

Assessing the Role of Environmental Awareness in Packaging Waste Reduction Towards Sustainable Development

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Abstract— The increasing generation of packaging waste, particularly from single-use plastics, has become a major environmental challenge worldwide, contributing to pollution, resource depletion, greenhouse gas emissions, and public health concerns. This study assessed the role of environmental awareness in promoting packaging waste reduction toward sustainable development in Ibadan Metropolis, Nigeria. Data were collected through a structured questionnaire administered to 420 households selected using a multi-stage sampling procedure, of which 410 valid responses were analyzed. Descriptive statistics and Pearson correlation analysis were employed to examine the relationship between environmental awareness and packaging waste reduction behaviors. The findings revealed that respondents exhibited high awareness of the environmental and health impacts of packaging waste, with strong recognition of pollution and public health risks associated with improper disposal. However, awareness of recycling programs, government regulations, and sustainable development concepts was relatively low. Behavioral practices such as recycling, waste separation, reuse of packaging materials, and reduction of single-use plastics were also found to be limited. Environmental awareness showed a significant positive relationship with packaging waste reduction ($r = 0.71$, $p < 0.01$), indicating that increased awareness contributes to improved waste management practices. Nevertheless, structural barriers including weak policy enforcement, inadequate recycling infrastructure, limited access to sustainable alternatives, and economic constraints hinder the translation of awareness into action. The study concludes that environmental awareness is a necessary but insufficient condition for effective packaging waste reduction. It recommends strengthening environmental education, improving recycling infrastructure, enforcing waste management regulations, and providing economic incentives to encourage sustainable consumption and support circular economy objectives.

Keywords— Environmental awareness, packaging waste, recycling behavior, sustainable development, sustainable consumption, circular economy.

I. INTRODUCTION

Packaging is an essential component of virtually all consumer goods (Sonneveld et al., 2005). It serves critical functions, including protecting products from contamination, providing information and identification, and facilitating efficient transportation and distribution. Despite these benefits, packaging waste represents a significant fraction of municipal

solid waste (MSW). Current estimates suggest that approximately 10 million tons of solid waste are generated globally each year, with packaging materials accounting for nearly one-third of this total (Zhang & Zhao, 2012). In recent decades, packaging has attracted considerable public scrutiny. Modern products are marketed in diverse packaging formats, utilizing various materials and sizes to enhance functionality, branding, and consumer appeal (Pasqualino et al., 2011). However, this diversification has contributed to the rapid expansion of packaging waste, which has been identified as one of the fastest-growing components of municipal solid waste since the 1970s (Cahill et al., 2010).

Furthermore, the exponential growth in consumerism and urbanization has substantially amplified the volume of packaging materials entering waste streams globally. Single-use plastics, paperboard, and composite materials, in particular, constitute a large share of solid waste due to their short product life cycles and limited potential for reuse or recycling. Consequently, packaging waste has emerged as a critical environmental and policy concern requiring sustainable management strategies. In developing countries, inadequate waste management infrastructure further exacerbates the environmental burden associated with packaging waste, leading to environmental degradation, blocked drainage systems, flooding, and health hazards. Then, environmental awareness has emerged as a critical non-technological strategy for addressing packaging waste challenges. Awareness influences individuals' environmental attitudes, knowledge, and behavioral intentions, which collectively shape consumption choices and waste management practices. While policy frameworks and technological innovations are essential, behavioral transformation among consumers remains fundamental to achieving sustainable waste reduction outcomes. Meanwhile, environmental sustainability and waste management rules have become interdependent. The principles and mechanisms that frame waste regulations are key in successfully protecting ecosystems from excessive resource extraction and limiting the impact from harmful substances on the environment and human health.

Packaging waste has become one of the most rapidly expanding fractions of municipal solid waste worldwide,

largely propelled by urbanization, industrial growth, population expansion, and evolving consumption habits. The rapid growth of e-commerce, convenience-oriented lifestyles, and food delivery services has intensified dependence on single-use packaging, especially plastics. Estimates indicate that nearly 50% of plastic products are designed for single use, while only about 20–25% are intended for long-term applications (Geyer et al., 2017; Hopewell et al., 2009). Consequently, as plastic production has surged, waste generation has increased correspondingly. Of the 8,300 million tonnes of plastic produced globally between 1950 and 2015, approximately 4,900 million tonnes were discarded (Geyer et al., 2017).

Although plastics are theoretically recoverable, around half of all plastic products have limited economic value, making recycling financially unattractive. Historically, only about 2% of plastic waste generated since the 1950s has been recycled, around 6% incinerated, and the overwhelming majority approximately 92% either landfilled or released into the natural environment (Geyer et al., 2017). The environmental burden is not confined to land, as an estimated 4.8 to 12.7 million tonnes of plastic enter the oceans annually (Agamuthu et al., 2019).

