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Environmental impacts of packaging and waste accumulation from online shopping platforms in Caranan, Pasacao, Camarines Sur

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Abstract

The proliferation of e-commerce has significantly enhanced consumer convenience while simultaneously escalating the accumulation of non-biodegradable packaging waste, particularly in coastal communities with constrained waste management infrastructure like Barangay Caranan, Pasacao, Camarines Sur. Utilizing a mixed-methods descriptive research design involving a one-month waste segregation study and structured surveys of 30 purposively selected frequent-shopper households, this research identified a total accumulation of 7.085 kg of plastic-based residuals. The waste stream was heavily dominated by bubble wrap (4.922 kg) and poly mailers (2.163 kg), whereas durable materials like cardboard boxes were absent due to high rates of domestic reuse. While findings indicated a "Strongly Aware" level of consumer consciousness ($\bar{x}$ = 4.27) regarding immediate environmental nuisances like increased garbage volume and coastal water pollution, a critical knowledge gap was identified concerning the direct link between thin-film plastics and localized flooding risks. To address these systemic challenges, the study developed the "CY 2027 Waste Management Plan," which has been institutionalized via a formal Barangay Resolution to prioritize non-punitive, incentive-based systems and logistical take-back partnerships with local courier hubs. Ultimately, this research underscores the necessity of transitioning from general environmental advocacy toward technical skill-building, multi-sectoral accountability, and the institutionalization of dedicated local funding to effectively mitigate the ecological footprint of e-commerce logistics in vulnerable coastal ecosystems. This framework serves as a scalable model for integrating digital consumer trends into grassroots environmental governance.

Keywords: packaging waste, e-Commerce, waste accumulation, sustainable waste management, circular economy

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1. Introduction

Online shopping has significantly transformed consumer behavior by prioritizing convenience and personalized services. While this digital shift offers economic opportunities, it introduces severe environmental challenges, specifically packaging waste generation. In rural coastal areas like Pasacao, the impact is pronounced due to limited disposal and recycling infrastructure. Although awareness has increased, behavior change is restricted by structural and policy constraints (Romualdo, 2019; Perez, 2016). This is exacerbated by the Philippine Sachet Economy, where the normalization of single-use plastic has transitioned into e-commerce, creating an influx of micro-packaging that overwhelms local recovery systems (Gallo et al., 2020). The environmental effects are multifaceted, involving packaging, carbon emissions, and logistical inefficiencies. Excessive packaging, or the Amazon Effect, prioritizes product protection at an extreme ecological cost (Jara et al., 2023). A critical distinction exists between materials: while corrugated cardboard often finds a secondary life through reuse, flexible plastic films and bubble wrap are almost exclusively treated as single-use waste (Escursell, Lereu, & Guaita, 2021). This leads to an accumulation pattern where non-biodegradable plastics dominate the waste stream. Furthermore, biodegradable alternatives often behave identically to traditional plastics in the absence of industrial composting facilities (Tacker et al., 2022).

Transportation and last-mile delivery also contribute substantially to e-commerce's carbon footprint (Reyes, 2022). In rural provinces, the lack of consolidated delivery hubs leads to logistical fragmentation, where multiple couriers travel long distances for single items, doubling per-parcel emissions compared to urban centers (Tan et al., 2021). Additionally, unboxing culture encourages sellers to employ over-packaging to ensure aesthetic integrity for social media, triggering a self-sustaining loop of incoming parcels and outgoing waste (Mazaheri et al., 2021). Despite increasing consciousness, a value-action gap remains as convenience often takes precedence over sustainability (Corpuz, 2021). In developing economies, price sensitivity often leaves the burden of sustainability on the producer (Nguyen et al., 2020). While the Philippines' Extended Producer Responsibility (EPR) Act of 2022 (RA 11898) marks a significant policy shift, implementation in rural areas remains a challenge (Greenpeace Philippines, 2022). This policy vacuum can result in Waste Colonialism, where environmental costs are disproportionately borne by under-resourced coastal communities (Liboiron, 2021).

