

Research Article**Littering as Environmental Incivility: Socio-Economic Interactions in Urban Communities in Nigeria**Martin Okokon Ufi^{1,2*}¹Sustainable Development Centre, University of Abuja, Abuja, Nigeria.²Centre for the Study of the Economies of Africa (CSEA), Abuja, Nigeria.

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Abstract

In recent decades, littering has evolved from a primarily aesthetic and environmental concern into a significant ecological and economic challenge with implications for public expenditure, urban environmental quality, and regulatory effectiveness. This study conceptualizes littering as a form of environmental incivility and examines its influence on individuals' anticipation of incivilities and perception of crime prevalence, situating the analysis within the broader framework of ecological and environmental economics. This study also investigates how social characteristics (age, gender and level of education) and economic factors (type of economic activities, occupational status and average monthly income) interact with littering behaviour and show wider socio-economic consequences. Using a correlational research design, data were collected from 600 respondents across Akinyele and Ibadan North Local Government Areas of Oyo State. Structural equation modeling (SEM) was employed to estimate the relationships among key constructs. The findings reveal significant interaction effects between socio economic variables and littering and demonstrate that increased presence of litter is associated with higher perceptions of crime prevalence, suggesting indirect economic costs related to public health risks, environmental degradation, and urban service provision. The results highlight the inefficiencies arising from weak environmental regulation and inadequate waste management infrastructure. The study recommends targeted public investment in waste management facilities, strengthened environmental institutions, and behavior oriented regulatory interventions as cost effective policy measures for mitigating environmental incivility and improving urban environmental outcomes.

Keywords: Litter, fly-tipping, environmental incivilities, perception of crime, socio-economic factors**1. Introduction**

Littering is an inherent reality of modern living that exists in many cities, communities and countries of the world including Nigeria where it has been a major cause for environmental concern. If left unattended to, litter can lead to severe environmental decay and can pose serious health hazards such as exposure to diseases like cholera, malaria and other air and water borne diseases [1, 2]. Rising population is the major factor responsible for the continuous increase of waste generation in the world, and large amount of waste generated cannot be managed easily and properly [3, 4].

Transition points, such as bus stops and other areas where people move from one place to another, are significant hotspots for littering. A study by Schultz et al. [5] found that 88% of small, littered items at such locations were attributed to individuals, which highlights the role of behavior in contributing to the menace of littering. However, littering extends beyond transition points because households and businesses generate large volumes of waste daily yet often pay less attention to the growing accumulation of litter on the streets. Overtime, littering behavior can become a routine activity and in the absence of restrictive laws, it can lead to greater complacency towards this behavior [6, 7].

Littering has evolved into a significant socio-economic problem with substantial costs associated with its removal and management. In the United Kingdom, more than 30 million tonnes of unofficial waste (i.e. not in bins and recognized disposal units) are collected from streets annually. In 2015 the cost of fly-tipping in England alone was estimated to be £209 million, whereas in 2018/19 the estimated cost had increased to be £391.9 million [8]. In the United States of America, \$11.5 billion of taxpayers money was spent in a year to clean up litter across the country and this is ten times more than the cost of trash disposal [9].

In Nigeria, it takes a huge yearly budgetary investment of about ₦4.5 billion by both the Federal Government of Nigeria and the Oyo State Government to evacuate solid waste from Ibadan City - well known as one of the dirtiest cities in Nigeria [10, 11].

The presence of litter in cities and communities has increased tremendously over the years, and it has been greeted with a lackluster attitude from individuals and societies. One of the challenges facing all levels of government in Nigeria is how to reduce litter in the society and this has led to several attempts to establish environmental laws and the corresponding institutions to enforce these laws [12]. The consequences of littering can include financial and manpower costs associated with cleaning activities, health hazards, proliferation of rodents and other small and dangerous insects which breed ailments that may endanger human health [13]. However, littering has been found to lead to more severe cases of incivilities and crime [14]. This has led to calls for research on environmental incivilities (including litter) and their relationships with various crime-related measures.

Despite the growing body of literature on littering and environmental incivility, existing studies have largely focused on either environmental or criminological outcomes in isolation, with limited attention given to the combined socio economic and perceptual pathways through which litter influences anticipation of incivilities and perceptions of crime, particularly in developing urban contexts. Moreover, empirical evidence from Sub Saharan African cities remains scarce, and few studies have employed integrative modeling approaches capable of capturing both direct and interaction effects among social, economic, and perceptual variables. This study addresses these gaps by adopting a structural equation modeling framework to jointly examine the socio-economic determinants of littering and their indirect effects on anticipation of incivilities and perceptions of crime prevalence. The aim of this study, therefore, is to investigate the existence of environmental incivility, littering, and its impact on people's anticipation of incivilities in a given space and people's perceptions of crime prevalence.

The remainder of this paper is structured as follows. Section 2 presents the literature review, outlining the theoretical foundations and empirical evidence on littering and environmental incivility. Section 3 describes the methodology, including the model specification, data sources, sampling procedure, and estimation techniques based on structural equation modeling. Section 4 presents and discusses empirical results, including preliminary analysis, model estimation, and interpretation of findings. Section 5 concludes the paper by summarizing the key findings, discussing their policy implications, and suggesting directions for future research.