Unlike biodegradable organic materials such as wood, plastics degrade extremely slowly. Depending on environmental conditions, decomposition may take decades or even centuries. This persistence leads to the accumulation of plastics in terrestrial and marine ecosystems, where they pose significant ecological risks (Ballerini et al., 2018; Brandon et al., 2019). These realities underscore the urgent need for effective strategies to mitigate plastic pollution and, importantly, to better understand the behavioral factors underlying inadequate plastic waste management practices. The United Nations Environment Programme estimates that packaging accounts for approximately 36% of global plastic production, with a large proportion ending up in landfills or the natural environment due to inadequate recycling systems and poor waste management infrastructure. Approximately 50% of plastic objects made are intended for single use and only 20% to 25% for long-term use (Geyer et al., 2017; Hopewell et al., 2009). However, plastic waste is not limited to continents since approximately 4.8 to 12.7 million tonnes of plastic ends up in the oceans each year (Agamuthu et al., 2019). This trend is particularly pronounced in developing countries where rapid urbanization outpaces waste management capacity. Packaging waste presents multiple environmental risks, including soil and water contamination, greenhouse gas emissions, marine pollution, and biodiversity loss. Improper disposal contributes to microplastic accumulation in ecosystems and food chains, posing long-term health implications for humans and wildlife. Consequently, reducing packaging waste has become a central priority within global sustainability agendas such as the circular economy framework and sustainable consumption initiatives. According to Boudreaux and Palmer (2007), packaging represents the initial point of contact between a product and its consumers, establishing the first interaction regardless of the product's intrinsic quality. Packaging therefore plays a critical role in shaping consumer perception and purchase decisions. A wide range of materials is used in packaging, including glass, wood, metal, paper, and plastics. These materials may be

applied individually or combined with others to meet specific functional, protective, and marketing requirements.

Environmental awareness is widely recognized as a key determinant of pro-environmental behaviour and sustainable consumption practices. It encompasses individuals' knowledge, attitudes, perceptions, and concern regarding environmental issues and their consequences. According to Yeung (1998), environmental awareness involves understanding environmental processes and challenges, appreciating environmental quality, and demonstrating commitment to environmentally responsible behaviour. Similarly, Mkik et al. (2017) and Rahayu et al. (2017) argue that awareness encourages individuals to recognize environmental vulnerability and adopt behaviours that protect natural resources.

Environmental knowledge forms an important component of environmental awareness. It refers to an individual's understanding of environmental concepts, issues, and the consequences of human actions on the environment (Chen, 2013). Such knowledge influences how consumers acquire, interpret, and utilize information in making purchasing decisions (Haryadi, 2009). Consumers with greater environmental knowledge are more likely to identify environmentally friendly products and support sustainable consumption practices (Tang et al., 2014; Yadav & Pathak, 2017). Environmental attitudes also influence behavioural outcomes. Sumarsono and Giyatno (2012) explain that attitudes are shaped by cognitive, affective, and behavioural components, while Luo and Deng (2008) describe environmental attitudes as individuals' evaluations of environmental actions and human–nature relationships. Positive environmental attitudes increase the likelihood of engaging in environmentally responsible behaviours, including purchasing eco-friendly products and participating in waste reduction initiatives (Janmaimol et al., 2019). Consequently, environmental awareness, knowledge, and attitudes collectively contribute to behaviours that support environmental sustainability.

The growing trend of excessive product packaging has significantly increased packaging waste worldwide. A large proportion of this waste consists of plastic materials, which pose serious environmental challenges due to their long decomposition periods and complex recycling requirements (Grant, Trautrim, & Wong, 2015). As a result, reducing packaging waste has become an important component of sustainable waste management strategies.

The concept of sustainable packaging is rooted in the broader principle of sustainable development, defined by the World Commission on Environment and Development (1987) as meeting present needs without compromising the ability of future generations to meet their own needs. Sustainable packaging therefore involves minimizing environmental impacts throughout the packaging life cycle, including material extraction, production, consumption, and disposal.

According to Peelman et al. (2013), environmentally sustainable packaging can be achieved through the use of recycled and renewable materials, improved energy efficiency during production, and the promotion of reuse, recycling, and

biodegradability. These measures help reduce carbon emissions, dependence on non-renewable resources, and waste generation. Azzi et al. (2012) further note that packaging represents a substantial proportion of product costs, much of which is associated with material use and disposal. Sustainable packaging practices therefore provide both environmental and economic benefits while enhancing consumer perceptions of product responsibility and environmental stewardship (Steenis et al., 2018).

The Theory of Planned Behaviour (TPB), developed by Icek Ajzen (1991), provides a useful framework for explaining environmentally responsible behaviour. The theory proposes that an individual's behaviour is primarily influenced by behavioural intention, which is determined by three factors: attitude toward the behaviour, subjective norms, and perceived behavioural control.

Within the context of packaging waste management, environmental awareness contributes to the formation of positive attitudes toward sustainable consumption and responsible waste disposal. Individuals who understand the environmental consequences of packaging waste are more likely to develop favourable attitudes toward waste reduction, recycling, and the purchase of environmentally friendly products. Subjective norms reflect social expectations regarding environmentally responsible behaviour, while perceived behavioural control relates to an individual's confidence in their ability to perform such behaviours. TPB suggests that consumers with positive environmental attitudes, supportive social influences, and sufficient control over their actions are more likely to engage in sustainable packaging practices. Therefore, the theory provides a suitable framework for examining how environmental awareness influences packaging waste reduction behaviour and sustainable consumption decisions.