Consumer attitudes are influenced by trust and ecological awareness, yet high concern rarely translates into sustainable purchasing (White, Habib, & Hardisty, 2019). Mismanaged waste is particularly critical in coastal municipalities like Pasacao, where lightweight, buoyant plastics like LDPE mailers are susceptible to leaking into the marine environment, threatening aquatic ecosystems and local tourism (Meijer et al., 2021; Phelan et al., 2020). Effective waste management requires community participation and targeted policy. In the Philippines, the lack of comprehensive recycling systems makes managing e-commerce waste difficult (Cruz, 2020). However, social motivation through incentive-based trash-to-cash models is often more effective than punitive enforcement for household compliance (Bernardo, 2021). Furthermore, Community-Based Monitoring Systems (CBMS) are vital for tracking e-commerce residuals that are often ignored in municipal tallies (Vassanadumrongdee et al., 2020). The local government in Pasacao is currently challenged by the variability of these wastes, as existing facilities are overstretched (Dela Peña, 2021). While cardboard recovery remains high due to reuse value, soft plastics like bubble wrap present the most difficult challenge for municipal systems (DENR, 2021). Ultimately, transitioning toward a Circular E-commerce model requires localized waste characterization to develop interventions that reflect the unique socio-economic landscape of Bicol's coastal areas.

Statement of the Problem - This study aimed to investigate the extent of packaging waste generated by online shopping platforms in Caranan, Pasacao, Camarines Sur. Specifically, it sought to identify the major types and

quantity of packaging waste accumulated from online shopping activities, determine the environmental impacts of such waste, assess the level of consumer awareness regarding its environmental effects, and propose a sustainable waste management plan to help mitigate the environmental impacts of online shopping in the community. With the increasing popularity of e-commerce, the study aimed to better understand how packaging materials contribute to local waste accumulation and explore sustainable community-based solutions.

Significance of the Study - As online shopping becomes increasingly accessible, its environmental implications, particularly in terms of packaging waste, require closer examination. This study provides valuable insights into how e-commerce contributes to waste generation in Caranan, Pasacao, Camarines Sur and highlights the importance of sustainable waste management practices. The findings may help consumers become more environmentally responsible, encourage retailers and e-commerce platforms to adopt eco-friendly packaging practices, and assist Local Government Units (LGUs) and environmental organizations in strengthening waste management programs and awareness campaigns. Furthermore, the study may serve as a useful reference for future researchers exploring the environmental impacts of online shopping and digital consumerism.

Scope and Delimitation - This study focused on examining the perceived environmental impacts of online shopping in Barangay Caranan, Pasacao, Camarines Sur, by specifically identifying the types of packaging waste generated, such as poly mailers and bubble wrap. It explored household-level waste management practices and assessed community perceptions regarding the effects of e-commerce waste on local health, pollution, and marine ecosystems. The research was conducted during the first quarter of 2026 and employed a mixed-methods approach to capture both numerical data and descriptive insights. The quantitative component of the research centered on a one-month waste segregation study, which involved the weekly collection and sorting of online shopping packaging waste from the top 30 most frequent online shoppers in the barangay. These 30 participants were purposively selected from an initial screening of 100 residents based on their exceptionally high volume of monthly orders. By weighing and categorizing the collected materials every week for four consecutive weeks, the researchers obtained precise data on the specific composition and volume of waste produced at the household level.

In addition to the physical waste collection, a comprehensive survey was administered to the same top 30 respondents to evaluate their perceptions of the impact of online shopping waste, their awareness of environmental issues, and their specific suggestions for a localized waste management plan. To further deepen the qualitative analysis, a semi-structured interview was conducted with the top-ranked respondent, the individual identified as having the highest frequency of online orders to explore high-consumption habits, specific disposal challenges, and individual awareness in greater detail. The study was strictly restricted to the selected residents of Barangay Caranan, Pasacao, Camarines Sur, who were identified as the most active online shoppers. The scope did not extend to nearby barangays, commercial establishments, online sellers, or courier services. It did not aim to measure the total waste volume of the entire municipality, focusing instead on household-level data and consumer practices. Furthermore, the research excluded all forms of waste unrelated to online shopping, such as organic food waste or industrial materials. Consequently, the findings represent the specific experiences, awareness, and actual waste outputs of the selected respondents during the specified study period.

Theoretical Framework - This study is anchored on Circular Economy Theory by the Ellen MacArthur Foundation (2015), Institutional Theory (2014), and Sustainable Consumption Theory by Fernandes and Gabriel (2025).

The Circular Economy Theory (Ellen MacArthur Foundation, 2015) promotes the concept of a system where resources are continuously reused, repurposed, or recycled instead of being discarded after a single use. It challenges the traditional linear model of “take–make–dispose” by emphasizing the importance of reducing waste generation, extending the lifecycle of materials, and designing products that can re-enter production cycles. This approach encourages efficient resource utilization by minimizing raw material extraction and preventing waste leakage into the environment. In the context of online shopping, the theory highlights the need to transition from single-use packaging to reusable, recyclable, or biodegradable alternatives. It also supports the development of

recovery systems where packaging materials are collected and reintegrated into production, thereby reducing environmental impact and promoting sustainability at the community level.

