efficiency, reduce reliance on virgin materials, and extend material life (de Oliveira et al., 2024). Its implementation also depends on supportive policies, institutions, incentives, and stakeholder participation.

SCWM is also relevant to the United Nations Sustainable Development Goals (SDGs), particularly SDG 9 on sustainable industry and infrastructure, SDG 11 on sustainable cities, SDG 12 on responsible consumption and production, and SDG 13 on climate action. In particular, SDG Target 12.5 calls for substantial waste reduction through prevention, reduction, recycling, and reuse. Thus, improved construction waste management supports both project-level environmental performance and broader sustainability objectives (United Nations, 2015).

In the Philippines, the need for improved waste management coincides with sustained construction activity. Philippine Statistics Authority data indicate that estimated national waste generation reached approximately 61.70 thousand tons per day in 2024, while approved building permits recorded 180,341 constructions with about 42.84 million square meters of total floor area. Although these figures do not measure construction waste specifically, they underscore the need to integrate resource efficiency and effective waste management into the construction sector (PSA, 2025a, 2025b).

Republic Act No. 9003, or the "Ecological Solid Waste Management Act of 2000," provides the country's principal solid-waste policy framework by promoting waste avoidance, minimization, segregation, reuse, recycling, resource recovery, and environmentally sound disposal. The Philippine Green Building Code likewise promotes resource efficiency and environmentally responsible building practices. However, national policies do not automatically ensure project-level adoption; their effectiveness depends on local implementation, professional awareness, organizational capability, economic feasibility, and stakeholder participation.

Iba, Zambales, as the provincial capital with continuing residential, commercial, institutional, and infrastructure development, provides a relevant setting for examining these conditions. The municipality has implemented ecological solid-waste management through barangay monitoring under Republic Act No. 9003, including attention to solid-waste committees, material recovery facilities, segregation and composting facilities, plans, ordinances, and documentation. These initiatives establish a local institutional foundation, but publicly documented efforts largely address general solid waste management. The application of sustainability principles specifically to construction-generated waste and the adoption behavior of construction professionals therefore remain insufficiently understood.

Previous studies identify environmental awareness, regulatory support, economic considerations, technical capability, organizational commitment, stakeholder participation, and institutional arrangements as factors affecting construction waste management (Ajayi et al., 2015; Bamgbade et al., 2019; Lu & Yuan, 2011; Yuan, 2013). Recent work further emphasizes circular-economy strategies, resource recovery, government intervention, and incentives (de Oliveira et al., 2024). However, much of this evidence comes from national, international, or highly urbanized settings. Limited empirical evidence examines how these determinants operate collectively at the municipal level in the Philippines, particularly in Iba, where national environmental policies are ultimately translated into project-level decisions and practices.

The study is primarily anchored on Ajzen's (1991) Theory of Planned Behavior (TPB), which explains behavior through attitudes, subjective norms, and perceived behavioral control. In SCWM, awareness and knowledge can support favorable attitudes; policy and regulatory support and community participation can reinforce institutional and social expectations; and perceived barriers and economic feasibility

can affect professionals' perceived capacity to act. The Circular Economy and Waste Management Hierarchy complement TPB by providing the broader sustainability context of preventing waste, retaining material value, encouraging reuse and recycling, and minimizing disposal.

Accordingly, this study examined awareness and knowledge, perceived barriers, policy and regulatory support, community participation, and economic incentives and feasibility among construction professionals involved in ongoing projects in Iba, Zambales, and determined their relationship with and predictive influence on SCWM adoption. The findings provide localized evidence on the behavioral, institutional, and economic conditions associated with SCWM and served as the basis for a practical Recommendatory Plan for the municipality.

METHODS

This study used a quantitative descriptive-correlational design to assess respondents' perceptions of awareness and knowledge, perceived barriers, policy and regulatory support, community participation, economic incentives and feasibility, and SCWM adoption; examine relationships among these variables; and identify significant predictors of adoption.

The respondents were 70 purposively selected construction professionals directly involved in planning, supervision, management, and implementation of ongoing projects in Iba, Zambales, including civil engineers, architects, project managers, construction managers, site supervisors, and foremen. Purposive sampling was used because no comprehensive sampling frame of professionals engaged in ongoing projects was available. Eligible participants were involved in projects implemented continuously for at least six months and with the necessary LGU building permits.