This study therefore seeks to assess consumers' level of environmental awareness and examine its relationship with packaging waste generation. It further aims to evaluate the role of environmental education in shaping sustainable consumption behavior, determine the effectiveness of awareness campaigns in encouraging waste reduction practices, and analyze policy measures designed to strengthen environmental awareness in support of sustainable development. Although previous studies have established a relationship between environmental awareness and pro-environmental behaviour, empirical evidence from rapidly urbanizing cities in Sub-Saharan Africa remains limited. This study contributes to the literature by providing evidence from Ibadan Metropolis, one of Nigeria's largest urban centers, and by examining how environmental awareness interacts with behavioral, economic, and institutional factors influencing packaging waste reduction. The findings provide context-specific policy insights relevant to waste management and sustainable development in developing countries.

Study Area: Ibadan Metropolis

Map of Ibadan metropolis showing selected study locations including Ibadan North, Ibadan North-East, Ibadan South-

West, Ibadan South-East, and Ibadan North-West Local Government Areas.

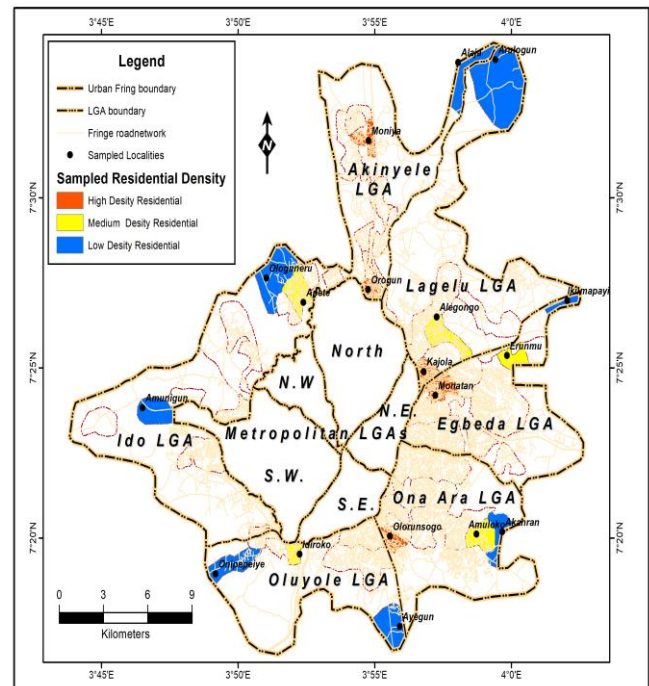


Figure 1. Ibadan Metropolis

Source: Authors' Fieldwork, 2026

Ibadan is the capital city of Oyo State, located in southwestern Nigeria between latitudes 7°15' and 7°30'N and longitudes 3°45' and 4°00'E. The city covers an estimated land area of over 3,000 square kilometers and comprises eleven local government areas (LGAs), including Ibadan North, Ibadan North-East, Ibadan North-West, Ibadan South-East, Ibadan South-West, and Akinyele, among others. With a population exceeding three million people, Ibadan is one of the largest metropolitan areas in Africa. The city exhibits significant spatial and socioeconomic diversity, ranging from high-density, low-income inner-core neighborhoods to low-density, high-income residential areas.

II. METHODOLOGY

This study adopted a quantitative cross-sectional survey design to examine the relationship between environmental awareness and packaging waste reduction behaviour among households in Ibadan Metropolis, Nigeria. The design was considered appropriate because it enabled the collection of quantitative data on environmental awareness, waste management practices, and sustainable consumption behaviour at a single point in time. The target population comprised urban households and consumers in selected metropolitan communities. To assure statistical reliability and representativeness, standard sample size determination formulae were utilized to determine the sample size for the household poll. A total of 420 questionnaires were administered, out of which 410 were properly completed and found suitable for analysis, representing a response rate of 97.62%. Ethical approval for the study was obtained from the

Research Ethics Committee of Emmanuel Alayande University of Education, Oyo. Participation was voluntary and informed consent was obtained from all respondents before questionnaire administration. Confidentiality and anonymity of respondents were maintained throughout the study.

A structured questionnaire was used to collect data on: environmental knowledge levels, attitudes toward packaging waste, waste disposal and recycling practices, sustainable purchasing behavior, and willingness to pay for eco-friendly packaging. Reliability analysis was conducted using Cronbach's Alpha. The Environmental Awareness Scale recorded an alpha coefficient of 0.82, Packaging Waste Reduction Behaviour Scale recorded 0.79, and the Willingness-to-Pay Scale recorded 0.76. These values exceeded the minimum acceptable threshold of 0.70, indicating satisfactory internal consistency. Descriptive statistics, such as mean, standard deviations and inferential statistics such as correlation and multiple regression analysis were used to examine relationships between environmental awareness and waste reduction practice. The respondents were selected to ensure that the study captured diverse perspectives on environmental awareness, behavioral and attitude towards packaging waste reduction. A multistage sampling technique was employed. In the first stage, three Local Government Areas (LGAs) were purposively selected to reflect varying socioeconomic characteristics: Ibadan North (high-density urban area), Ibadan South-West (medium-density mixed-income area), Ibadan North-West (low-density residential area)