2. Literature Review

2.1 Theoretical Framework

Littering and environmental incivility can be understood through multiple theoretical lenses, including the Broken Windows Theory, the Norm Activation Model (NAM), and attitudinal theories such as the Theory of Planned Behaviour. The broken windows theory was introduced in 1982 by James Q. Wilson and George Kelling [15], and it is a theory of norm-setting and shows the effect of disorder and willful or malicious destruction of property on additional crime and anti-social behavior. The theory posits that when a seemingly minor infraction like littering and graffiti goes unchecked, it can create an environment that fosters more serious defiant behaviour, ultimately leading to lawlessness.

On the other hand, the Norm Activation Model (NAM), developed by Shalom Schwartz [16], provides a psychological explanation for pro-environmental behavior. It posits that individuals are more likely to engage in responsible behavior, such as proper waste disposal, when they (i) are aware of the negative consequences of inaction, and (ii) feel a personal moral obligation to act. In the context of this study, NAM helps explain how social norms and moral beliefs shape responses to littering and influence community-level environmental outcomes.

To further deepen the understanding of individual behavior, this study also draws on the Theory of Planned Behavior (TPB) developed by Ajzen [17]. TPB posits that behavior is guided by three key components: attitudes toward the behavior, subjective norms, and perceived behavioral control. Attitudinal approaches, as emphasized in TPB, are particularly relevant in understanding littering, as individuals' beliefs about the consequences of littering (e.g., whether it is harmful or acceptable), their perception of social expectations (e.g., whether others litter), and their sense of control (e.g., availability of bins) all contribute to their likelihood of engaging in or avoiding littering.

By integrating these three theories, this study offers a multi-level framework for understanding how environmental cues, moral responsibility, and personal attitudes interact with socio-economic factors to influence littering behavior, anticipation of incivilities, and perceptions of crime prevalence. This triangulated theoretical foundation supports the use of structural equation modeling (SEM) to test both direct and mediated relationships among observed constructs.

2.2 Empirical Review

Empirical research presents varied findings in explaining littering behavior an environmental incivility. Studies have shown that visible signs or disorder, such as litter, contribute to rule-breaking behaviour and a weakened sense of social control. For instance, research by Abed and Aljibarat [18] found that the deteriorated built environment, represented by physical incivility signs such as abandoned buildings, litter, and graffiti, contributed significantly to a feeling of unsafety for residents. Medway et al [14] found the existence of a causal relationship between litter and both anticipation of incivilities and perception of crime prevalence. Navarrete-Hernandez et al. [19] also found that multiple physical signs of incivility in an area, such as the presence of litter, foster a perception that residents are unable or unwilling to protect their neighborhoods from crime, which leads to a localized increase in fear.

On the other hand, Ojedokun et al. [20] found that people who intend to prevent littering are also more likely to engage in actual littering behaviour. In a similar vein, Mori et al. [21] found that individuals with pro-environmental behavioral intentions engaged in littering behaviors when dominated by anti-environmental implementation intentions in situations conducive to, encouraging, or tempting littering.

Recent empirical evidence has further expanded the understanding of littering and waste mismanagement as critical socio economic and public health challenges in urban environments. Omowumi and Abdulkadir [13] assessed the environmental and health implications of waste management deficiencies in Gwagwalada, Abuja, using an integrated solid waste management framework. Their findings revealed a statistically significant relationship between improper waste management practices and deteriorating health outcomes among residents, underscoring the economic and welfare costs associated with weak waste governance. The study emphasized the role of information provision, behavioral change, and public procurement policies as effective tools for improving waste management outcomes.

Similarly, Oluwadamilola and Qazeem [4] examined the institutional and operational dimensions of solid waste management in Ibadan and Port Harcourt, employing a mixed methods approach. Their findings revealed that fragile institutional frameworks, inadequate funding, weak enforcement mechanisms, and poor inter agency coordination significantly exacerbate environmental degradation and public health risks. The study highlights the importance of institutional capacity building, public private partnerships, and community participation as key strategies for achieving sustainable urban waste management.

At the micro level, Dimkpa et al. [22] explored waste management practices in urban eateries in Port Harcourt and their implications for environmental hygiene and public health. The study found that inadequate waste storage, irregular waste collection, and poor compliance with sanitation guidelines contribute significantly to pest infestation, thereby increasing health risks. The authors emphasized that infrastructural improvements, regulatory enforcement, and targeted training are essential for mitigating the environmental and health externalities associated with poor waste handling practices.

From an environmental quality perspective, Fayomi et al. [23] provided a comprehensive review of the impact of waste littering and dumping on surface water quality in Nigeria. Their findings revealed that widespread littering, particularly plastic waste, contributes to elevated levels of heavy metals, turbidity, and microbial contamination in surface water bodies, rendering many sources unsuitable for human consumption. The study highlighted the broader ecological and economic implications of waste mismanagement, including ecosystem degradation, increased water treatment costs, and heightened public health risks, and called for stronger waste management policies, enforcement of littering penalties, and increased public awareness.

Collectively, these findings suggest that interventions aimed at improving individual awareness and reinforcing social norms could effectively reduce littering and thus environmental incivility. An integrated approach that combines behavioral change strategies, infrastructural investment, and regulatory enforcement is crucial for addressing the socio economic, environmental, and public health externalities of littering. Such an approach offers a more comprehensive understanding of littering behavior and its

wider implications, as empirical evidence increasingly suggests that both institutional effectiveness and individual behavioral responses shape environmental outcomes in urban settings.

