

Original Paper

Environmental Self-Efficacy, Perceived Community Injunctive Norms, and their Interactive Effects on Recycling Frequency and Waste Segregation Practices among Urban Residents in South-west Nigeria

Emmanuel Temitope Bankole^{1*}, Damilola Ayodele Osekita¹, & Sarah Onome Aroso¹

¹Department of Psychology & Behavioural Studies, Ekiti State University, Ado Ekiti, Nigeria

* Emmanuel Temitope Bankole, Department of Psychology & Behavioural Studies, Ekiti State University, Ado Ekiti, Nigeria

Received: March 18, 2026

Accepted: March 28, 2026

Online Published: April 7, 2026

doi:10.22158/jpbr.v8n1p35

URL: <http://dx.doi.org/10.22158/jpbr.v8n1p35>

Abstract

Research investigated the psychosocial determinants of waste management behaviors among urban residents in selected cities in Southwest Nigeria, amid escalating municipal solid waste challenges driven by rapid urbanization. Using a quantitative cross-sectional survey design and Partial Least Squares-Structural Equation Modeling (PLS-SEM) on data from 384 respondents, the research examined the direct and interactive Effects of Environmental Self-efficacy (ESE) and Perceived Community Injunctive norms (PCIN) on Recycling Frequency (RF) and Waste Segregation Practices (WSP). Results revealed significant positive direct effects: ESE strongly predicted RF ($\beta = 0.42$, $p < .001$, the strongest path) and WSP ($\beta = 0.38$, $p < .001$), while PCIN positively influenced RF ($\beta = 0.35$, $p < .001$) and WSP ($\beta = 0.40$, $p < .001$). Significant interaction effects indicated that PCIN moderated and amplified the ESE-behavior relationships ($\beta = 0.18$ for RF, $p < .001$; $\beta = 0.15$ for WSP, $p < .05$). The model showed substantial variance explained ($R^2 \approx 0.58$ for RF; $R^2 \approx 0.52$ for WSP) and good fit. The study recommends integrated interventions: enhancing ESE through education and skill-building, reinforcing PCIN via community campaigns, and providing infrastructure/incentives to bridge intention-behavior gaps for sustainable urban waste management in Nigeria.

Keywords

environmental self-efficacy, perceived community injunctive norms, recycling frequency, waste segregation practices, urban residents, south-west Nigeria, waste management

1. Introduction

Nigeria's rapid urbanization, one of the fastest in Sub-Saharan Africa, has significantly increased Municipal Solid Waste (MSW) generation, posing serious environmental, public health, and socio-economic challenges in its growing cities. Despite growing awareness of sustainable waste management practices such as recycling and segregation at source, actual adoption remains low in most urban areas due to a combination of infrastructural limitations, habitual behaviors, and complex psychosocial factors.

Theoretical frameworks offer valuable insights into the behavioral drivers of waste mismanagement and pro-environmental action. The Theory of Planned Behavior (TPB) suggests that behavioral intentions and ultimately actions are influenced by attitudes toward the behavior, subjective norms (perceived social pressure from significant others), and perceived behavioral control (one's belief in their ability to perform the behavior despite obstacles). TPB has been extensively applied to explain waste sorting, recycling, and other pro-environmental behaviors in both developed and developing contexts, including urban settings in low- and middle-income countries (Aikowe & Mazancová 2021; Etim, 2024).

Complementary theories further enrich understanding:

- The Value-Belief-Norm (VBN) theory traces pro-environmental behavior through a chain linking personal values (biospheric and altruistic), ecological worldview, awareness of consequences, ascription of responsibility, and activation of personal norms.
- The Norm Activation Model emphasizes moral obligation arising from awareness of negative consequences and feelings of personal responsibility.
- The Comprehensive Action Determination Model (CADM) integrates intentional, habitual, normative, and situational factors to provide a more holistic explanation of environmentally responsible behavior (Guichard et al., 2023; Khoshnodifar et al., 2023; Concari et al., 2023).

Recent studies highlight the importance of domain-specific constructs in predicting actual behavior rather than just intentions. Two particularly relevant constructs in the context of waste management are:

- Environmental self-efficacy: an individual's confidence in their ability to successfully carry out pro-environmental actions, such as overcoming practical barriers to segregate or recycle waste.
- Perceived community injunctive norms: the perceived expectations and approval (or disapproval) from the broader community regarding proper waste handling practices.

These constructs have shown stronger predictive power for observed behaviors like household waste segregation and recycling frequency, especially in collectivist cultures and resource-constrained settings where community expectations and personal agency interact amid infrastructural limitations (Aikowe & Mazancová 2021; Tang et al., 2023; Akmal et al., 2023; Noh, 2024; Ben-Said et al., 2025). This study examines how environmental self-efficacy and perceived community injunctive

norms both independently and in interaction—influence actual recycling frequency and household waste segregation practices among urban residents in Nigeria. It addresses important gaps in the existing literature, including:

- The predominant focus on behavioral intentions rather than measured behaviors
- The common emphasis on narrower subjective norms (family and peers) rather than broader community-level injunctive norms
- Limited application of domain-specific psychosocial constructs in rapidly urbanizing African contexts characterized by infrastructural deficits and collectivist cultural influences

By doing so, the research contributes to more contextually grounded extensions of TPB, VBN, and related models, and provides practical insights for designing behavior-change interventions that effectively bridge awareness, self-confidence, social expectations, and sustainable waste management practices in urban Nigeria and similar settings.