Institutional Theory (Scott, 2014; Bitektine et al., 2021) explains that the actions of individuals and organizations are influenced by established norms, rules, and social expectations within a given society. People tend to adopt behaviors not only for practical or economic reasons but also to gain legitimacy and conform to accepted standards within their community or institution. In relation to environmental management, this theory suggests that sustainable practices are more likely to be adopted when supported by strong institutional frameworks, such as government policies, barangay ordinances, environmental programs, and community initiatives. In the case of Barangay Caranan, the effectiveness of waste management practices depends largely on the presence and enforcement of local regulations, as well as the active participation of community leaders and stakeholders in promoting environmentally responsible behavior.

Sustainable Consumption Theory (Fernandes & Gabriel, 2025) focuses on how individuals regulate their consumption patterns and align their choices with environmental and ethical considerations. It examines the relationship between consumer awareness, attitudes, and actual behavior, emphasizing that knowledge of environmental issues does not always result in sustainable actions. This theory highlights the existence of an awareness–behavior gap, where individuals may understand the negative impacts of their consumption but still prioritize convenience and affordability. In the context of online shopping packaging waste, the theory is relevant in explaining why consumers continue to generate large amounts of waste despite being aware of its environmental consequences. It underscores the need for interventions that not only increase awareness but also encourage practical behavior changes, such as reducing packaging use, reusing materials, and participating in recycling programs.

These three theories collectively guide the framework of this study on the environmental impact of online shopping waste in Caranan, Pasacao, Camarines Sur. The Circular Economy Theory provides the foundation for proposing sustainable waste management practices that promote recycling and reuse of packaging materials. The Institutional Theory supports the understanding of how government policies, community programs, and social norms influence the waste disposal behavior of residents. Meanwhile, the Sustainable Consumption Theory explains how consumers' awareness and attitudes affect their actual waste management practices. Together, these theories offer a comprehensive lens to analyze the problem by connecting individual behavior, institutional influence, and systemic solutions leading to the development of an effective community-based waste management plan that reduces the environmental impacts of online shopping.

2. Methodology

This section involves the description of the research methods utilized in the study. The methodology of the study is divided into sections including research design, area of the study, research method, sampling design, data gathering procedure, and statistical treatment of data.

Research Design - This study employed a mixed-methods descriptive research design, integrating quantitative and qualitative approaches to comprehensively examine online shopping packaging waste in Barangay Caranan, Pasacao, Camarines Sur. Mixed-methods research combines numerical measurement and narrative explanation to provide a deeper and more reliable understanding of complex research problems (Creswell & Plano Clark, 2018). The quantitative component involved a one-month waste segregation study to determine the types and accumulated weight of packaging materials generated from online shopping. This was complemented by a household survey administered to the top 30 respondents to assess their perceived environmental impacts and their level of environmental awareness of e-commerce waste. Descriptive statistical tools, specifically summation, frequency count, and weighted mean, were utilized to analyze the quantitative data and identify dominant trends in waste generation and community perception (Trochim et al., 2016).

The qualitative component consisted of a semi-structured interview with the top-ranked respondent, identified

as the individual with the highest monthly average order volume. This interview was designed to gather contextual insights into the motivations behind high-frequency online ordering, such as the influence of e-commerce affiliation and the "unboxing" culture. Qualitative interviews are appropriate for understanding individual experiences, consumption habits, and the specific behavioral drivers that contribute to household waste accumulation (Guest et al., 2012). In general, the descriptive mixed-methods design allowed for a clear, accurate, and context-specific understanding of packaging waste volumes, levels of awareness, and the perceived environmental threats within the community. This integrated approach provided a sound empirical basis for the development of a proposed waste management plan tailored to the unique consumption patterns of Barangay Caranan.

Area of the Study - The study was conducted in Barangay Caranan, Pasacao, Camarines Sur, focusing specifically on households and individuals who frequently engage in online shopping. This area was selected due to the rapid expansion of digital commerce platforms among residents and the corresponding growth in packaging waste generated from e-commerce activities. The selection of this specific locale allowed for a detailed analysis of how high-frequency consumption translates into localized waste accumulation. As a coastal community, Barangay Caranan is particularly vulnerable to the environmental impacts of improperly managed plastic packaging waste. This geographic characteristic provides a critical and relevant setting for examining the accumulation of packaging materials and the community's environmental impacts and level of awareness. The proximity to marine ecosystems underscores the urgency of understanding how non-biodegradable materials from online shopping may threaten local environmental health. The study aimed to identify the major types and accumulated weight of packaging waste from online shopping, evaluate residents perceived environmental impacts and level of awareness, and gather suggestions for a proposed waste management plan. Focusing on Caranan, Pasacao provides a local context for understanding how digital shopping contributes to ecological challenges and supports the development of community-based solutions.