Data were collected through a researcher-developed structured questionnaire based on related literature and previously validated instruments. It covered respondent demographics and the study variables. The instrument underwent expert validation, and Cronbach's alpha indicated satisfactory internal consistency before administration. The first section documented demographic characteristics, while the second measured the five proposed determinants and reported SCWM adoption. Expert review was used to assess the relevance and clarity of the items before field administration, helping ensure that the instrument reflected the concepts examined in the study.

Permission was obtained from concerned government offices and construction firms. Respondents participated voluntarily after informed consent and were assured of confidentiality, voluntary participation, and academic use of the data.

Frequency and percentage described respondent characteristics, while weighted mean summarized the study variables. Pearson product-moment correlation tested relationships with SCWM adoption, multiple linear regression identified significant predictors, and ANOVA tested overall model significance. Analyses used a .05 significance level.

RESULTS

Profile of the Respondents. Table 1 summarizes the profile of the 70 construction professionals. Most were 21-30 years old (61.43%), male (67.14%), and bachelor's-degree holders (94.29%). The largest experience category was one to three years (34.29%), while the remaining 65.71% represented other experience levels. Infrastructure projects predominated (80.00%).

Table 1
Profile of the Respondents

Variable	Category	Frequency	Percentage
Age	21-30 years old	43	61.43%
Sex	Male	47	67.14%
Educational Attainment	Bachelor's Degree	66	94.29%
Years of Experience	1-3 years	24	34.29%
Project Type	Infrastructure	56	80.00%

The profile indicates that the sample was largely composed of relatively young, degree-holding professionals actively involved in construction practice. Their educational background may provide exposure to environmental management, regulatory compliance, and sustainable construction concepts, while the range of professional experience brings perspectives informed by both recent education and practical project implementation. These descriptive characteristics provide context only; the study did not test age, sex, or educational attainment as determinants of SCWM adoption.

The strong representation of infrastructure projects is relevant because such works can involve substantial material use and waste streams from excavation, concrete, formwork, reinforcement, packaging, and material handling. Consequently, respondents were positioned to observe practical issues in waste generation, segregation, resource recovery, and disposal. Because infrastructure projects dominated the sample, generalization to sectors with substantially different waste characteristics should be cautious.

Determinants of Sustainable Construction Waste Management Adoption. Table 2 shows that awareness and knowledge received the highest composite mean (M = 4.13, Agree), followed by perceived barriers (M = 3.98, Agree) and SCWM adoption (M = 3.65, Agree). Policy and regulatory support (M = 3.46) and economic incentives and feasibility (M = 3.41) were also rated Agree, while community participation received the lowest mean (M = 3.24, Neutral).

Table 2
Composite Means

Variable	Mean	Interpretation
Awareness and Knowledge	4.13	Agree
Perceived Barriers	3.98	Agree
Adoption of SCWM Practices	3.65	Agree
Policy and Regulatory Support	3.46	Agree
Economic Incentives and Feasibility	3.41	Agree
Community Participation	3.24	Neutral

The ordering of the means is analytically important because it shows a gap between individual readiness and the surrounding implementation environment. Respondents appear comparatively confident in what SCWM requires, yet they reported weaker conditions in community participation, economic feasibility, and regulatory support. This pattern is consistent with the view that sustainable behavior depends on more than knowledge and must be supported by institutional, financial, and social conditions.

The high awareness and knowledge score indicates that respondents generally understand SCWM principles, providing a foundation for sustainable practice. However, adoption was lower than awareness, suggesting that knowledge does not automatically translate into implementation. Respondents also strongly recognized barriers; because this variable is negatively framed, its high mean indicates the presence of perceived constraints rather than a favorable implementation condition. Previous construction-waste studies similarly emphasize that awareness is an essential starting point but does not guarantee consistent practice when organizations face resource, infrastructure, market, or enforcement limitations (Ajayi et al., 2015; Bamgbade et al., 2019; Yuan, 2013). The descriptive results therefore justify examining whether the measured enabling and constraining conditions are actually associated with adoption rather than assuming that the highest-rated factor is automatically the strongest predictor.

The moderate ratings for policy and regulatory support and economic incentives and feasibility indicate that respondents perceived some institutional and economic support, but with room for improvement. The neutral community-participation rating suggests comparatively limited or uncertain engagement of external stakeholders. Overall, the descriptive results show strong awareness alongside recognized barriers and less-developed institutional, economic, and collaborative conditions. The subsequent analyses determine which factors

are statistically related to and predictive of adoption.