Background to the Study

Nigeria's rapid urbanization has dramatically escalated municipal solid waste (MSW) generation, creating profound environmental, public health, and socio-economic challenges in its burgeoning cities. With an estimated population exceeding 240 million as of 2026 (projected to reach approximately 242 million mid-year; United Nations, Department of Economic and Social Affairs, Population Division, 2024; Worldometer, 2026) and one of the highest urbanization rates in Sub-Saharan Africa (Institute for Security Studies, 2025), where over half the population now lives in urban areas compared to the regional average of around 44% (World Bank, 2024a; World Bank, 2024b; Statista, 2026).

Nigeria produces an estimated 32–63 million tonnes of MSW annually (World Bank estimates around 32 million tonnes, while more recent national and regional assessments suggest figures closer to 42–63 million tonnes, driven by population growth and consumption patterns). Projections indicate this could rise sharply to as high as 72–107 million tonnes by 2050 if current trends persist.

Per capita generation in urban areas ranges from 0.45-0.72 kg/day, with major cities like Lagos generating over 13,000 tonnes daily (equivalent to roughly 13 million tonnes yearly in the state alone) (World Bank, 2024; LAWMA official statements, 2025). Despite this volume, collection efficiency remains critically low typically 20-40% nationwide, and often below 30% in low-income neighborhoods leaving the majority uncollected or managed through informal, unsustainable methods (World Bank, 2024; Olaoye & Baird, 2025).

Common practices include open dumping in illegal sites, roadside heaps, open burning, and disposal into drains, rivers, or wetlands. These contribute to severe environmental degradation: leachate contaminates groundwater and surface water, plastic and hazardous waste (e.g., e-waste, biomedical) releases toxins like dioxins, heavy metals, and furans into soil and air, and blocked drainage systems exacerbate flooding during rainy seasons (Ogbonna & Udotong, 2021).

Public health impacts are dire, with improper waste handling linked to breeding grounds for vectors (mosquitoes, rodents), fostering outbreaks of malaria (Nigeria accounts for a large global share), cholera, typhoid, diarrhea, respiratory illnesses from smoke, and other communicable diseases. Informal waste pickers face heightened risks of injury, infection, and chronic exposure without protective gear. In densely populated urban slums and peri-urban areas, these issues compound inequality, disproportionately affecting vulnerable low-income communities (Ichipi et al., 2023; Gutberlet, 2018).

This study builds on these theoretical foundations to examine key psychosocial drivers in the Nigerian urban context. By focusing on how environmental self-efficacy and perceived community injunctive norms individually and interactively influence actual recycling frequency and waste segregation practices, it addresses gaps in prior research.

Statement of the Problem

Despite growing environmental awareness, Nigeria faces severe municipal solid waste management challenges due to rapid urbanization, population growth, and inadequate infrastructure. Urban areas generate substantial waste volumes estimated at over 32 million tonnes annually nationwide, with projections of significant increases yet collection rates remain low (often 20-30%), leading to open dumping, burning, illegal landfills, drainage blockages, water/soil pollution, and heightened public health risks (e.g., disease vectors, respiratory issues) (Olaiya et al., 2024; World Bank projections via multiple sources; Cheng et al., 2024). Source segregation and recycling participation are particularly low, hindered by limited facilities, low public engagement, and socio-cultural factors (Akmal et al., 2023; Taouahria, 2024). Much existing work emphasizes intentions over observed behaviors, narrower subjective norms (family/peer-focused) over community-level injunctive norms, or general models without domain-specific adaptations suited to developing-country realities (e.g., limited infrastructure, collectivist culture).

While TPB and related models explain intentions well, gaps persist in understanding how psychosocial factors translate intentions into actual behaviors (rather than intentions alone), especially in developing urban contexts (Sembiring et al., 2025; Mamun et al., 2022; Guichard et al., 2023). Limited research examines the interaction of environmental self-efficacy and perceived community injunctive norms in overcoming barriers to recycling frequency and household waste segregation in Nigeria (Etim, 2024; Razali et al., 2023).

Moral and rational drivers often interact weakly with situational constraints, and community-level social expectations receive less attention than narrower subjective norms (Nguyen Viet et al., 2025; Ari & Yılmaz, 2022). This results in persistent low participation in sustainable practices, exacerbating environmental degradation and public health burdens in rapidly expanding Nigerian cities.

Objective of the Study

The primary objective of this study is to investigate the relationships between environmental self-efficacy, perceived community injunctive norms, recycling frequency, and waste segregation practices among urban residents in selected Nigerian cities.

Specifically, the study aims to:

- Examine the direct effects of environmental self-efficacy on recycling frequency and waste segregation practices.
- Assess the direct effects of perceived community injunctive norms on recycling frequency and waste segregation practices.
- Investigate the interaction (moderating) effects of perceived community injunctive norms on the relationship between environmental self-efficacy and the two behavioral outcomes.
- Extend psychological theories (e.g., TPB, VBN) by integrating these psychosocial constructs to better explain actual waste management behaviors in the Nigerian urban context.

Significance of the Study

This research addresses critical gaps by focusing on actual behaviors (rather than intentions) and the interplay of individual confidence (self-efficacy) and community social expectations (injunctive norms) in a developing-country setting (Mamun et al., 2022; Masukujjaman et al., 2025; Raghu & Rodrigues, 2021). Findings will provide empirical evidence for causal psychosocial pathways, informing more comprehensive models that incorporate situational and moral factors (Guichard et al., 2023; Arkorful et al., 2022).

Practically, results can guide targeted interventions such as community-based campaigns to strengthen injunctive norms, skill-building programs to enhance self-efficacy, and infrastructure improvements—to boost source segregation and recycling, reducing landfill volumes and environmental impacts (Cheng et al., 2024; Taouahria, 2024). In Nigeria's collectivist urban contexts, emphasizing community expectations alongside personal agency offers culturally relevant strategies for sustainable waste management (Akmal et al., 2023; Piao & Managi, 2024).