3. Methodology

3.1 Model Specification

This study developed a structural model (Figure 1) and applied a SEM technique to estimate the relationships. The model demonstrates the direct and indirect influences between the social and economic constructs (age, gender, level of education, occupation, level of income) as they affect littering attitude, the anticipation of incivilities (AOI) and perception of crime prevalence (PCP). Given the cross-sectional nature of the data, the model is correlational and does not imply causal inference, but rather identifies patterns of association among constructs.

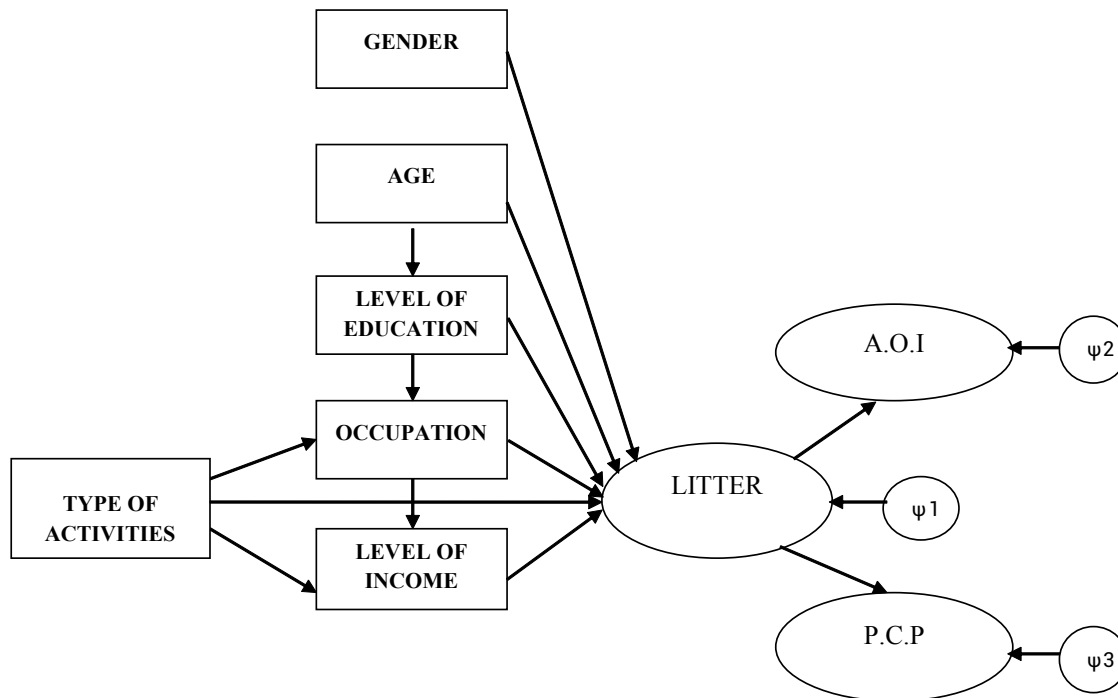


Figure 1. Path diagram of the structural model.

All constructs in this model have direct and indirect impact (through the mediating role of each of the constructs – except gender) on litter and indirect impact of anticipation of incivilities and perceptions of crime prevalence (through the mediating role of litter). The model can be represented in the Matrix form below:

$$\begin{bmatrix} \text{AGE} \\ \text{GENDER} \\ \text{LEVEL OF EDUCATION} \\ \text{OCCUPATION} \\ \text{LEVEL OF INCOME} \\ \text{TYPE OF ACTIVITIES} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ \theta_{1,3} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \theta_{3,4} & 0 & 0 & \theta_{6,4} \\ 0 & 0 & 0 & \theta_{4,5} & 0 & \theta_{6,5} \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} \text{AGE} \\ \text{GENDER} \\ \text{LEVEL OF EDUCATION} \\ \text{OCCUPATION} \\ \text{LEVEL OF INCOME} \\ \text{TYPE OF ACTIVITIES} \end{bmatrix} + \begin{bmatrix} \lambda_{1,1} & 0 & 0 \\ \lambda_{2,1} & 0 & 0 \\ \lambda_{3,1} & 0 & 0 \\ \lambda_{5,1} & 0 & 0 \\ \lambda_{6,1} & 0 & 0 \end{bmatrix} \times \begin{bmatrix} \text{LITTER} \\ \text{AOI} \\ \text{PCP} \end{bmatrix} + \begin{bmatrix} \psi_1 \\ \psi_2 \\ \psi_3 \end{bmatrix}$$

θ_{ij} and λ_{ij} are parameters to be estimated. θ_{ij} represents the $m \times m$ matrix denoting the effect of the i th predictor variables (social and economic) on the j th predictor variables (social and economic) constructs. λ_{ij} represents the $m \times n$ matrix denoting the effects

of the *i*th predictor variables (social and economic) constructs on the *j*th outcome variables constructs. ψ_i represents the error terms for the model.

3.2 Data Sources and Estimation

A multistage sampling technique was used in the selection of participants. Ibadan North and Akinyele Local Government Areas of Oyo State was purposively selected for data collection. A total sample of 600 respondents were sampled in the study area: 300 each from the two Local Government Areas.