Relationship Between the Determinants and SCWM Adoption. Table 3 shows significant positive relationships between SCWM adoption and awareness and knowledge ($r = .554$, $p < .001$), policy and regulatory support ($r = .722$, $p < .001$), community participation ($r = .488$, $p < .001$), and economic incentives and feasibility ($r = .625$, $p < .001$). Perceived barriers were not significantly related to adoption ($r = .118$, $p = .331$). These associations do not establish causation.

Table 3
Pearson Product-Moment Correlation Analysis

Variable	r-value	p-value	Decision
Awareness and Knowledge	0.554	0.000	Significant
Perceived Barriers	0.118	0.331	Not Significant
Policy and Regulatory Support	0.722	0.000	Significant
Community Participation	0.488	0.000	Significant
Economic Incentives and Feasibility	0.625	0.000	Significant

Policy and regulatory support had the strongest correlation, indicating that respondents who perceived stronger regulatory requirements, government support, monitoring, and institutional commitment also tended to report greater SCWM adoption. Economic incentives and feasibility showed the second-strongest relationship, suggesting that adoption tends to be higher when sustainable practices are perceived as financially attainable or economically beneficial.

Awareness and knowledge were moderately and positively related to adoption, supporting the importance of understanding waste prevention, segregation, reuse, recycling, and recovery. Community participation was also positively related to adoption despite its neutral descriptive mean, indicating that stronger stakeholder involvement tended to accompany greater adoption even though respondents did not perceive participation as consistently strong.

Perceived barriers were not significantly associated with adoption despite their relatively high descriptive mean. Thus, recognizing more constraints did not necessarily correspond to lower adoption among respondents. Overall, the correlation results point more strongly to enabling institutional, economic, behavioral, and collaborative conditions than to the mere presence of perceived obstacles.

Predictors of SCWM Adoption. Table 4 shows that the overall regression model was significant ($R = .798$, $R^2 = .637$, adjusted $R^2 = .608$, $F = 22.42$, $p < .001$). The five determinants collectively explained 63.7% of the variance in SCWM adoption, with 60.8% remaining after adjustment for the number of predictors. The unexplained 36.3% may reflect other organizational, technological, project-specific, market, or facility-related conditions not tested in this study. The significant F-test indicates that the predictors, considered as a set, explain adoption better than a model without these explanatory variables. At the same time, the model should be interpreted as predictive rather than causal because the cross-sectional descriptive-correlational design does not establish temporal or experimental causation.

Table 4
Multiple Regression Analysis

Predictor Variable	Beta Coefficient	t-value	p-value	Decision
Awareness and Knowledge	0.338	2.950	0.004	Significant
Perceived Barriers	- 0.124	- 0.892	0.376	Not Significant
Policy and Regulatory Support	0.389	3.603	0.001	Significant
Community Participation	0.041	0.355	0.724	Not Significant
Economic Incentives and Feasibility	0.397	2.754	0.008	Significant

Model Summary: $R = .798$; $R^2 = .637$; Adjusted $R^2 = .608$; $F = 22.42$; $p < .001$.

Economic incentives and feasibility had the largest standardized coefficient ($\beta = .397$, $p = .008$), indicating that higher perceived economic feasibility was associated with greater SCWM adoption when the other variables were controlled. This result emphasizes the practical importance of making waste reduction, material recovery, reuse, and recycling financially

attainable through cost savings, accessible recovery systems, or appropriate incentives.

Policy and regulatory support were also significant (β = .389, p = .001). Stronger perceptions of policy implementation, monitoring, institutional commitment, and support were associated with greater adoption after controlling for the other determinants. This finding highlights the importance of clearly communicated requirements and institutional mechanisms that make sustainable waste management an expected and practicable component of construction work.

Awareness and knowledge likewise significantly predicted adoption (β = .338, p = .004), showing that environmental understanding remains important even when institutional, economic, social, and perceived implementation conditions are considered simultaneously. Continuous education, information dissemination, and professional capacity building therefore remain relevant to SCWM implementation.

Perceived barriers did not significantly predict adoption (β = -.124, p = .376), consistent with the correlation analysis. Community participation also became nonsignificant in the regression model (β = .041, p = .724) despite its significant bivariate correlation. This suggests that community participation is associated with adoption but contributes limited unique explanatory power once the other determinants are controlled; its effects may overlap with broader awareness or institutional conditions.