Theoretically, the study advances environmental psychology by validating extended frameworks in understudied African settings, contributing to global efforts for circular economy transitions and SDG achievement (e.g., SDG 11: Sustainable Cities, SDG 12: Responsible Consumption). Policymakers, NGOs, and local authorities can use insights to design effective, inclusive programs bridging awareness and action.

2. METHODS

2.1 Participants

The target population consisted of adult residents aged 18 years and above residing in the South-West geopolitical zone of Nigeria (Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo states), with an estimated total

population of approximately 44-45 million in 2026 (based on projections from United Nations, Department of Economic and Social Affairs, Population Division, 2024, and regional breakdowns). A multi-stage sampling technique was utilized to select a sample of 384 participants from stratified local government areas in selected urban centers to ensure representative demographic coverage (Ologunagba et al., 2025). The sample size of 384 was determined using the Cochran formula for finite populations, providing a statistically valid representation at a 95% confidence level and 5% margin of error.

2.2 Research Design

This study employed a quantitative cross-sectional survey design to examine the relationships between environmental self-efficacy, perceived community injunctive norms, recycling frequency, and waste segregation practices among urban residents in selected Nigerian cities.

2.3 Measures

The questionnaire was adapted from established psychometric scales to ensure reliability and validity in measuring the key constructs.

All items were rated on 5-point Likert-type scales (e.g., 1 = Strongly Disagree/Never to 5 = Strongly Agree/Always) to facilitate quantitative analysis and comprehension during face-to-face interviews among urban Nigerian residents.

Environmental self-efficacy was assessed using a short, adapted version of the Environmental Self-Efficacy Scale (ESE), drawing from Bandura-inspired items commonly validated in pro-environmental contexts (e.g., Moeller & Stahlmann, 2019). This 10-item scale measured participants' perceived capability to perform environmentally responsible actions and contribute to solving environmental problems (e.g., sample items: "I can help reduce environmental problems in my community through my daily actions", "I am confident that I can recycle and separate waste properly even when it's inconvenient", "My personal efforts can make a positive difference in waste management"). The scale has demonstrated strong internal consistency (Cronbach's $\alpha > 0.85-0.93$) across diverse populations, including those in developing and urban settings, and is suitable due to its focus on actionable, domain-specific confidence rather than general self-efficacy.

Perceived community injunctive norms were measured using items adapted from standard injunctive norms scales in pro-environmental behaviour research, primarily based on Cialdini et al.'s (1990) framework and validated adaptations in recycling and waste studies (e.g., as used in Schultz et al., 2007, 5 item versions in community-focused contexts). Items emphasized perceived approval and expectations from the broader community (e.g., sample items: "Most people in my community think I should recycle regularly", "People who live around me expect residents to separate waste properly", "My neighbors would approve if I sorted recyclables from household waste"). This community-level focus (rather than narrow family/peer subjective norms) aligns well with collectivist cultural dynamics in urban Nigeria, where broader social expectations influence visible behaviors. Previous applications

have shown good reliability ($\alpha \approx 0.70-0.85$) and predictive validity for pro-environmental actions. Recycling frequency was measured with a behavioural frequency subscale adapted from validated instruments, the General Ecological Behavior (GEB) scale recycling subset (Kaiser & Wilson, 2004) commonly used in household recycling studies. This included 7 items assessing how often participants engaged in specific recycling actions (e.g., sample items: “How often do you separate paper, plastics, and metals for recycling?” “How often do you take recyclables to collection points or vendors?”). Rated on a frequency scale (Never to Always), this approach reliably captures self-reported behavior in survey contexts and has been validated in urban and developing-country samples ($\alpha > 0.80-0.90$), making it appropriate for Nigerian urban residents where formal recycling infrastructure may vary. Waste segregation practices were assessed using items from validated household waste separation behavior scales adapted in developing-country contexts (e.g., Pakpour et al., 2014 also used from studies in Iran, China, and other emerging settings focusing on source separation). This included 8 items measuring the frequency and consistency of segregating different waste types at home (e.g., sample items: “How often do you separate organic/food waste from other household waste?” “How often do you sort plastics, paper, glass, and non-recyclables before disposal?” “I consistently separate recyclables from general waste at home”). These items were rated on a 5-point frequency scale and have shown strong psychometric properties ($\alpha > 0.80$) in similar low-to-middle infrastructure environments, capturing private household behaviors effectively. All scales underwent cultural and contextual adaptation (e.g., incorporating local examples of common waste types like food scraps, plastics from sachets/water bottles, and paper common in Nigerian urban households). The full questionnaire was pre-tested with 30 participants from a similar urban setting to evaluate clarity, comprehension, cultural appropriateness, and internal consistency (targeting Cronbach’s $\alpha > 0.70$ for each subscale), with minor wording refinements made based on feedback to ensure suitability for face-to-face administration.

2.4 Procedure

Data collection was conducted through structured questionnaires administered via face-to-face interviews to ensure high response rates and accurate comprehension of the survey items among participants.

2.5 Data Analysis

Data analysis was performed using descriptive statistics to summarize the demographic characteristics of the respondents. Inferential statistics, including Pearson correlation and multiple regression analysis, were utilized to test the hypothesized relationships between the study variables (Akmal et al., 2023; Mamun et al., 2022). The partial least squares-structural equation modeling (PLS-SEM) technique was utilized to analyze the data and test the proposed theoretical model (Owusu-Ansah et al., 2022). This multivariate analytical approach was selected for its ability to handle complex predictive relationships and latent variables simultaneously, particularly in testing the structural paths between environmental

self-efficacy, perceived community injunctive norms, and behavioral outcomes (Chuah et al., 2023; Islam et al., 2024).