Research Method - This study employed a mixed-methods research approach to comprehensively examine the environmental effects of packaging waste generated from online shopping activities in Barangay Caranan, Pasacao, Camarines Sur. The method combined quantitative and qualitative techniques to capture both measurable waste data and contextual community perspectives. The quantitative component involved the conduct of a waste segregation to identify the types and accumulated weight of packaging waste generated from online shopping. In addition, a household survey was administered to assess consumers perceived environmental impacts, level of environmental awareness and suggestions for proposed waste management plan regarding online shopping packaging waste. The qualitative component consisted of a semi-structured interview with the Top 1 respondent, identified as the individual with the highest frequency of online orders among the top 30 participants. This deep-dive interview was designed to gather in-depth insights into the specific behavioral drivers behind high-volume consumption. By focusing on the most frequent shopper, the researchers aimed to understand the personal and economic motivations for frequent ordering such as the influence of e-commerce affiliation, the reception of product samples, and the "unboxing" culture and how these individual habits contribute to the overall concentration of packaging waste within the household. By integrating quantitative measurements with qualitative insights, the mixed-methods approach enabled the researchers to develop a holistic understanding of online shopping packaging waste generation, household behaviors, and institutional responses. This approach also provided a sound basis for the formulation of a proposed waste management plan tailored to the local context of the community.

Sampling Design - This study involved the residents of Barangay Caranan, Pasacao, Camarines Sur, who actively engage in online shopping. The research employed a multi-stage purposive sampling technique to ensure that the data collected represents the most significant contributors to the local e-commerce waste stream. In the initial stage, a screening survey was conducted among 100 residents to evaluate their monthly shopping habits and general engagement with digital commerce platforms. From this initial pool, the Top 30 respondents were purposively selected based on their monthly average order volume. These 30 participants served as the primary subjects for the one-month waste segregation study and the detailed household surveys, as their high-frequency

consumption patterns provide the most critical data regarding packaging waste accumulation and environmental awareness.

Data collection was facilitated through surveys and a semi-structured interview. The surveys were administered to all 30 selected participants to gather quantitative data on their perceived environmental impacts, level of awareness and suggestions for waste management. Additionally, a focused interview was conducted with the Top 1 highest shopper to gain qualitative insights into the specific motivations behind extreme ordering frequencies, such as e-commerce affiliation and the "unboxing" culture. By focusing on this specific group of high-volume consumers, the study ensures that the resulting proposed waste management plan is directly addressed to the areas with high waste generation within the community.

Data Gathering Procedure - To examine how residents of Barangay Caranan view the environmental impact of online shopping, the researchers conduct a survey-based data collection complemented by a waste segregation study and a qualitative interview. Prior to the data gathering, a formal letter was submitted to the Barangay Council of Caranan to request permission to conduct the research within the community. The procedure begins with an initial screening of 100 residents to evaluate their monthly online shopping habits. From this group, the top 30 respondents were purposively selected to participate based on their high frequency of orders. Surveys and the semi-structured interview were conducted in person, depending on the participants' availability and preference. The survey questions were focus on specific themes, including the perceived environmental impacts, levels of environmental awareness, and community suggestions for a waste management plan. Ethical standards were strictly followed, including obtaining informed consent from all participants and ensuring the full confidentiality of their responses.

In addition to the surveys and interviews, the researchers were conducted a one-month waste segregation study. This quantitative method involves the weekly collection, sorting, and weighing of actual household packaging materials to provide measurable data on the composition and volume of materials such as bubble wrap and poly mailers. This waste segregation process helps validate the information gathered from the survey responses and support the formulation of accurate findings regarding actual waste accumulation in the community. The combination of waste segregation, surveys, and the targeted interview enable the researchers to obtain both quantitative and qualitative data. This integrated approach provides a holistic understanding of the environmental impact of online shopping waste in Barangay Caranan, Pasacao, Camarines Sur, serving as the empirical basis for the proposed sustainable waste management plan.

Statistical Treatment of Data - To analyze the data gathered from the waste segregation study and the surveys, the following statistical tools were employed to ensure the accuracy and reliability of the findings.