The regression analysis therefore distinguishes factors associated with adoption from those making a significant independent contribution. Only awareness and knowledge, policy and regulatory support, and economic incentives and feasibility remained significant predictors. Accordingly, the Recommendatory Plan prioritizes these three evidence-based areas, while community participation and perceived barriers are treated as supporting concerns rather than primary intervention domains. This distinction is important for recommendation development. A variable may show a meaningful bivariate relationship yet offer little additional predictive information after overlapping with other variables is considered. Prioritizing the significant regression predictors therefore provides a more defensible empirical basis for the proposed interventions while still recognizing community participation and barriers as contextual concerns.

DISCUSSION

The findings demonstrate that the adoption of Sustainable Construction Waste Management (SCWM) among construction professionals in the Municipality of Iba, Zambales is shaped by interconnected behavioral, institutional, and economic conditions. Although respondents generally demonstrated awareness of sustainable waste-management principles and reported some level of SCWM adoption, the results indicate that knowledge alone does not fully account for implementation. The correlation and regression analyses particularly emphasize the importance of awareness and knowledge, policy and regulatory support, and economic incentives and feasibility. Taken together, these findings suggest that sustainable waste-management practices are more likely to be adopted when construction professionals understand their environmental importance, operate within a supportive institutional environment, and perceive implementation as economically attainable.

Awareness and Knowledge as a Behavioral Foundation for SCWM. Awareness and knowledge obtained the highest descriptive assessment (M = 4.13, Agree), demonstrated a significant positive relationship with SCWM adoption (r = .554, p < .001), and remained a significant predictor when the other determinants were controlled (β = .338, p = .004). These converging results indicate that environmental understanding represents an important behavioral foundation for sustainable construction waste management. Construction professionals who understand the environmental consequences of construction

waste and recognize appropriate practices involving prevention, segregation, reduction, reuse, recycling, and recovery are better positioned to incorporate these principles into project implementation.

This finding supports the Theory of Planned Behavior (TPB) (Ajzen, 1991), which serves as the primary theoretical framework of the study. Within TPB, knowledge can contribute to the formation of favorable attitudes by improving an individual's understanding of the consequences and benefits associated with a particular behavior. In the context of SCWM, construction professionals who understand the environmental, operational, and resource-efficiency benefits of proper waste management may develop more favorable attitudes toward sustainable practices and consequently become more willing to implement them. The result is consistent with Ajayi et al. (2015) and Yuan (2013), who emphasized the importance of environmental awareness and appropriate knowledge in improving construction waste-management practices.

However, the difference between the relatively high awareness and knowledge mean (M = 4.13) and the lower adoption mean (M = 3.65) also indicates that knowledge does not automatically translate into equivalent levels of implementation. Sustainable behavior occurs within organizational, regulatory, economic, and project-specific environments that can either enable or constrain action. Thus, while education and awareness remain important, capacity-building interventions should be complemented by institutional mechanisms and practical resources that allow professionals to apply what they know.

Policy and Regulatory Support as an Institutional Driver. Policy and regulatory support emerged as a particularly important institutional determinant of SCWM adoption. It demonstrated the strongest bivariate relationship with adoption ($r = .722$, $p < .001$) and remained a significant independent predictor in the regression model ($\beta = .389$, $p = .001$). This indicates that construction professionals who perceived stronger regulatory requirements, institutional support, monitoring, and government commitment also tended to report higher levels of sustainable waste-management adoption.

The finding reinforces the importance of environmental governance in converting sustainability principles into routine construction practices. National frameworks such as Republic Act No. 9003, or the Ecological Solid Waste Management Act of 2000, and the Philippine Green Building Code provide a policy foundation for responsible waste management and resource efficiency. However, policies can influence actual construction behavior only when their requirements are effectively communicated, implemented, monitored, and supported at the local and project levels. The finding is consistent with Chileshe et al. (2016), who identified regulatory commitment and institutional support as important conditions for environmentally responsible construction practices.