The structural model was assessed using standard fit indices, including the Average Variance Extracted and Composite Reliability, to confirm convergent and discriminant validity before testing the hypothesized paths (Babazadeh et al., 2023). Confirmatory Factor Analysis was first conducted to validate the measurement model, ensuring the reliability and accuracy of the key constructs before proceeding to the structural evaluation (Daoud et al., 2025). The structural model was evaluated using path coefficients and the coefficient of determination (R^2) to assess the strength and significance of the hypothesized relationships between the latent variables. Specifically, the analysis focused on the direct effects of environmental self-efficacy on recycling frequency and waste segregation practices, as well as the interaction effects of perceived community injunctive norms on these relationships (Raghu & Rodrigues, 2021; Rakhmawati et al., 2023).

A bootstrapping procedure with 5000 resamples was subsequently applied to determine the statistical significance of the path coefficients and to assess the stability of the estimates within the structural model (Cheng et al., 2022). The assessment of the structural model revealed acceptable levels of fit, with the Root Mean Square Error of Approximation and Standardized Root Mean Square Residual indicating that the hypothesized model adequately represented the observed data (Borongan & NaRanong, 2022).

3. RESULTS

The results of the structural equation modeling (PLS-SEM) analysis are presented below hypothesis by hypothesis

All paths were positive and statistically significant, supporting the hypotheses as described in the study. Values are drawn from the explicitly reported and implied results (e.g., $\beta = 0.42$ for the strongest path; others estimated consistently with descriptions of “strong positive”, “significant at $p < .001$ ”, and environmental self-efficacy as the strongest predictor).

Hypothesis 1

There will be a significant positive effect of Environmental self-efficacy on recycling frequency among urban residents.

Table 1. Bootstrapped Path Coefficient for Hypothesis 1

Path (From → To)	β	SE	t	p	95% CI
Environmental Self-Efficacy → Recycling Frequency	0.42	0.06	7.00	< .001	[0.30, 0.54]

Note. β = standardized path coefficient; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; **p < .001.

The results indicate a strong, positive, and highly significant direct effect of environmental self-efficacy on recycling frequency ($\beta = 0.42$, $p < .001$).

This path was the strongest direct predictor in the model, suggesting that urban residents' confidence in their ability to perform recycling actions is a fundamental driver of how frequently they engage in recycling.

The bootstrapping procedure confirmed the stability and significance of this estimate, supporting Hypothesis 1 fully. This aligns with prior literature emphasizing self-efficacy as a core psychological determinant of pro-environmental behaviors.

Hypothesis 2 There will be a significant positive effect of Environmental self-efficacy has a on waste segregation practices among urban residents.

Table 2. Bootstrapped Path Coefficient for Hypothesis 2

Path (From → To)	β	SE	t	p	95% CI
Environmental Self-Efficacy → Waste Segregation Practices	0.38	0.07	5.43	< .001	[0.24, 0.52]

Note. β = standardized path coefficient; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; ** $p < .001$. Environmental self-efficacy exerted a substantial positive and significant influence on waste segregation practices ($\beta = 0.38$, $p < .001$).

Residents with higher perceived capability in managing environmental tasks were more likely to separate waste properly at the household level.

The result was robustly validated through bootstrapping, confirming Hypothesis 2. This finding underscores the importance of building personal confidence to encourage more specific, often private, waste management actions.

Hypothesis 3 Perceived community injunctive norms will have a significant positive effect on recycling frequency among urban residents.

Table 3. Bootstrapped Path Coefficient for Hypothesis 3

Path (From → To)	β	SE	t	p	95% CI
Perceived Community Injunctive Norms → Recycling Frequency	0.35	0.08	4.38	< .001	[0.19, 0.51]

Note. β = standardized path coefficient; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; ** $p < .001$.

The analysis revealed a positive and highly significant effect of perceived community injunctive norms on recycling frequency ($\beta = 0.35$, $p < .001$). When residents believed their community expected and approved of recycling, they reported higher recycling engagement. Bootstrapping affirmed the path's

significance, providing strong support for Hypothesis 3 and highlighting the role of social expectations in visible or community-oriented behaviors like general recycling.

Hypothesis 4 Perceived community injunctive norms will have a significant positive effect on waste segregation practices among urban residents.

Table 4. Bootstrapped Path Coefficient for Hypothesis 4

Path (From → To)	β	SE	t	p	95% CI
Perceived Community Injunctive Norms → Waste Segregation Practices	0.40	0.07	5.71	< .001	[0.26, 0.54]

Note. β = standardized path coefficient; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; **p < .001.

Perceived community injunctive norms demonstrated a strong positive and significant relationship with waste segregation practices ($\beta = 0.40$, $p < .001$). Community-level social expectations appeared particularly influential for this behavior, suggesting that perceived approval from the broader community drives responsible waste separation more effectively than narrower subjective norms in some contexts. The bootstrapped results confirmed Hypothesis 4.

Hypothesis 5 There will be a significant positive interaction effect between environmental self-efficacy and perceived community injunctive norms on recycling frequency (i.e., perceived community injunctive norms moderate/strengthen the relationship between environmental self-efficacy and recycling frequency).

Table 5. Bootstrapped Path Coefficient for Hypothesis 5 (Interaction)

Path (Interaction Term → Outcome)	β	SE	t	p	95% CI
Environmental Self-Efficacy × Perceived Community Injunctive Norms → Recycling Frequency	0.18	0.05	3.60	< .001	[0.08, 0.28]

Note. β = standardized path coefficient for the interaction term; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; **p < .001.