For this study, we employed Confirmatory Factor Analysis which allowed for the assessment of fit between observed data and a theoretically grounded model that specifies the hypothesized causal relations between latent factors and their observed indicator variables. Structural equations modeling (SEM) was applied to examine if there is a causal relationship between exogenous and endogenous variables.

SEM was considered appropriate for this study because it allows for the simultaneous estimation of multiple interrelated dependence relationships while explicitly accounting for measurement errors in latent constructs such as littering, anticipation of incivilities, and perceptions of crime prevalence. Unlike traditional regression techniques, SEM enables the modeling of both direct and indirect effects among social, economic, and perceptual variables within a single analytical framework, making it particularly suitable for examining complex socio-economic interactions [24-25].

SEM was carried out in two stages – the measurement model and structural model analysis. The measurement model analysis tested the reliability of the observed items in determining whether items adequately measure the variables represented. The model considered measurement errors which reduced the bias in the SEM model. The structural model analysis tested the relationship between endogenous and exogenous variables as well as relationship among endogenous variables. Analysis of Movement Structure (AMOS) was used to estimate the SEM model and to test the causal relationship between the variables. A maximum likelihood (ML) estimator was employed in AMOS for the estimation, as it provides efficient and consistent parameter estimates under conditions of multivariate normality and moderate deviations from normality [26-27].

4. Data Analysis and Discussion of Result

4.1. Preliminary analysis

To provide context for interpreting the findings, a descriptive summary of participants’ key demographic characteristics is presented below. This includes gender, age, marital status, education, occupation, income distribution, and type of environment.

As shown in Figure 2(A) below, out of the total respondents surveyed, 53.3% were male while 46.7% were female. As seen in Figure 2(B), most respondents were between 20 and 30 years old (46.7%), followed by those aged 31 to 45 years (30.1%), with fewer participants in the younger (13–19 years, 12.8%) and older age brackets (46–65 years, 9.5%; above 65 years, 0.9%).

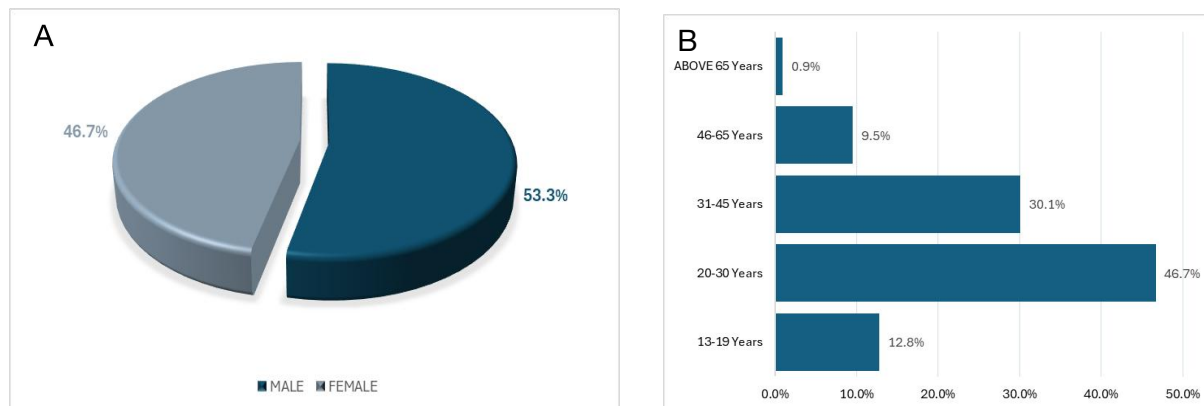


Figure 2. (A) Gender and (B) Age Distribution of Respondents

As seen in Figure 3(A), most respondents had a Primary or Secondary School Certificate (45.4%), followed by those with HND/BSc or related degrees (20.4%) and ND/NCE or other diplomas (16.2%), while 11.7% held postgraduate qualifications, and 6.3% had no formal education. Additionally, Figure 3(B) shows that the largest proportion of respondents were business owners (32.4%), followed closely by students (30.3%), while public sector employees (15.3%) and private sector employees (15.1%) made up nearly equal shares, and unemployed individuals accounted for 6.8% of the sample.

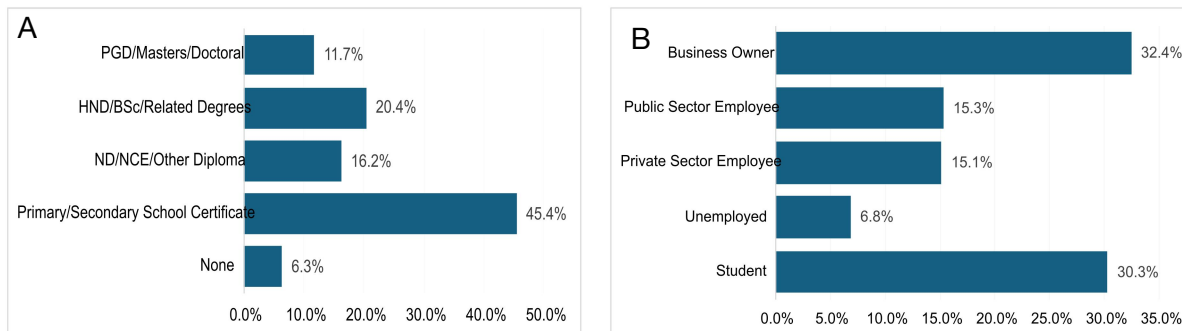


Figure 3. (A) Educational qualification and (B) occupational status of respondents.