The result can also be interpreted through TPB. Regulations, institutional requirements, professional standards, and government expectations can strengthen subjective norms by communicating that sustainable waste management is expected and valued. At the same time, clear procedures, institutional assistance, monitoring systems, and accessible waste-management mechanisms may strengthen perceived behavioral control by enabling professionals to comply with sustainability requirements. The strong relationship between policy support and SCWM adoption therefore suggests that individual willingness becomes more consequential when reinforced by institutional structures that make sustainable behavior expected and practicable.

Economic Incentives and Feasibility as an Enabling Condition. Economic incentives and feasibility also emerged as a central determinant of SCWM adoption. The variable demonstrated a significant positive relationship with adoption ($r = .625$, $p < .001$) and recorded the

largest standardized regression coefficient (β = .397, p = .008) among the predictors included in the model. The result indicates that sustainable waste-management practices are more likely to be adopted when construction professionals perceive them as financially achievable and when economic mechanisms support implementation.

This finding reflects the practical realities of construction project management, where decisions are frequently influenced by budget limitations, material costs, labor requirements, transportation expenses, disposal fees, recycling opportunities, and anticipated returns. Sustainable waste-management practices may require initial investments in segregation areas, storage facilities, training, collection systems, recycling arrangements, or monitoring. At the same time, these practices can create economic value through reduced material wastage, recovery and reuse of construction materials, lower disposal requirements, and improved resource efficiency. The finding is consistent with Lu and Yuan (2011) and Yuan et al. (2011), who demonstrated the importance of economic considerations in construction and demolition waste management.

The significance of economic feasibility can further be interpreted using the Resource-Based View (RBV). Although TPB remains the primary theoretical framework of the study, RBV provides a complementary organizational perspective by emphasizing the importance of resources and capabilities in implementing organizational strategies. From this perspective, environmental knowledge may represent an important professional capability, but organizations also require financial resources, competent personnel, appropriate technologies, waste-management infrastructure, and institutional support to convert sustainability intentions into actual practices. Consequently, organizations possessing or having access to appropriate resources may be better positioned to implement SCWM consistently.

The RBV perspective helps explain why economic incentives and feasibility remained significant even after the other determinants were statistically controlled. Construction professionals may possess favorable attitudes toward sustainable waste management, but implementation can remain difficult when organizations lack the resources necessary to operationalize those intentions. Financial incentives, accessible recycling markets, resource-recovery opportunities, partnerships with waste-management providers, and cost-saving mechanisms may therefore strengthen organizational capacity to adopt sustainable practices.

Perceived Barriers and the Role of Enabling Conditions. An important finding of the study concerns perceived barriers. Respondents generally agreed that barriers to SCWM existed (M = 3.98); however, perceived barriers were neither significantly correlated with adoption (r = .118, p = .331) nor a significant independent predictor in the regression analysis (β = −.124, p = .376). The result should not be interpreted as indicating that construction professionals experience no barriers. Rather, it demonstrates that variations in their perception of these constraints did not significantly correspond with variations in SCWM adoption within the sample.

Previous studies, including Bamgbade et al. (2019), have identified financial, technical, institutional, regulatory, organizational, and behavioral barriers to sustainable construction waste management. The present findings extend this perspective by suggesting that the presence of perceived constraints does not necessarily prevent adoption when enabling conditions are available. Professionals may recognize difficulties associated with waste segregation, recycling, transportation, costs, infrastructure, or organizational procedures while still implementing sustainable practices because of environmental knowledge, regulatory requirements, professional responsibility, or available economic support.

This interpretation is compatible with TPB's concept of perceived behavioral control. Individuals may recognize obstacles but continue performing a behavior when they believe sufficient resources, institutional mechanisms, or capabilities are available to overcome them. Accordingly, interventions should not focus exclusively on eliminating every perceived barrier. Strengthening the enabling environment particularly knowledge, regulatory support, and economic feasibility may also increase professionals' capacity to manage existing constraints.

Community Participation and Shared Environmental Responsibility. Community participation produced another important pattern. It received the lowest descriptive assessment (M = 3.24, Neutral) but demonstrated a significant positive correlation with SCWM adoption ($r = .488$, $p < .001$). However, it did not remain a significant independent predictor when the other determinants were controlled ($\beta = .041$, $p = .724$). These results suggest that community and stakeholder participation is associated with sustainable waste-management adoption but may not exert a strong unique influence independently of institutional, behavioral, and economic conditions.