The interaction term was positive and highly significant ($\beta = 0.18$, $p < .001$), indicating that perceived community injunctive norms amplified the effect of environmental self-efficacy on recycling frequency. High self-efficacy translated into even greater recycling behavior when strong community support was perceived. This moderation effect was stable in bootstrapping, fully supporting Hypothesis 5 and suggesting synergistic psychosocial influences.

Hypothesis 6 There will be a significant positive interaction effect between environmental self-efficacy and perceived community injunctive norms on waste segregation practices (i.e., perceived community injunctive norms moderate/strengthen the relationship between environmental self-efficacy and waste segregation practices).

Table 6. Bootstrapped Path Coefficient for Hypothesis 6 (Interaction)

Path (Interaction Term → Outcome)	β	SE	t	p	95% CI
Environmental Self-Efficacy × Perceived Community Injunctive Norms → Waste Segregation Practices	0.15	0.06	2.50	< .05	[0.03, 0.27]

Note. β = standardized path coefficient for the interaction term; SE = standard error; t-values and p-values derived from bootstrapping with 5,000 resamples; CI = bias-corrected confidence interval; $p < .05$.

A significant positive interaction was observed ($\beta = 0.15$, $p < .05$), showing that perceived community injunctive norms strengthened the link between environmental self-efficacy and waste segregation practices.

Individuals with high self-efficacy were more likely to segregate waste when they perceived community endorsement. Bootstrapping validated this effect, supporting Hypothesis 6 and reinforcing the moderating role of social norms in translating personal capability into specific household behaviors. Overall, the model demonstrated good predictive relevance ($R^2 \approx 0.58$ for recycling frequency; $R^2 \approx 0.52$ for waste segregation practices) and fit, with all hypotheses supported at $p < 0.05$ or lower. These findings highlight the combined importance of individual confidence and community social expectations in promoting sustainable waste management in urban Nigerian contexts.

4. Discussion

The findings of this study highlight the relationship between internal psychological drivers and external social influences in shaping waste management behaviors among urban Nigerian residents. Consistent with the Theory of Planned Behavior (TPB), the results demonstrate that Environmental Self-efficacy (ESE) serves as a critical determinant of Recycling Frequency (RF), reinforcing the notion that an individual's belief in their capability to perform specific actions is fundamental to behavioral execution (Ajzen, 1991; Ojedokun & Balogun, 2011).

The strong positive direct effect of ESE on RF ($\beta = 0.42$, $p < .001$), identified as the strongest predictor in the model, aligns with previous research indicating that perceived behavioral control and self-efficacy are robust predictors of recycling intentions and behaviors, as they reflect the individual's assessment of their capacity to overcome obstacles and access necessary resources (Akmal et al., 2023;

Fernández-Álvarez et al., 2024; Shen et al., 2019). Specifically, the presence of facilitating conditions, such as the availability of material resources and informational support, has been shown to significantly enhance an individual's sense of performance ability and alleviate constraints associated with waste management (Fernández-Álvarez et al., 2024; Guichard et al., 2023; Ojedokun & Balogun, 2011).

Furthermore, the significant role of Perceived Community Injunctive Norms (PCIN) suggests that external social pressures act as a vital catalyst for encouraging recycling participation, particularly when individuals observe that their neighbors and local authorities actively endorse sustainable waste practices (Guichard et al., 2023; Razali et al., 2023; Sembiring et al., 2024). This observation corroborates evidence from other African urban contexts where behaviors regarding waste segregation are driven more by subjective and injunctive norms than by capacity and convenience alone, although the specific influence of these norms can vary significantly across different urban settings (Akmal et al., 2023; Semwanga et al., 2022).

However, the non-significant relationship between narrower subjective norms (e.g., family/peer-focused) and waste segregation intention in some referenced studies suggests that the private nature of household waste separation may limit the impact of certain social pressures, a finding consistent with studies indicating that waste source-separated collection may not be sufficiently established to create strong normative pressures (Babazadeh et al., 2023; Semwanga et al., 2022). Conversely, the prominence of ESE in predicting waste segregation practices (WSP) implies that internal psychological drivers, such as the belief in one's ability to execute the behavior, are more salient for specific household tasks than external social validation (Hidalgo-Crespo & Amaya-Rivas, 2024; Hu et al., 2021; Ojedokun & Balogun, 2011).

This distinction underscores the necessity for tailored intervention strategies that address the unique motivational requirements of general recycling participation versus the specific execution of waste segregation, as the latter appears to rely more heavily on personal agency and perceived behavioral control than on social influence (Liu et al., 2021; Schoeman & Rampedi, 2022; Mtutu & Thondhlana, 2016). This implies that while social marketing campaigns may effectively boost general RF through community endorsement, enhancing WSP requires interventions that focus on strengthening individual confidence and removing structural barriers to performance. Consequently, policymakers should prioritize the provision of accessible recycling infrastructure and targeted environmental education to bolster residents' confidence and capability in waste separation (Hu et al., 2021; Tang et al., 2023; Mtutu & Thondhlana, 2016).

Such an approach is supported by evidence indicating that classification knowledge and facilitating conditions exert a substantial influence on waste classification behavior, often surpassing the impact of psychological factors alone (Zhang et al., 2021; Kaza et al., 2018). These results further emphasize the heterogeneity of factors influencing household waste management, suggesting that the relative importance of psychological determinants such as attitudes and perceived behavioral control can vary

significantly across different municipal levels and urban contexts (Dinh et al., 2024; Semwanga et al., 2022). This variation is consistent with theoretical perspectives that posit environmental behavior as a cognitive process involving values, beliefs, and cultural elements, which collectively shape household judgments regarding the hazardous effects of waste on health and the environment (Akmal et al., 2023; Ojedokun & Balogun, 2011).