Most respondents earned below ₦30,000 per month (58.6%), followed by 35.9% who earned between ₦30,001 and ₦99,999, while only 5.2% reported monthly incomes between ₦100,000 and ₦499,999, 0.4% earned between ₦500,000 and ₦1,000,000, and none earned above ₦1,000,000 (Figure 4A). Lastly, as seen in Figure 4(B), most of the respondents resided in urban areas (68.3%), while 31.7% resided in rural locations.

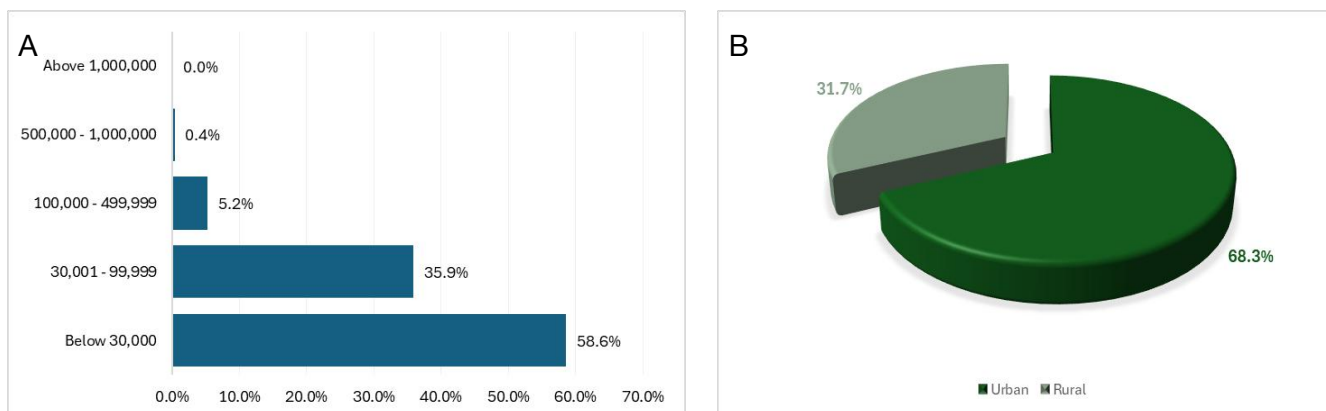


Figure 4. (A) Average monthly income and (B) location of respondents.

In both LGAs, majority of participants reported that there are no waste receptacles in their immediate environments. In Akinyele LGA, participants that reported the existence of waste receptacles in their environment indicated waste collection vehicles as the most used waste receptacle while most participants in Ibadan North LGA indicated waste bins/drums as the most used form of waste receptacles in their environment. Furthermore, most participants in both LGAs also indicated that there are no mechanisms (like presence of environmental officials, imposition of fines, etc.) for controlling and/or managing littering behaviors in their environment.

4.2. Model Presentation

Proposed Model For Estimation

The model presents the direct and indirect effects of a combination of exogenous social and economic constructs on litter as well as their indirect effects on anticipation of incivilities and perceptions of crime prevalence. Litter is measured by thirty-two items, anticipation of incivilities by eleven items and perceptions of crime prevalence by six items. The proposed model for estimation is shown in supplementary file (Figure S1).

Table 1. Participants' responses on methods of waste disposal.

Category	Availability of Waste Receptacles					
	Akinyele LGA		Ibadan North LGA		All LGAs	
	Frequency	%	Frequency	%	Frequency	%
Yes	124	45.8	133	46.8	257	46.3
No	147	54.2	151	53.2	298	53.7
Total	271	100	284	100	555	100
Category	Respondents' Methods of Waste Disposal					
	Akinyele LGA		Ibadan North LGA		All LGAs	
	Frequency	%	Frequency	%	Frequency	%
In waste cans	25	9.2	102	35.9	127	22.9
Through waste collection vehicles	216	79.7	125	44.0	341	61.4
By burning them	18	6.6	39	13.7	57	10.3
Through incinerators	12	4.4	17	6.0	29	5.2
Streams	-	-	1	0.4	1	0.2
Total	271	100	284	100	555	100
Category	Usage of nearby bushes/canals as alternative method of waste disposal					
	Akinyele LGA		Ibadan North LGA		All LGAs	
	Frequency	%	Frequency	%	Frequency	%
Yes	129	47.6	88	30.9	217	39.1
No	142	52.4	196	69.1	338	60.9
Total	271	100	284	100	555	100
Category	Availability of mechanisms for managing or controlling littering behaviors					
	Akinyele LGA		Ibadan North LGA		All LGAs	
	Frequency	%	Frequency	%	Frequency	%
Yes	90	33.2	89	31.3	179	32.3
No	181	66.8	195	68.7	376	67.7
Total	271	100	284	100	555	100
Category	Type of mechanism for managing/controlling littering behaviors					
	Akinyele LGA		Ibadan North LGA		All LGAs	
	Frequency	%	Frequency	%	Frequency	%
Provision of waste collection bins/drums	10	3.7	28	9.9	38	6.8
Presence of environmental officials	77	28.4	42	14.8	42	7.6
Imposition of fines on defaulters	3	1.1	5	1.8	8	1.4
Indifferent	-	-	14	4.9	14	2.5
None	181	66.8	195	68.7	376	67.7
Total	271	100	284	100	555	100