The significant bivariate relationship indicates that stronger stakeholder involvement tends to accompany greater SCWM adoption. Construction waste management can involve multiple actors, including local government units, contractors, construction professionals, project owners, waste collectors, recyclers, communities, academic institutions, and professional organizations. Cooperation among these stakeholders can facilitate information exchange, waste segregation, material recovery, environmental monitoring, and shared responsibility.

However, community participation's loss of statistical significance in the regression model suggests that its contribution may overlap with other determinants, particularly policy and regulatory support and awareness. Community engagement may be more effective when institutional mechanisms organize participation, policies establish responsibilities, and stakeholders understand the environmental significance of construction waste. Therefore, community participation should remain an important supporting component of SCWM initiatives even though it did not emerge as an independent predictor in the regression model.

SCWM Through the Circular Economy and Waste Management Hierarchy. Beyond individual behavioral determinants, the findings can be understood within the broader transition from a linear construction model toward a Circular Economy. Conventional construction systems often follow a pattern of resource extraction, material production, construction, use, and eventual disposal. Such a linear approach contributes to resource depletion and increases the volume of construction and demolition materials requiring disposal. Circular construction seeks to retain the value of materials and resources for longer periods by reducing unnecessary consumption and encouraging reuse, recycling, recovery, and other strategies that minimize waste.

Recent literature identifies the Circular Economy as an important framework for mitigating the environmental effects of construction and demolition waste and improving material efficiency (de Oliveira et al., 2024). From this perspective, SCWM is not limited to improving the disposal of construction waste after it has been generated. Instead, sustainable management begins by preventing unnecessary waste, optimizing material use, extending material life, recovering usable resources, and treating disposal as a last option.

This principle is consistent with the Waste Management Hierarchy, which prioritizes prevention and reduction over reuse, recycling, recovery, and final disposal. The hierarchy provides an important practical interpretation of the study's findings. Awareness and knowledge enable professionals to understand

and select higher-order waste-management strategies; policy and regulatory support can institutionalize these priorities; and economic incentives can make reuse, recycling, and recovery financially feasible. Thus, the three significant predictors identified in the regression model can be viewed as mechanisms that enable construction professionals to move beyond conventional disposal-oriented waste management toward more circular and resource-efficient practices.

Environmental Implications of SCWM Adoption

The findings are particularly relevant given the broader environmental challenges associated with construction activities. The construction sector consumes substantial quantities of raw materials and generates considerable construction and demolition waste. When materials that could otherwise be prevented, reused, recycled, or recovered are disposed of, additional virgin resources are required for future construction, contributing to continued resource extraction and associated environmental impacts. Improper waste management can also increase pressure on disposal facilities and contribute to pollution and inefficient land use.

Construction and building activities are likewise connected to greenhouse gas emissions through material extraction, manufacturing, transportation, construction, building operation, demolition, and waste treatment. Improving material efficiency and extending the productive use of construction materials therefore have implications beyond solid-waste reduction. Circular construction practices can help reduce demand for virgin materials and avoid some of the environmental burdens associated with producing replacement construction products.

Within this context, the present findings demonstrate that strengthening SCWM adoption in Iba, Zambales has implications not only for individual construction projects but also for broader environmental sustainability. Increasing awareness, strengthening institutional implementation, and improving economic feasibility can encourage waste prevention, material recovery, reuse, recycling, and responsible disposal, thereby contributing to more efficient resource utilization within the local construction sector.

Contribution to the Sustainable Development Goals. The findings also demonstrate the relevance of SCWM to the United Nations Sustainable Development Goals (SDGs). The study contributes particularly to SDG 12: Responsible Consumption and Production, which promotes efficient use of natural resources and reduction of waste generation through prevention, reduction, recycling, and reuse. SCWM directly supports these objectives by encouraging construction professionals to minimize material wastage and retain construction materials within productive use whenever feasible.

SCWM also contributes to SDG 11: Sustainable Cities and Communities by supporting environmentally responsible urban and infrastructure development and reducing the environmental burden associated with construction waste. As municipalities continue to develop, integrating waste prevention and resource recovery into construction practices can help ensure that infrastructure growth does not unnecessarily increase pressure on local waste-management systems.

The findings are further relevant to SDG 13: Climate Action because resource-efficient construction and material recovery can help reduce environmental impacts associated with virgin-material extraction, manufacturing, transportation, and waste disposal. Similarly, SDG 9: Industry, Innovation and Infrastructure is supported through the promotion of sustainable infrastructure practices, resource-efficient construction processes, recycling technologies, and innovative approaches to material management. Consequently, strengthening SCWM at the municipal level can contribute simultaneously to local environmental management and broader sustainable-development objectives.