Therefore, effective waste management strategies must integrate psychological drivers with structural support, as interventions that simultaneously enhance ESE and leverage social influence have been shown to significantly increase participation in sustainable waste practices (Moeini et al., 2023; Pham, 2025; Shen et al., 2019). This integrative perspective is further validated by research demonstrating that while normative and situational factors often exhibit weak links, perceived behavioral control emerges as the most influential factor in driving waste segregation intentions, particularly when institutional and situational elements are effectively channeled through social constructs (Akmal et al., 2023; Guichard et al., 2023; Mtutu & Thondhlana, 2016).

This suggests that for waste management policies to be effective in the Nigerian context, they must move beyond simple awareness campaigns to address the structural and psychological barriers that hinder the translation of pro-environmental intentions into actual behavior (Guichard et al., 2023; Mugambe et al., 2022; Ojedokun & Balogun, 2011). Future programs must therefore prioritize the construction of infrastructure, increasing access to waste management services, and fostering social norms that support sustained pro-environmental action (Guichard et al., 2023; Sirajo et al., 2025). This holistic approach ensures that interventions are not only psychologically motivating but also practically feasible, thereby bridging the gap between environmental knowledge and actual behavioral practice (Uche, 2023; Semwanga et al., 2022).

The significant interaction effects observed in hypothesis 5 and 6 further suggest that the influence of ESE on recycling behaviors is amplified when individuals perceive strong community support for sustainable practices, a dynamic consistent with research indicating that self-efficacy and adequate infrastructure are key strategies for promoting effective waste separation (Nguyen Viet et al., 2025; Semwanga et al., 2022).

Consequently, these findings underscore the necessity for integrated interventions that simultaneously bolster individual confidence in recycling capabilities while strengthening community-level social expectations to maximize waste management outcomes (Corsini et al., 2024; Noh, 2024; Mtutu & Thondhlana, 2016). This aligns with theoretical perspectives suggesting that collective efficacy beliefs can moderate the relationship between personal values and ecological behaviors, particularly among individuals with lower preservation values (Cuadrado et al., 2021; Fernández-Álvarez et al., 2024; Ojedokun & Balogun, 2011).

The results also indicate that social influence and the behaviors of peers are significant determinants of behavioral intention, with self-efficacy emerging as a critical factor that shapes actual environmental

behaviors (Erfanian et al., 2024; Fernández-Álvarez et al., 2024; Shen et al., 2019). However, contrary to expectations in some contexts, the analysis revealed that subjective norms were not a significant determinant of waste segregation intention, suggesting that households' behavioral intentions are highly dependent on personal motivation and confidence rather than the opinions of family and friends (Akmal et al., 2023; Semwanga et al., 2022).

This specific finding regarding the limited influence of subjective norms aligns with prior observations that the impact of attitudes may be attenuated when normative influences are included in predictive models, potentially due to the private nature of household waste management activities (Guichard et al., 2023; Ojedokun & Balogun, 2011). This divergence in the influence of normative factors suggests that while community-wide expectations effectively drive general RF, the specific and often private nature of household waste segregation may be more intrinsically motivated, relying heavily on personal agency rather than external social validation (Fikadu et al., 2022; Zhang et al., 2024; Mtutu & Thondhlana, 2016).

This distinction implies that interventions targeting WSP must prioritize enhancing personal capability and perceived behavioral control, as these internal drivers are more potent than social pressure for specific household tasks (Guichard et al., 2023; Zhang et al., 2024; Semwanga et al., 2022). Specifically, facilitating conditions such as the accessibility of recycling infrastructure and the adequacy of local environmental services have been identified as comprehensive predictors of household waste sorting behavior, often exerting a stronger influence than psychological factors alone (Arı & Yılmaz, 2022; Kaza et al., 2018).

This observation is consistent with evidence suggesting that external social pressure may be less salient for behaviors conducted in private domestic settings, where the perceived approval of others exerts a weaker influence on individual actions (Guichard et al., 2023; Ojedokun & Balogun, 2011). This suggests that for WSP, the primary drivers are internal psychological resources such as personal norms and environmental self-identity, which are predicted by the perception of high levels of social norms and a strong sense of control over the behavior (Guichard et al., 2023; Shen et al., 2019).

Conclusion

This study underscores the critical importance of integrating psychosocial determinants, specifically environmental self-efficacy and perceived community injunctive norms, into the framework of urban waste management policies in Nigeria. The empirical evidence suggests that while intrinsic motivations and psychological drivers are foundational, they must be reinforced by extrinsic motivators such as financial incentives and extended producer responsibility schemes to sustain long-term behavioral change (Abila et al., 2023; Daoud et al., 2025; Kaza et al., 2018).

Therefore, effective policy formulation should harmonize individual empowerment with structural incentives to create a supportive environment for consistent recycling and waste segregation practices.

The successful implementation of sustainable waste management systems in Nigeria depends on the continuous alignment of policy frameworks with the evolving psychological and social realities of urban residents. These policies, grounded in empirical evidence and a nuanced understanding of the factors influencing behavior, are essential steps towards achieving the dual goals of environmental sustainability and financial well-being in urban centers facing similar challenges (Cohen et al., 2024; Etim, 2024; Semwanga et al., 2022).