Source: Author's Computation (2025)

Initial Estimated Model

The structural models were estimated to test for the hypothesized relationships among the constructs. Maximum likelihood estimation was used for the regression analysis as parameters produced with this technique are assumed to be robust in the presence of moderate violation of non-normality [24]. Various evaluative indexes have been suggested to assess goodness-of-fit of a model, though there are no exact threshold for these indexes. The indexes adopted for use in this study are like those used by Adedeji et al. [28]. These are: Chi-square (χ^2), Normed chi-square (χ^2/DF), goodness-of-fit index (GFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Incremental Fit Index (IFI) and the Root Mean Square Error of Approximation (RMSEA).

In the initial model, the RMSEA value was 0.81. The values of GFI, CFI, TLI and IFI also fell below the recommended threshold of 0.9 [25][27]. Since the chi-square has been found to be sensitive to sample size, as the chi-square often rejects models of sample size greater than 200, the normed chi-square was used to replace the chi-square. However, some of the normed chi-square values for our initial estimates were above (and some below) the cut-off point of 5 which is used as an indication of good fit. Generally, the values of the indexes indicated poor fit, implying that the proposed model does not fit the data well enough.

However, in order to achieve a better model fit, the model was modified by removing items with factor loadings below 0.4 [29]. Based on this criterion, the models were modified by removing items with low factor loadings, starting with the items with the lowest factor loading. The initial estimates are presented in supplementary file (Figure S2).

Modified Model

Figure S3 in supplementary file presents the modified model and it shows that the normed chi-square value = 6.729 which is above the 5.0 cut-off point, hence indicating a bad model fit. The GFI value = 0.878 (≈ 0.9) indicates a good fit. CFI = 0.713, IFI = 0.717, TLI = 0.641 and RMSEA = 0.102 indicates bad fit. Table 2 presents the SMC values for the modified model. Q61 is a key indicator of litter with SMC value of 0.598. This means that $\approx 60\%$ of the variation in litter is explained by Q61. This is followed by Q62 with SMC = 0.512 and Q63 with SMC = 0.505. This means that 52% and 50% of the variations in litter is explained by Q62 and Q63 respectively. A key indicator of PCP is Q92 with SMC value = 0.754. This means that 75% of the variation in PCP is explained by Q92. Lastly, a key indicator of AOI is Q88 with SMC value = 0.653 meaning that 65% of the variations in AOI is explained by Q88.

Table 2. Squared multiple correlations: modified model.

Variable/Item	Estimate
HIGHESTEDUCATION	0.030
OCCUPATION	0.022
MONTHLYINCOME	0.003
LITTER	0.110
Perception of crime prevalence (P.C.P)	0.093
Anticipation of incivilities (A.O.I)	0.000
I am not comfortable in a littered surrounding (Q63)	0.505
Seeing someone littering upsets me (Q62)	0.512
Seeing litter in drainages upsets me personally (Q61)	0.598
A littered environment creates a safe haven for criminals of all sorts (Q94)	0.364
Crime in my Local Government has gone up in the past few (Q93)	0.082
A littered environment has higher crime occurrence than a non-littered environment (Q92)	0.754
People using or dealing illicit drugs (Q90)	0.457
People begging (Q88)	0.653
People drunk (Q87)	0.547

Source: Author’s Computation (2025)

4.3. Results and Discussion

Tables 3 to 5 present the standardized direct, indirect, and total effects estimated in the model. The standardized direct (unmediated) effect of litter on perceptions of crime prevalence (P.C.P) is 0.304, indicating that a one standard deviation increase in litter is associated with a 0.304 standard deviation increase in perceived crime prevalence. This finding provides empirical support for the incivilities hypothesis, which posits that visible physical disorder, including litter, is associated with heightened perceptions of insecurity and crime. It is consistent with empirical evidence showing that litter and other forms of physical incivility are linked to higher perceived crime prevalence and anticipation of disorder [14][30].

The standardized direct (unmediated) effect of litter on anticipation of incivilities (A.O.I) is -0.008, indicating a small negative relationship. Although the magnitude of this effect is limited, its direction suggests the possibility of habituation or normalization of environmental disorder in contexts where litter is persistent. In such settings, repeated exposure may reduce anticipatory reactions to incivilities even when perceptions of crime prevalence increase, implying that perceived risk and anticipatory responses may not necessarily move in the same direction. This finding aligns with studies demonstrating that relationships between disorder cues, fear, and anticipation are complex and context dependent [30][19].

The standardized direct effect of monthly income on litter is positive but small (0.007), while occupation exhibits a negative effect on litter (-0.140). These results suggest that economic positioning influences littering attitudes and behaviors, though not always in a linear or intuitive manner. This reinforces the importance of interpreting socio-economic effects alongside contextual factors such as waste infrastructure availability and enforcement mechanisms.

Table 3 - Standardized direct effects.