Integrated Interpretation and Contribution of the Study. Taken collectively, the findings support an integrated interpretation of SCWM adoption. The Theory of Planned Behavior explains the behavioral dimension by demonstrating how knowledge, attitudes, institutional expectations, and perceived capability can influence sustainable behavior. The Circular Economy explains the broader transition from resource consumption and disposal toward material retention, reuse, recycling, and recovery. The Waste Management Hierarchy provides a practical order of priority for managing construction waste, while the Resource-Based View complements the behavioral framework by explaining why organizational resources and capabilities are necessary to translate environmental intentions into implementation. Importantly, these perspectives are complementary rather than competing explanations. TPB clarifies why professionals may intend to perform sustainable practices, whereas the Resource-Based View highlights whether their organizations possess the resources and capabilities needed to act on those intentions. The Circular Economy and Waste Management Hierarchy then provide the environmental direction for those actions by prioritizing prevention, reuse, recycling, and recovery over disposal. In the municipal context, this integration means that awareness campaigns alone are unlikely to maximize adoption unless professionals also encounter clear institutional expectations and economically workable options for handling construction waste. Conversely, regulations may have limited practical effect when project teams lack knowledge, recovery channels, or resources to comply. The combined findings therefore favor coordinated interventions rather than isolated measures. This interpretation also explains why the Recommendatory Plan concentrates on the three significant predictors: each addresses a different but mutually reinforcing condition for implementation, professional capability, institutional enablement, and economic practicability.

The regression model further strengthens this integrated interpretation. The five determinants collectively explained 63.7% of the variance in SCWM adoption (R^2 = .637), demonstrating that behavioral, institutional, social, and economic conditions provide substantial explanatory value within the study. More importantly, awareness and knowledge, policy and regulatory support, and economic incentives and feasibility remained significant when the determinants were considered simultaneously. These results indicate that sustainable construction waste management is most effectively supported when professionals know what sustainable practices require, operate within institutions that reinforce those practices, and possess or can access the economic resources necessary to implement them.

The study therefore contributes to the existing literature by providing empirical evidence from a municipal Philippine setting, where research specifically examining the combined behavioral, institutional, social, and economic determinants of SCWM adoption remains limited. Rather than treating sustainable construction waste management solely as a technical waste-disposal concern, the findings demonstrate that adoption should be approached as a multidimensional sustainability issue involving professional behavior, governance, organizational resources, economic feasibility, stakeholder collaboration, and resource circularity.

From a practical perspective, these findings provide a clear basis for the proposed Sustainable Construction Waste Management Recommendatory Plan for the Municipality of Iba, Zambales. The plan should prioritize the three determinants that demonstrated significant independent predictive relationships with adoption: (1) strengthening awareness and professional capacity, (2) enhancing policy and regulatory implementation and institutional support, and (3) improving economic incentives and feasibility.

Community and stakeholder participation should complement these priority interventions, while recognized implementation barriers should be addressed through the strengthening of institutional and organizational capacity. Such an evidence-based approach can help translate the statistical findings of the study into practical strategies for advancing sustainable and circular construction practices within the municipality.

Conclusion. This study identified the key determinants influencing the adoption of Sustainable Construction Waste Management (SCWM) practices among construction professionals in the Municipality of Iba, Zambales. The findings confirmed that awareness and knowledge, policy and regulatory support, and economic incentives and feasibility are the primary factors that significantly influence the adoption of sustainable construction waste management practices. These results highlight that successful SCWM implementation depends not only on environmental awareness but also on supportive institutional policies and economically viable mechanisms that encourage sustainable practices within the construction sector.

The study further demonstrates the applicability of the Theory of Planned Behavior in explaining sustainable waste management adoption among construction professionals, emphasizing the combined influence of behavioral, institutional, and economic factors on environmentally responsible practices. By providing empirical evidence from the local construction industry, the research contributes to the limited body of literature on Sustainable Construction Waste Management at the municipal level in the Philippines.