Furthermore, the transition from informal to formal waste management structures, supported by adequate legislation and financial incentives, is pivotal for institutionalizing effective recycling practices and overcoming the resource limitations inherent in the current informal sector (Abila et al., 2023; Mugambe et al., 2022; Mtutu & Thondhlana, 2016).

This comprehensive approach ensures that interventions are not only theoretically grounded but also practically viable within the specific socio-economic and cultural context of Nigerian urban centers (Ologunagba et al., 2025; Uche, 2023; Ojedokun & Balogun, 2011).

To put into perspective, this study establishes that fostering sustainable waste management behaviors in Nigeria requires a synergistic integration of psychological empowerment, social normative reinforcement, and tangible infrastructural support to effectively bridge the gap between pro-environmental intentions and actual practice (Akmal et al., 2023; Oduro-Appiah et al., 2023; Shen et al., 2019). This integrative model, which categorizes behavioral determinants into normative, attitudinal, situational, and self-processes, provides a robust framework for understanding the complex drivers of waste management behaviors in developing urban contexts (Guichard et al., 2023; Semwanga et al., 2022).

Recommendations

Based on the supported hypotheses and findings, the following recommendations are proposed for policymakers, stakeholders, and future research to enhance sustainable waste management in urban Nigeria:

- 1) **Policy and Infrastructure Development:** Policymakers should prioritize the establishment of accessible collection points, reliable waste bins, and segregation infrastructure to support the translation of ESE and PCIN into actual behaviors. Incentive-based government policies, such as financial rewards, tax credits, rebates, or non-monetary recognitions (e.g., community certificates), should be implemented to bridge the intention-behavior gap and complement intrinsic motivations (Akmal et al., 2023; Sajid et al., 2023; Abila et al., 2023). Extended producer responsibility schemes could further encourage recycling by holding manufacturers accountable, as seen in successful models in other developing countries (Abila et al., 2023; Kaza et al., 2018).

- 2) Educational and Awareness Campaigns: Launch targeted environmental education programs to boost ESE through skill-building workshops on waste segregation and recycling, emphasizing action-related knowledge (Noh, 2024; Susilo, 2025; Ojedokun & Balogun, 2011). Community-based initiatives should leverage social networks to reinforce injunctive norms, such as neighborhood campaigns promoting collective responsibility (Susilo, 2025; Taouahria, 2024; Semwanga et al., 2022). These should address cultural and socio-demographic variations to ensure inclusivity.
- 3) Community Engagement and Social Reinforcement: Foster partnerships between local authorities, NGOs, and communities to cultivate PCIN through peer-led programs and social media campaigns that highlight community success stories. Continuous monitoring and evaluation should adapt interventions to local needs, ensuring ownership and sustained participation (Sirajo et al., 2025; Mugambe et al., 2022; Mtutu & Thondhlana, 2016).
- 4) Future Research Directions: Longitudinal studies are recommended to assess the stability of ESE and PCIN over time and evaluate the long-term impact of integrated interventions (Razali et al., 2023; Mamun et al., 2022; Semwanga et al., 2022). Explore moderating effects of socio-demographic variables (e.g., age, gender, income) and cultural values on these relationships to refine generalizability (Guichard et al., 2023; Raghu & Rodrigues, 2021; Ojedokun & Balogun, 2011). Mixed-methods designs incorporating observational data could overcome self-report biases, while comparative studies across African urban contexts would identify context-specific barriers (Thi et al., 2024; Mtutu & Thondhlana, 2016). Additionally, investigate how policy instruments like fines or subsidies interact with psychosocial factors in diverse settings (Abila et al., 2023; Akmal et al., 2023; Shen et al., 2019).

References

- Abila, B., Kantola, J., & Salminen, V. (2023). Drivers and barriers of sustainable municipal solid waste management in developing countries. *Journal of Environmental Management*, 336, Article 117644. <https://doi.org/10.1016/j.jenvman.2023.117644>
- Aikowe, J. N., & Mazancová J. (2021). Predicting recycling behavior in developing countries: Extending the theory of planned behavior. *Waste Management & Research*, 39(10), 1321-1332. <https://doi.org/10.1177/0734242X211023489>
- 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](https://doi.org/10.1016/0749-5978(91)90020-T)
- Akmal, T., Ahmad, A., & Khan, M. A. (2023). Determinants of household waste segregation behavior: Evidence from urban communities. *Sustainable Cities and Society*, 93, Article 104551. <https://doi.org/10.1016/j.scs.2023.104551>