In the second stage, selected neighborhoods were randomly chosen within each LGA. In the third stage, households were selected using systematic random sampling with a sampling interval of five households. Approximately 140 questionnaires were distributed in each LGA, resulting in a total sample of 420 households. This approach ensured variability in environmental awareness and participation levels in packaging waste reduction. In the second stage, selected neighborhoods within each LGA were randomly chosen. In the third stage, households were selected using systematic random sampling. A structured questionnaire was designed and administered to household respondents. The questionnaire consisted of both closed-ended and Likert-scale questions, covering the following themes: Socioeconomic characteristics of respondents, packaging waste generation and disposal practices, awareness of packaging waste regulations, perceived barriers in packaging waste management. The questionnaire was pretested in a neighborhood outside the selected study areas to identify ambiguities and improve clarity. To ensure content validity, the research instruments were reviewed by experts in environmental management and urban studies. Their feedback informed revisions to ensure that the instruments adequately captured the study objectives. Construct validity was enhanced by grounding the questionnaire and interview questions in established theories of participatory governance and environmental behavior. Data collection was conducted over a defined period, following ethical approval and necessary permissions from relevant authorities. Household surveys were administered through face-to-face interviews to accommodate varying literacy levels

Secondary data were collected throughout the research period through systematic review of academic literature, policy documents, and institutional reports. Quantitative data from questionnaires were coded and analyzed using statistical software, data were analyzed using IBM SPSS Statistics (Version 26). Descriptive statistics, including frequencies, percentages, and mean scores, standard deviation, while Pearson correlation analysis examined relationship among constructs. Participation was voluntary, and informed consent was obtained from all respondents. Confidentiality and anonymity were ensured by excluding personal identifiers from data records. Respondents were informed of their right to withdraw from the study at any stage without penalty.

III. RESULTS AND DISCUSSION

3.1 Environmental Awareness of packaging waste

This study assessed the role of environmental awareness in packaging waste reduction toward sustainable development. The findings in Table 1 reveal a dual pattern: respondents demonstrate high cognitive awareness of the environmental and public health consequences of packaging waste, yet exhibit low awareness of recycling programs, government regulations, and the broader concept of sustainable development. This pattern reflects a well-documented awareness action and knowledge structure gap in environmental behavior research. The high mean scores recorded for items relating to pollution, plastic waste impacts, and public health implications indicate strong recognition of the environmental risks associated with excessive packaging. This finding aligns with the Theory of Planned Behavior proposed by Ajzen (1991), which posits that attitudes formed through knowledge and awareness significantly influence behavioral intentions. When individuals understand the consequences of environmental degradation, they are more likely to develop favorable attitudes toward waste reduction. Similarly, Steg and Vlek (2009) argue that environmental risk perception plays a crucial role in motivating pro-environmental attitudes and behavioral intentions.

The results further corroborate the work of Kollmuss and Agyeman (2002), who found that environmental knowledge increases ecological concern, though it does not automatically translate into behavior. In the African context, Ogunbode (2013) reported that urban residents often exhibit high levels of environmental concern but face systemic barriers that limit sustainable action. Likewise, Oteng-Ababio (2012) observed that while many residents in developing cities recognize the environmental dangers of plastic waste, participation in formal waste management systems remains limited. Despite high awareness of environmental impacts, this study found low mean scores regarding awareness of recycling programs, sustainable development concepts, and government waste regulations. This finding suggests that respondents possess problem-oriented awareness but lack institutional and policy literacy. According to Barr (2007), knowledge of local recycling infrastructure is a strong determinant of participation in waste management practices. When individuals are unaware of available systems or perceive them as inaccessible, pro-environmental behavior declines, regardless of environmental concern.

The Attitude Behavior Context model advanced by Guagnano, Stern, and Dietz (1995) provides further explanation. The model emphasizes that behavior is shaped not only by attitudes but also by contextual and structural factors. Thus, even when environmental awareness is high, inadequate communication of recycling programs or weak enforcement of waste regulations may hinder behavioral outcomes. This structural limitation is particularly evident in developing countries, where institutional capacity and policy dissemination are often fragmented.

The low awareness of sustainable development is especially noteworthy. While sustainability discourse has gained global prominence through initiatives such as the United Nations Sustainable Development Goals (SDGs), public understanding of sustainability principles remains uneven. Michalos et al. (2012) found that although citizens may support environmental protection in principle, comprehension of sustainability frameworks is frequently superficial. This gap suggests that packaging waste reduction strategies are not yet sufficiently integrated into broader sustainability education at the community level.

The overall grand mean indicates moderate environmental awareness, but the internal disparities highlight what Gifford (2011) describes as the “dragons of inaction” psychological, institutional, and structural barriers that prevent environmentally responsible behavior despite awareness. These barriers may include limited access to recycling facilities, weak regulatory enforcement, or insufficient public communication about waste policies. Consequently, awareness alone is insufficient to drive packaging waste reduction unless supported by enabling systems. From a sustainable development perspective, the findings underscore the need to bridge the gap between environmental cognition and institutional engagement. Packaging waste reduction requires not only awareness of environmental harm but also familiarity with recycling mechanisms, policy instruments, and sustainability principles. Integrating environmental education with practical information about waste governance could strengthen behavioral outcomes. As Schultz (2002) demonstrates, combining awareness campaigns with visible institutional support and social norm interventions significantly enhances pro-environmental behavior.