VARIABLE / ITEM	GENDER	AGE	Q8	HIGHEST EDUCATION	OCCUPATION	MONTHLY INCOME	LITTER	P.C.P	A.O.I
HIGHEST EDUCATION	0	0.172	0	0	0	0	0	0	0
OCCUPATION	0	0	0.001	-0.148	0	0	0	0	0
MONTHLY INCOME	0	0	-0.044	0	0.024	0	0	0	0
LITTER	0.1	0.082	0.045	0.234	-0.14	0.007	0	0	0
P.C.P	0	0	0	0	0	0	0.304	0	0
A.O.I	0	0	0	0	0	0	-0.008	0	0
Q63	0	0	0	0	0	0	0.711	0	0
Q62	0	0	0	0	0	0	0.716	0	0
Q61	0	0	0	0	0	0	0.774	0	0
Q94	0	0	0	0	0	0	0	0.603	0
Q93	0	0	0	0	0	0	0	0.286	0
Q92	0	0	0	0	0	0	0	0.868	0
Q90	0	0	0	0	0	0	0	0	0.676
Q88	0	0	0	0	0	0	0	0	0.808
Q87	0	0	0	0	0	0	0	0	0.74

Source: Author’s Computation (2025)

Education shows a positive direct effect on littering (0.234) and perceptions of crime prevalence, but a negative effect on anticipation of incivilities. This finding suggests that higher formal education alone does not necessarily translate into lower littering behavior in this context. One possible explanation is that pro-environmental attitudes may be constrained by weak environmental governance, limited availability of waste receptacles, and low perceived enforcement, thereby weakening the translation of environmental knowledge into behavior. This interpretation is consistent with recent evidence emphasizing the primacy of institutional capacity, enforcement, and operational effectiveness in shaping solid waste outcomes in Nigerian cities [4].

Table 4. Standardized indirect effects.

VARIABLE / ITEM	GENDER	AGE	Q8	HIGHEST EDUCATION	OCCUPATION	MONTHLY INCOME	LITTER	P.C.P	A.O.I
HIGHEST EDUCATION	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OCCUPATION	0.000	-0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MONTHLY INCOME	0.000	-0.001	0.000	-0.004	0.000	0.000	0.000	0.000	0.000
LITTER	0.000	0.044	0.000	0.021	0.000	0.000	0.000	0.000	0.000
P.C.P	0.031	0.038	0.014	0.077	-0.043	0.002	0.000	0.000	0.000
A.O.I	-0.001	-0.001	0.000	-0.002	0.001	0.000	0.000	0.000	0.000
Q63	0.071	0.089	0.032	0.181	-0.099	0.005	0.000	0.000	0.000
Q62	0.072	0.090	0.032	0.182	-0.100	0.005	0.000	0.000	0.000
Q61	0.078	0.097	0.034	0.197	-0.108	0.005	0.000	0.000	0.000
Q94	0.018	0.023	0.008	0.047	-0.026	0.001	0.184	0.000	0.000
Q93	0.009	0.011	0.004	0.022	-0.012	0.001	0.087	0.000	0.000
Q92	0.027	0.033	0.012	0.067	-0.037	0.002	0.264	0.000	0.000
Q90	-0.001	-0.001	0.000	-0.001	0.001	0.000	-0.005	0.000	0.000
Q88	-0.001	-0.001	0.000	-0.002	0.001	0.000	-0.006	0.000	0.000
Q87	-0.001	-0.001	0.000	-0.001	0.001	0.000	-0.006	0.000	0.000

Source: Author's Computation (2025)

Table 5. Standardized total effects.

VARIABLE / ITEM	GENDER	AGE	Q8	HIGHEST EDUCATION	OCCUPATION	MONTHLY INCOME	LITTER	P.C.P	A.O.I
HIGHEST EDUCATION	0.000	0.172	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OCCUPATION	0.000	-0.026	0.001	-0.148	0.000	0.000	0.000	0.000	0.000
MONTHLY INCOME	0.000	-0.001	-0.044	-0.004	0.024	0.000	0.000	0.000	0.000
LITTER	0.100	0.126	0.045	0.254	-0.140	0.007	0.000	0.000	0.000
P.C.P	0.031	0.038	0.014	0.077	-0.043	0.002	0.304	0.000	0.000
A.O.I	-0.001	-0.001	0.000	-0.002	0.001	0.000	-0.008	0.000	0.000
Q63	0.071	0.089	0.032	0.181	-0.099	0.005	0.711	0.000	0.000
Q62	0.072	0.090	0.032	0.182	-0.100	0.005	0.716	0.000	0.000
Q61	0.078	0.097	0.034	0.197	-0.108	0.005	0.774	0.000	0.000
Q94	0.018	0.023	0.008	0.047	-0.026	0.001	0.184	0.603	0.000
Q93	0.009	0.011	0.004	0.022	-0.012	0.001	0.087	0.286	0.000
Q92	0.027	0.033	0.012	0.067	-0.037	0.002	0.264	0.868	0.000
Q90	-0.001	-0.001	0.000	-0.001	0.001	0.000	-0.005	0.000	0.676
Q88	-0.001	-0.001	0.000	-0.002	0.001	0.000	-0.006	0.000	0.808
Q87	-0.001	-0.001	0.000	-0.001	0.001	0.000	-0.006	0.000	0.740

Source: Author's Computation (2025)

The standardized direct effects of age (0.082) and gender (0.100) on litter indicate demographic heterogeneity in littering behavior and related perceptions. These findings imply that uniform policy interventions may be less effective than targeted strategies that account for age- and gender-specific differences in exposure, behavior, and perception of environmental incivilities.