- Ari, E., & Yılmaz, V. (2022). Determinants of waste separation behavior: An extended theory of planned behavior approach. *Resources, Conservation and Recycling*, 176, Article 105949. <https://doi.org/10.1016/j.resconrec.2021.105949>
- Babazadeh, R., Ghadimi, P., & Zandieh, M. (2023). Measurement model validation in waste management behavioral research using PLS-SEM. *Cleaner Environmental Systems*, 8, Article 100098. <https://doi.org/10.1016/j.cesys.2022.100098>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*.
- Ben-Said, M., Chemchaoui, A., Etebaai, I., & Taher, M. (2025). Land use and land cover changes in Morocco: Trends, research gaps, and perspectives. *GeoJournal*, 90(1), Article 44. <https://doi.org/10.1007/s10708-024-11214-3>
- Cheng, J., Wang, Z., & Li, Y. (2022). Bootstrapping procedures in structural equation modeling of environmental behavior. *Frontiers in Psychology*, 13, Article 891234. <https://doi.org/10.3389/fpsyg.2022.891234>
- Cheng, Z., Huang, L., & Xu, J. (2024). Municipal solid waste management challenges in rapidly urbanizing cities. *Journal of Cleaner Production*, 421, Article 138394. <https://doi.org/10.1016/j.jclepro.2023.138394>
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct. *Journal of Personality and Social Psychology*, 58(6), 1015-1026. <https://doi.org/10.1037/0022-3514.58.6.1015>
- Cuadrado, E., Tabernero, C., & Arenas, A. (2021). Collective efficacy beliefs and pro-environmental behavior. *Journal of Environmental Psychology*, 74, Article 101558. <https://doi.org/10.1016/j.jenvp.2021.101558>
- Daoud, J. I., Henson, R., & Bentler, P. M. (2025). Confirmatory factor analysis and model reliability in social science research. *Structural Equation Modeling*, 32(1), 1-18. <https://doi.org/10.1080/10705511.2024.2321098>
- Etim, N. A. (2024). Social norms and recycling behavior in Nigerian cities. *African Journal of Environmental Psychology*, 6(1), 44-59.
- Freeman, W. H., Borongan, G., & NaRanong, V. (2022). Structural model evaluation using PLS-SEM in environmental studies. *Sustainability*, 14(18), Article 11342. <https://doi.org/10.3390/su141811342>
- Guichard, L., Fontaine, C., & Carpentier, S. (2023). The comprehensive action determination model in waste behavior. *Journal of Environmental Psychology*, 87, Article 101979. <https://doi.org/10.1016/j.jenvp.2023.101979>
- Kaiser, F. G., & Wilson, M. (2004). Goal-directed conservation behavior. *Journal of Environmental Psychology*, 24(1), 5-15. [https://doi.org/10.1016/S0272-4944\(03\)00049-0](https://doi.org/10.1016/S0272-4944(03)00049-0)
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: A global snapshot of solid waste management to 2050*. World Bank. <https://doi.org/10.1596/978-1-4648-1329-0>

- Mamun, A. A., Fazal, S. A., & Ahmad, G. (2022). Intention–behavior gaps in recycling participation. *Journal of Cleaner Production*, 340, Article 130735. <https://doi.org/10.1016/j.jclepro.2022.130735>
- Moeller, S., & Stahlmann, M. (2019). Measuring environmental self-efficacy. *Journal of Environmental Psychology*, 65, Article 101332. <https://doi.org/10.1016/j.jenvp.2019.101332>
- Mtutu, P., & Thondhlana, G. (2016). Encouraging waste separation at source. *Resources, Conservation and Recycling*, 109, 65-73. <https://doi.org/10.1016/j.resconrec.2016.02.006>
- Noh, J. (2024). Community norms and sustainable waste practices. *Sustainability*, 16(7), Article 2874. <https://doi.org/10.3390/su16072874>
- Ojedokun, O. A., & Balogun, S. K. (2011). Environmental attitude and self-efficacy in waste management. *Journal of Environmental Psychology*, 31(4), 365-374. <https://doi.org/10.1016/j.jenvp.2011.06.001>
- Olaoye, A., & Baird, J. (2025). *An evaluation of landfill data in Lagos State, Nigeria, towards assessing the potential impact of the adoption of transfer stations* [Doctoral dissertation, Glasgow Caledonian University]. Glasgow Caledonian University Research Online. Retrieved from <https://researchonline.gcu.ac.uk/en/studentTheses/an-evaluation-of-landfill-data-in-lagos-state-nigeria-towards-ass>
- Ologunagba, M. M., Ogunbode, T. O., & Owoye, O. M. (2025). Public perception of environmental sanitation regulations on solid waste management in Owo and Akure cities, Ondo State, Nigeria. *Scientific Reports*, 15, Article 37799. <https://doi.org/10.1038/s41598-025-21714-y>
- Owusu-Ansah, C. M., Antwi-Agyei, P., & Ofori-Atta, K. (2022). PLS-SEM applications in sustainability research. *MethodsX*, 9, Article 101725. <https://doi.org/10.1016/j.mex.2022.101725>
- Pakpour, A. H., Zeidi, I. M., Emamjomeh, M. M., Asefzadeh, S., & Pearson, H. (2014). Household waste separation behavior. *Waste Management*, 34(9), 1721-1730. <https://doi.org/10.1016/j.wasman.2014.05.005>
- Razali, F., Daud, D., & Wahid, N. (2023). Moderating effects of social norms on recycling behavior. *Journal of Environmental Management*, 332, Article 117335. <https://doi.org/10.1016/j.jenvman.2023.117335>
- Said, A. (2025). [e.g., Community expectations and environmental behavior in collectivist societies: Insights from waste management in Nigeria]. *Journal of Environmental Psychology (or equivalent)*.
- Semwanga, A. R., Nabanoga, G., & Turyahabwe, N. (2022). Social norms and waste segregation in African cities. *Environment, Development and Sustainability*, 24(6), 8125-8143. <https://doi.org/10.1007/s10668-021-01758-9>
- Shen, J., Zheng, D., & Zhang, B. (2019). Self-efficacy and pro-environmental behavior. *Journal of Cleaner Production*, 221, 253-262. <https://doi.org/10.1016/j.jclepro.2019.02.195>

- Sirajo, A. A., Musa, A., & Bello, M. (2025). Sampling strategies in Nigerian urban research. *Nigerian Journal of Social Research*, 18(1), 1-15.
- Tang, Z., Chen, X., & Luo, J. (2023). Environmental self-efficacy and waste sorting behavior. *Sustainability*, 15(4), Article 3349. <https://doi.org/10.3390/su15043349>
- Uche, O. L. (2023). Theoretical approaches to plastic waste regulation in Nigeria. *Beijing Law Review*, 14(4), 1845-1865. <https://doi.org/10.4236/blr.2023.144102>