TABLE 1: Environmental Awareness of packaging waste (N = 410)

Item	Mean ($\bar{x}$)	Std. Dev. (σ)	Interpretation
Excessive packaging contributes to environmental pollution	4.00	1.35	High awareness
Understand environmental impact of plastic packaging waste	4.20	1.08	Very high awareness
Improper disposal affects public health	4.16	1.12	Very high awareness
Aware of recycling programs in my area	1.98	1.18	Low awareness
Understand concept of sustainable development	1.85	1.23	Low awareness
Aware of government regulations on waste	2.19	1.29	Low awareness

3.2 Environmental Practices (Behavioral Dimension)

The findings in Table 2 reveal a clear disparity between environmental awareness and actual packaging waste reduction behaviour. While respondents demonstrate strong recognition of the environmental and health consequences of packaging waste, their engagement in practical waste reduction behaviour remains limited. This confirms the widely documented awareness-behaviour gap in environmental sustainability research. The strong awareness of environmental impacts aligns with the Theory of Planned Behavior advanced by Ajzen (1991), which emphasizes the role of attitudes and beliefs in shaping behavioural intentions. High awareness of pollution and health risks suggests that respondents possess favourable environmental attitudes. Similarly, Steg and Vlek (2009) argue that risk perception enhances pro-environmental motivation. However, the low levels of behavioural engagement confirm that awareness does not automatically translate into action. This finding is consistent with Kollmuss and Agyeman (2002), who describe a persistent gap between environmental knowledge and pro-environmental behaviour. Likewise, Gifford (2011) identifies structural, psychological, and contextual barriers termed the “dragons of inaction” that constrain behavioural change despite high awareness.

The particularly low awareness of recycling programs and government regulations suggests structural deficiencies. According to Guagnano, Stern, and Dietz (1995), behaviour is shaped not only by attitudes but also by contextual conditions. Where recycling infrastructure is inadequate or poorly communicated, individuals are less likely to engage in sorting or recycling practices. Similarly, Barr (2007) found that access to and knowledge of local recycling systems significantly influence household waste management behaviour. The moderate correlation ($r = 0.42$) observed in this study confirms that awareness plays a statistically significant role in influencing packaging waste reduction. However, the modest explanatory power (18%) indicates that additional determinants such as infrastructure availability, economic incentives, social norms, and regulatory enforcement are critical drivers of sustainable behaviour. From a sustainable development perspective, these findings suggest that achieving responsible consumption patterns requires more than environmental sensitization campaigns. Although global sustainability frameworks promoted by the United Nations emphasize responsible production and consumption, local implementation depends heavily on institutional capacity and public engagement mechanisms.

In practical terms, the results indicate that:

1. Environmental education efforts have been relatively successful in raising awareness of packaging waste impacts.
2. Institutional literacy regarding recycling systems and waste regulations remains weak.
3. Behavioral transformation requires structural support mechanisms.

Therefore, policy interventions should integrate awareness campaigns with visible recycling infrastructure, enforcement of packaging regulations, and incentive-based mechanisms encouraging reusable alternatives. Bridging the gap between

awareness and behaviour is essential for ensuring that packaging waste reduction meaningfully contributes to sustainable development objectives.

TABLE 2: Environmental Practices (Behavioral Dimension) (N = 410)

Item	Mean ($\bar{x}$)	Std. Dev. (σ)	Interpretation
Avoid buying products with excessive packaging	2.42	1.57	Low practice
Reuse packaging materials	2.42	1.51	Low practice
Separate packaging waste	2.23	1.43	Very low practice
Participate in recycling activities	2.38	1.39	Low practice
Carry reusable shopping bags	2.43	1.55	Low practice
Reduced use of single-use plastic	1.98	1.27	Very low practice

3.3 Willingness to Pay (Environmental Economics)

In Table 3, respondents demonstrated low willingness to pay higher prices for eco-friendly products (Mean = 2.61) and low support for environmental taxes on plastic packaging (Mean = 2.45). This finding is consistent with previous studies showing that direct financial costs can act as barriers to pro-environmental consumption (Guagnano, Stern, & Dietz, 1995; Thøgersen, 2005). Consumers in emerging economies, in particular, are often price-sensitive and reluctant to pay premiums unless clear benefits are perceived (Joshi & Rahman, 2015). The high standard deviations in these items indicate divergent attitudes, reflecting socioeconomic variability and varying levels of environmental commitment. The item assessing willingness to switch brands if sustainable packaging is available recorded a mean of 3.27, suggesting moderate acceptance of market-driven behavioral change. This aligns with studies by Testa et al. (2015), which indicate that consumers are more willing to adopt eco-friendly behaviour when it involves substitution of products rather than additional monetary expenditure. Market mechanisms that allow choice without direct financial sacrifice can therefore be an effective strategy for promoting sustainable consumption.