Further results show that age positively influences educational attainment, while education negatively affects occupation, and occupation positively affects income. However, the standardized indirect effects of age and occupation on litter through education and income, respectively, are weak and statistically insignificant. Similarly, the indirect effect of gender on perceptions of crime prevalence is positive but insignificant, while its indirect effect on anticipation of incivilities is negative and significant. Overall, the weak mediation effects indicate that the relationships in the model are driven primarily by direct pathways rather than indirect channels. This highlights the relevance of examining interaction effects and contextual constraints, particularly institutional and infrastructural conditions that shape environmental behavior and perceptions at the neighborhood level.

Beyond the structural coefficients, the descriptive evidence indicates that littering in both LGAs is strongly associated with environmental service gaps. The reported unavailability of waste receptacles and the limited presence of mechanisms for controlling littering suggest that individual behavior is taking place in an enabling environment for improper disposal. This is consistent with experimental and applied evidence showing that the placement and availability of receptacles can influence littering behavior in public spaces [31]. It also aligns with recent Nigerian evidence emphasizing how weak institutional arrangements, irregular collection systems, and limited enforcement contribute to persistent urban waste challenges [4].

The strong linkage between litter and perceived crime prevalence also has important implications for urban welfare and public expenditure. Increased perceptions of crime associated with environmental disorder may reduce public space usage, weaken informal social control, and increase demand for formal security interventions and other public services. Prior research has shown that physical disorder and neighborhood conditions play a critical role in shaping safety perceptions and urban livability [19].

Finally, the results reinforce the policy relevance of combining infrastructure investment with institutional strengthening. Recent empirical evidence indicates that deficiencies in waste management systems are closely associated with adverse environmental and public health outcomes, while weak enforcement, inadequate funding, and limited institutional coordination increase these risks in urban settings [4][13][22-23]. These findings highlight the need for integrated urban environmental policies that address both behavioral and institutional dimensions of littering in order to improve environmental quality and urban safety outcomes.

5. Conclusion

This study examined the relationships between selected social factors (age, gender, and educational attainment), economic factors (type of economic activity, occupational status, and average monthly income), and key latent constructs of environmental incivility, namely littering, perceptions of crime prevalence, and anticipation of incivilities. Using structural equation modeling, the study provided empirical evidence on how socio economic characteristics interact with environmental conditions to shape both behavioral and perceptual outcomes in urban settings.

The findings reveal that littering plays a significant role in shaping perceptions of crime prevalence, lending support to the incivilities hypothesis that visible physical disorder contributes to heightened perceptions of insecurity. While the direct effect of litter on anticipation of incivilities was weak and negative, the results suggest that repeated exposure to environmental disorder may reduce anticipatory responses, pointing to possible habituation effects in contexts where litter is persistent. Socio demographic characteristics were also found to influence littering behavior and related perceptions, with age, gender, education, occupation, and income exhibiting differentiated effects. Notably, higher educational attainment did not necessarily translate into lower littering behavior, underscoring the importance of contextual and institutional factors in shaping environmental outcomes.

From a policy perspective, the results highlight the central role of environmental infrastructure and institutional effectiveness in addressing littering and environmental incivility. The widespread absence of waste receptacles and weak mechanisms for controlling littering behavior suggest that individual actions occur within an enabling environment for improper disposal. Accordingly, policy interventions should prioritize the strategic provision of waste management infrastructure, including adequately distributed waste receptacles and reliable collection systems. Strengthening institutional capacity through improved enforcement, clearer regulatory frameworks, and better coordination among relevant agencies is also essential for reducing the socio economic and public health costs associated with littering.

In addition to infrastructure and enforcement, behavior focused interventions remain important. Public awareness campaigns that reinforce social norms against littering, combined with community engagement initiatives, can help translate environmental knowledge into responsible behavior. The integration of technological tools, such as geospatial monitoring of littering hotspots and data driven enforcement mechanisms, may further enhance the effectiveness of waste management policies and reduce long term cleanup costs.

Despite its contributions, this study has some limitations that point to avenues for future research. The cross-sectional design limits the ability to draw causal inferences, suggesting the need for longitudinal or experimental studies to better capture dynamic relationships between environmental incivility and perceptions of crime. Future research could also incorporate objective measures of litter and crime alongside perceptual data, extend the analysis to other urban and rural contexts, and explore the role of additional institutional and policy variables. Such efforts would deepen understanding of the economic, environmental, and social dimensions of littering and support the design of more effective and context sensitive urban environmental policies.

Declarations

Ethics approval/declaration: This study involved a survey of adult participants and posed minimal risk to respondents. Ethical principles guiding social science research were strictly observed throughout the study. Prior to participation, all respondents were informed about the purpose of the research, the voluntary nature of their participation, the confidentiality and anonymity of their responses, and their right to withdraw from the study at any time without any consequences. Verbal informed consent was obtained from all participants before data collection commenced. No personal identifiers were collected, and all data were analyzed and reported in aggregate form to ensure participant confidentiality.

Consent to participate: Not applicable.

Consent for publication: Not applicable.

Author Contributions: Martin Ufi – conceptualization, methodology, writing, data analysis, original draft preparation, review and editing. All authors reviewed and approved the final manuscript.

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Conflicts of Interest: The authors declare no conflict of interest.

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