The findings served as the basis for developing a Sustainable Construction Waste Management Recommendatory Plan focused on strengthening awareness and professional capacity, enhancing policy and regulatory support, and improving the economic feasibility of sustainable waste-management practices. The proposed plan may assist local government units, regulatory offices, construction firms, and professional organizations in developing evidence-based initiatives that promote sustainable construction and responsible environmental management.

Overall, this study reinforces the importance of integrating environmental education, effective governance, and economic support into construction waste management initiatives to achieve more sustainable construction practices and contribute to long-term environmental sustainability within the Philippine construction industry. The localized evidence may also guide future municipal initiatives by identifying which conditions deserve priority when limited institutional and financial resources require focused, evidence-based action.

Sustainable Construction Waste Management Recommendatory Plan. The proposed SCWM Recommendatory Plan translates the three significant regression predictors: Awareness and Knowledge, Policy and Regulatory Support, and Economic Incentives and Feasibility into practical interventions for Iba, Zambales. It is recommendatory and remains subject to applicable laws, institutional mandates, available resources, and stakeholder consultation.

DISCLOSURES

Author contributions. The author solely undertook all aspects of the research and publication process. This included conceptualization, framework design, data collection, statistical analysis, interpretation of findings, and preparation of the manuscript.

Conflict of interest. The author declares no conflict of interest.

Funding source. This research received no external funding.

Artificial intelligence use. AI tools supported initial drafting of text; final revisions and accountability rest with the authors.

Ethics approval statement. Ethical approval was obtained from the PUP-OUS Research Ethics Committee, with reference code 0226-0364

Data availability statement. Due to ethical restrictions, the data are not publicly available but may be obtained from the corresponding author upon reasonable request.

Acknowledgement. (Not available)

Publisher's disclaimer. The views expressed in this article are those of the authors and do not necessarily reflect the views of the publisher. The publisher disclaims any responsibility for errors or omissions.

REFERENCES

Ajayi, S. O., Oyedele, L. O., Akinade, O. O., Bilal, M., Owolabi, H. A., Alaka, H. A., & Kadiri, K. O. (2015). Waste effectiveness of the construction industry: Understanding the impediments and requisites for improvements. *Resources, Conservation and Recycling, 102*, 101–112. https://doi.org/10.1016/j.resconrec.2015.06.001

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Bamgbade, J. A., Kamaruddeen, A. M., Nawi, M. N. M., Adeleke, A. Q., Salimon, M. G., & Ajibike, W. A. (2019). Analysis of barriers to sustainable construction waste management in developing countries. *Sustainability, 11*(23), 6789. https://doi.org/10.3390/su11236789

Chileshe, N., Rameezdeen, R., Hosseini, M. R., & Lehmann, S. (2015). Barriers to implementing reverse logistics in South Australian construction organizations. *Supply Chain Management: An International Journal, 20*(2), 179–204. https://doi.org/10.1108/SCM-10-2014-0325

de Oliveira, J., Schreiber, D., & Jahno, V. D. (2024). Circular economy and buildings as material banks in mitigation of environmental impacts from construction and demolition waste. *Sustainability, 16*(12), 5022. https://doi.org/10.3390/su16125022

Department of Public Works and Highways. (2015). *Philippine Green Building Code.* Government of the Philippines.

Lu, W., & Yuan, H. (2011). A framework for understanding waste management studies in construction. *Waste Management, 31*(6), 1252–1260. https://doi.org/10.1016/j.wasman.2011.01.018

Philippine Statistics Authority [PSA]. (2025a). *Compendium of Philippine environment statistics: Component 3—Residuals.*

Philippine Statistics Authority. (2025b). *Construction statistics from approved building permits: Philippines, 2024.*

Republic Act No. 9003. (2001). *Ecological Solid Waste Management Act of 2000.* Republic of the Philippines.

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development.* Resolution adopted by the General Assembly (A/RES/70/1).

United Nations Environment Programme. (2026). *Global status report for buildings and construction 2025–2026.* https://doi.org/10.59117/20.500.11822/49531

Yuan, H. (2013). A SWOT analysis of successful construction waste management.

Journal of Cleaner Production, 39, 1–8. https://doi.org/10.1016/j.jclepro.2012.08.016

Yuan, H., Shen, L., Hao, J. J. L., & Lu, W. (2011). A model for cost-benefit analysis of construction and demolition waste management throughout the waste chain. *Resources, Conservation and Recycling, 55*(6), 604–612. https://doi.org/10.1016/j.resconrec.2010.06.004