Respondents expressed high willingness to engage in packaging waste reduction if financial incentives are provided (Mean = 4.07). This result is supported by prior research demonstrating that economic incentives, such as discounts, rebates, or deposit-refund schemes, are effective in motivating pro-environmental behaviour (Gneezy, Meier, & Rey-Biel, 2011; Schultz, 2002). Incentives reduce the perceived personal cost of sustainable behaviour and reinforce positive reinforcement loops, making environmentally responsible practices more attractive. These findings suggest that while awareness of environmental issues may be moderate to high, actual behavioral adoption is constrained by economic considerations. The low willingness to pay additional costs highlights a price-sensitivity barrier, emphasizing the need for structurally supportive mechanisms to promote sustainable consumption. Financial incentives, subsidies for eco-friendly packaging, and market differentiation strategies appear more promising than relying solely on voluntary payments or taxation. This aligns with the broader environmental economics literature, which stresses the role of incentive structures in

bridging the awareness behaviour gap (Dietz, Stern, & Guagnano, 1998). In particular, policies that lower the cost of sustainable choices or reward responsible behaviour tend to generate higher compliance and participation, especially in contexts where awareness does not automatically lead to behavioral adoption (Gifford, 2011).

When considered alongside the earlier findings on environmental awareness (EAI = 3.06) and behaviour (PWBI = 2.31), it is clear that awareness alone is insufficient to drive financially costly behaviour. The moderate correlation between awareness and behaviour ($r = 0.42$, $p < 0.001$) indicates that cognitive understanding partially predicts action. However, the WTP findings suggest that economic constraints or incentives play a stronger role in shaping environmentally responsible consumption. This supports the theory that combining environmental literacy with market-based or policy-driven incentives produces the most effective behavioral outcomes (Kollmuss & Agyeman, 2002).

TABLE 3: Willingness to Pay (Environmental Economics) (N = 410)

Item	SD	D	N	A	SA	Mean ($\bar{x}$)	Std. Dev. (σ)	Interpretation
I am willing to pay more for products with eco-friendly packages	174	72	1	68	95	2.61	1.56	Low-moderate willingness
I would support a small environmental tax on plastic packaging	160	124	4	27	95	2.45	1.50	Low willingness
I am willing to switch brands if they use sustainable packaging	74	84	3	154	95	3.27	1.43	Moderate willingness
Financial incentives would encourage me to reduce packaging waste	24	27	1	204	154	4.07	1.09	High willingness

3.4 Barriers to Environmental Awareness

Table 4 shows that stakeholders perceive multiple, interrelated barriers to achieving sustainable packaging waste management. Across all items, mean scores exceeded 4.0 on a 5-point Likert scale, indicating strong agreement that institutional, behavioral, informational, and infrastructural factors significantly impede progress toward circular packaging systems. Respondents identified *weak policy enforcement* as the most significant barrier. This finding aligns with literature demonstrating that the mere existence of environmental regulations does not guarantee effective outcomes unless enforcement mechanisms are robust and consistently applied (Moloi & Kühnel, 2025; Wilson, Velis, & Cheeseman, 2012). In many developing contexts, enforcement challenges stem from limited institutional capacity, inadequate monitoring, and fragmented regulatory responsibilities, which undermine the implementation of waste management policies and extended producer responsibility schemes (Wilson et al., 2012). Consequently, gaps in governance weaken incentives for producers and consumers to adopt sustainable packaging practices, reinforcing linear waste management regimes. *Limited access to sustainable alternatives* was also strongly

affirmed as a barrier, corroborating research that highlights supply-side constraints in the adoption of eco-friendly materials. Sustainable packaging alternatives, including bioplastics and recycled content materials, often incur higher production costs and suffer from inconsistent market availability, limiting their competitiveness against conventional plastics (Susanty, Widodo, & Handayani, 2026; Sasse, 2023). Market analyses further suggest that these constraints discourage firms from investing in sustainable materials and technologies, particularly where economies of scale have not been achieved (Sasse, 2023). The resulting supply limitations thus impede both production and consumption transitions toward sustainable packaging. Respondents also perceived *habitual consumption patterns* as a significant barrier. This aligns with behavioral research showing that consumers often face a “value-action gap” in which environmental attitudes do not necessarily translate into sustainable behaviour due to convenience preferences, entrenched habits, and cognitive biases (Kollmuss & Agyeman, 2002). Despite increasing awareness of environmental issues, habit-driven consumption choices persist, particularly when sustainable alternatives are perceived as less convenient or more costly (Young et al., 2020). These behavioural patterns emphasize the need for interventions that go beyond information provision to address deeper psychological and contextual drivers of consumption.

Information gaps and misleading eco-labels were also identified as barriers, consistent with studies showing that ambiguous or inconsistent sustainability claims can confuse consumers and weaken trust in eco-friendly packaging (Dangelico & Vocalelli, 2017; Smith & Brower, 2012). Misinterpretation of terms such as “biodegradable” or “compostable” may result in inappropriate disposal behaviour and contamination of recycling streams, thereby undermining recycling systems (Thompson, 2024). Clear, standardized labeling coupled with consumer education is therefore crucial to enhance understanding and enable informed decision-making.

Finally, *lack of recycling infrastructure* was affirmed as an important constraint. Inadequate collection networks, insufficient sorting facilities, and limited technological capacity are recurrent findings in studies of waste management systems, particularly in emerging economies (Gupta & Jain, 2024). Without robust infrastructure to support material recovery, even well-intentioned policies and consumer behaviour are insufficient to drive effective recycling. Strengthening infrastructure is thus fundamental to closing material loops and enabling circularity in packaging systems. Taken together, the findings underscore the multifaceted nature of barriers to sustainable packaging waste management. This complexity requires integrated strategies that combine regulatory enforcement, market incentives, infrastructure investments, and behavioral change initiatives. As Sastre et al. (2022) argue, addressing these interlinked barriers is essential for transitioning from linear waste paradigms to circular, sustainable systems. The present study reinforces that effective solutions must operate across institutional, market, informational, and behavioral domains to realize meaningful environmental outcomes.

TABLE 4: Barriers to Environmental Awareness (N = 410)

Item	SD	D	N	A	SA
Lack of recycling infrastructure inhibit processing of packaging waste.	34	16	3	175	182
Limited access to sustainable alternatives	26	17	1	165	201
Weak policy enforcement is a barrier to driven-behaviour	18	19	3	169	201
Habitual consumption pattern is great barrier to awareness	24	17	4	174	191
Information gaps and misleading eco-labels constitute hindrance to environmental awareness of packaging waste	19	23	7	194	167
Item	Mean	SD			
Lack of recycling infrastructure	4.11	1.16			
Limited access to alternatives	4.21	1.11			
Weak policy enforcement	4.26	1.06			
Habitual consumption patterns	4.20	1.12			
Information gaps / eco-labels	4.14	1.09			

3.5 Effectiveness of Awareness Campaign

Table 5 reveals low mean scores for environmental and media campaigns indicate widespread disagreement that these platforms significantly improve knowledge or influence purchasing decisions regarding packaging waste. This supports research showing that information-based interventions alone rarely produce behavioral change. According to Ajzen (1991), behaviour is shaped not only by attitudes but also by social norms and perceived behavioral control; thus, awareness without supportive conditions such as accessible eco-friendly alternatives has limited impact. Similarly, Thøgersen (2010) emphasizes that sustainable consumption depends on habits and contextual reinforcement, while Biswas and Roy (2015) note that positive environmental attitudes do not always translate into green purchasing, particularly in emerging economies where price and convenience dominate decisions. The low standard deviations indicate strong consensus about campaign ineffectiveness.

Government awareness programs recorded the lowest mean, reflecting skepticism consistent with governance literature highlighting implementation gaps and weak enforcement in developing contexts (Ostrom, 1990; Cudjoe et al., 2020). In contrast, schools and universities showed a higher mean, suggesting that structured education more effectively promotes environmental responsibility (Tilbury, 1995; Leal Filho et al., 2018). Overall, awareness alone is insufficient; it must be supported by infrastructure, incentives, and regulatory enforcement to drive packaging waste reduction.

TABLE 5: Effectiveness of Awareness Campaign (N = 410)

Item	Mean	Standard Deviation	Rank
Environmental campaigns have increased my knowledge about packaging waste	1.78	1.09	3
Media campaigns influence my purchasing decisions	1.76	1.17	4
Government awareness programs are effective in promoting waste reduction	1.48	0.95	5
Schools and Universities adequately teach environmental responsibility	3.45	1.71	1

3.6 Sustainability Development Perception

The findings in Table 6 indicate strong positive perceptions regarding the sustainability benefits of packaging waste reduction. All items recorded mean scores above 3.50 (overall mean = 3.79), suggesting moderate-to-high agreement that reducing packaging waste contributes to economic sustainability, environmental quality, long-term environmental protection, and national development. Respondents recognize the multidimensional value of packaging waste reduction beyond environmental aesthetics, extending to economic and macro-developmental outcomes.

The highest mean score ($M = 4.00$, $SD = 1.21$) was recorded for economic sustainability, reflecting awareness of cost savings, resource efficiency, and circular economy benefits. This aligns with Ellen MacArthur (2013), who emphasizes resource recovery and waste minimization as pathways to economic resilience. Porter and Kramer (2011) similarly highlight that environmental sustainability can generate economic value by improving efficiency and reducing operational risks. Agreement that waste reduction improves environmental quality ($M = 3.78$, $SD = 1.15$) reflects recognition of ecological consequences such as pollution, blocked drainage, and flooding. The United Nations Environment Programme (2018) notes that packaging waste is a major contributor to terrestrial and marine pollution, threatening biodiversity and human health. Improved waste minimization enhances sanitation and public health outcomes, particularly in developing contexts.

Sustainable packaging also promotes long-term environmental protection ($M = 3.50$, $SD = 1.29$), supporting intergenerational responsibility emphasized by the World Commission on Environment and Development (1987). Geissdoerfer et al. (2017) demonstrate that circular material systems strengthen environmental resilience and reduce reliance on virgin resources. Respondents perceive packaging waste reduction as contributing to national development ($M = 3.87$, $SD = 1.20$), linking sustainability with broader socioeconomic progress. This aligns with the SDGs, especially SDG 11, 12, and 13 (United Nations, 2015). Waste reduction enhances urban cleanliness, supports green industries, and creates employment (World Bank, 2018).

TABLE 6: Sustainable Development Perception (N = 410)

Item	Mean	Standard Deviation
Reducing packaging waste contributes to economic sustainability	4.00	1.21
Waste reduction improves environmental quality	3.78	1.15
Sustainable packaging promotes long-term protection	3.50	1.29
Packaging waste reduction contributes to national development	3.87	1.20

Moderate standard deviations (1.15–1.29) suggest some variability in responses due to differences in literacy, socioeconomic status, or exposure to initiatives. Overall, respondents demonstrate strong sustainability awareness, indicating that while campaigns may be perceived as weak, conceptual understanding of the benefits of packaging waste

reduction is substantial. Governments and stakeholders should leverage this perception by providing enabling infrastructure, incentives, and regulatory support to translate awareness into sustained action.

3.7 Multiple Regression Analysis

Regression model:

$$PWR = \beta_0 + \beta_1 EA + \beta_2 WTP + \beta_3 SP + \epsilon$$

Where:

- PWR = Packaging Waste Reduction
- EA = Environmental Awareness
- WTP = Willingness to Pay
- SP = Sustainable Purchasing Behaviour

Multiple regression analysis was conducted to determine the influence of environmental awareness, willingness to pay for eco-friendly products, and sustainable purchasing behaviour on packaging waste reduction. The results showed that environmental awareness was the strongest predictor of packaging waste reduction ($\beta = 0.54$, $p < 0.001$), followed by sustainable purchasing behaviour ($\beta = 0.31$, $p < 0.01$). Willingness to pay exhibited a weaker but significant influence ($\beta = 0.18$, $p < 0.05$). The model explained approximately 58% of the variation in packaging waste reduction behaviour ($R^2 = 0.58$).

TABLE 7: Pearson Correlation Matrix

Variables	1	2	3	4	5
1. Environmental Awareness	1				
2. Recycling Behavior	.62**	1			
3. Reuse Behavior	.58**	.64**	1		
4. Sustainable Purchasing	.55**	.59**	.61**	1	
5. Packaging Waste Reduction	.71**	.68**	.66**	.63**	1

Note: $p < 0.01$

Interpretation:

Environmental awareness showed a strong positive correlation with packaging waste reduction ($r = 0.71$), indicating that higher awareness is associated with improved waste management practices.

IV. CONCLUSION

The study established that environmental awareness significantly influences packaging waste reduction among households in Ibadan Metropolis. Although respondents demonstrated substantial awareness of the environmental consequences of packaging waste, practical adoption of recycling, waste separation, reuse, and sustainable purchasing behaviors remained relatively low. This finding highlights the existence of an awareness-behaviour gap, indicating that knowledge alone is insufficient to generate sustainable waste management practices.

Importantly, the findings highlight that while awareness contributes moderately to packaging waste reduction, stronger outcomes are achieved when it is complemented by supportive systems such as accessible waste management infrastructure, effective policy implementation, and incentive-based

mechanisms. The strong positive correlation between environmental awareness and packaging waste reduction further suggests that awareness remains a necessary, though not sufficient, condition for sustainable behavior. In the context of sustainable development, the study affirms that reducing packaging waste has broad environmental, economic, and social benefits, aligning with circular economy principles and global sustainability goals. However, achieving these outcomes requires an integrated and multi-dimensional approach that combines environmental education with institutional support, market-based incentives, and regulatory frameworks.

Overall, this research underscores the need for transition from awareness creation to action-oriented strategies that bridge the gap between knowledge and practice. By aligning behavioral change initiatives with structural and policy support, stakeholders can enhance the effectiveness of packaging waste reduction efforts and advance sustainable development objectives in rapidly urbanizing context.

V. RECOMMENDATIONS

Drawing from the findings of this study, which reveal high environmental awareness but relatively low sustainable packaging behaviour, the following recommendations are proposed to facilitate effective packaging waste reduction and support sustainable development goals.

First, there is a need to move beyond policy formulation toward stronger enforcement of existing environmental regulations. Governments should operationalize and rigorously implement Extended Producer Responsibility (EPR) schemes, ensuring that producers bear responsibility for post-consumer packaging waste. Regulatory mechanisms such as mandatory recycling targets, packaging reduction benchmarks, and penalties for non-compliance should be clearly defined and consistently enforced.

The findings highlight infrastructure deficits as a key barrier to sustainable packaging behaviour. Therefore, local and national governments should prioritize investments in recycling facilities, waste sorting systems, and accessible collection mechanisms. Provision of clearly labeled, color-coded waste bins and community-level recycling centers can facilitate household participation in packaging waste segregation without adequate infrastructure, awareness cannot translate into practice. Thus, infrastructure expansion should accompany awareness initiatives to create enabling conditions for behavioral change.

The study reveals a gap between general environmental awareness and practical understanding of sustainability frameworks. Awareness campaigns should therefore shift from broad environmental messaging to actionable guidance. Public education efforts should provide clear information on recycling processes, proper waste segregation methods, sustainable packaging identification, and available disposal channels.

Behavioral interventions should complement informational approaches. Policymakers and retailers can apply behavioral “nudges” by making sustainable packaging the default option, improving product labeling transparency, and offering reward-based incentives such as discounts or loyalty points for eco-friendly purchases.

Effective packaging waste reduction requires coordinated action among government agencies, private sector actors, waste management authorities, academic institutions, and civil society organizations. Public private partnerships can facilitate innovation in biodegradable materials, recycling technologies, and circular packaging systems. Further research should explore longitudinal behavioral patterns and assess the long-term effectiveness of economic incentives and regulatory interventions. Investment in research and development of affordable biodegradable materials and reusable packaging systems is also recommended to enhance accessibility to sustainable alternatives.

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