Summation - This will be used primarily for the one-month waste segregation study. The total weight and quantity of each packaging type (e.g., poly mailers, bubble wrap, and cardboard) collected from the top 30 respondents were summed to determine the overall volume of e-commerce waste generated in Barangay Caranan. This provides a clear quantitative profile of the total waste accumulation during the study period.

Frequency Count - Frequency count will be utilized to tally the number of times specific responses occur in the survey's checklist sections. This tool is essential for identifying the monthly average order volume of the initial 100 residents, categorizing the common types of perceived environmental impacts selected by the respondents and determining the most common suggestions for the proposed waste management plan from the provided checklist.

Mean - The mean will be used exclusively to assess the level of environmental awareness among the respondents. By applying a Likert-scale (e.g., 1 to 5), the researchers will calculate the average scores to determine the community's depth of knowledge regarding online shopping waste (Boone, 2012).

3. Results and Discussion

This section presents the results of the data gathered through the waste segregation, surveys, and interview conducted in Caranan, Pasacao, Camarines Sur. The findings are organized according to the four objectives of the study and are supported by literature to provide deeper interpretation of the observed results.

3.1 Major Types of Packaging Waste Accumulated from Online Shopping Platforms

Table 3.1
Total Quantity and Ranking of Segregated Online Shopping Packaging Waste (1-Month Collection)

Types	Quantity (kg.)	Rank
Bubble Wrap	4.922	1
Poly Mailer	2.163	2

Table 3.1 details the accumulated packaging waste from high-frequency e-commerce consumers in Barangay Caranan, Pasacao. Through a four-week segregation study of purposively selected households, researchers identified a total of 7.085 kg of plastic-based residuals. Bubble wrap dominates this stream (4.922 kg), as sellers prioritize product safety through redundant protective layers. Poly mailers (2.163 kg) rank second, favored for non-fragile items due to cost-effectiveness and moisture resistance. Notably, cardboard boxes and zip-lock bags were absent from the disposed waste. Household feedback revealed high secondary use rates for these materials, such as repurposed cartons for domestic organization and zip-locks for travel storage. While this reuse temporarily diverts them from landfills, they represent a latent waste stream that will eventually cause disposal spikes once their functional utility is exhausted.

These findings align with the EcoWaste Coalition (2022), confirming a national trend where immediate residuals dominate e-commerce waste. Because flexible plastics lack structural durability, they are discarded immediately upon unboxing. This behavioral disparity is contextualized by the DENR (2021), which notes that while cardboard has high recovery rates in the Philippines, soft plastics remain a critical threat. Consequently, Caranan faces a two-tiered crisis, visible, immediate soft plastic pollution and a latent stream of durable materials. The lack of recycling pathways for the 7.085 kg of collected flexible films underscores the difficulty of managing these materials in coastal municipalities. The dominance of bubble wrap and poly mailers signifies a growing environmental hazard due to their persistence and recycling difficulty, especially when contaminated by adhesives. This prioritization of safety over minimal packaging (Kumar et al., 2022; Jang et al., 2021) and the industry preference for lightweight, waterproof materials (DHL, 2023) exacerbate the issue. Furthermore, Escursell et al. (2021) found that while rigid plastics and cardboard are integrated into a circular home economy, flexible films are treated almost exclusively as single-use. Mitigating this footprint requires material innovation, policy reforms, and enhanced infrastructure. Promoting biodegradable alternatives and business responsibility is essential to address the long-term challenges posed by non-biodegradable packaging (Denvork & Kosior, 2020; UNEP, 2023). Ultimately, localized understanding of waste characterization is vital for developing interventions that protect vulnerable coastal ecosystems.

3.2 Environmental Impacts of Packaging Wastes Generated from Online Shopping

Table 3.2
Perception of 30 Respondents on the Environmental Impacts of Online Shopping Packaging Waste

Environmental Impacts	Frequency	Rank
Increases household garbage volume	24	1
Water Pollution	21	2
Soil Pollution	18	3
Increased landfill waste	17	4
Air pollution from burning wastes	12	5.5
Harm to marine animals	12	5.5
Makes surroundings dirty	11	7
Depletion of natural resources	10	8

Contributes to flooding during heavy rains	9	9
Adds burden to local waste management systems	8	10
Affects human health due to exposure to polluted environments	5	11
Causes unpleasant smell and pests	3	12
Increases long-term environmental cleanup costs	1	13

Table 3.2 illustrates the multifaceted perceptions of respondents in Barangay Caranan regarding the environmental consequences of e-commerce packaging. The highest-ranked impact is "Increases household garbage volume" (Frequency: 24), indicating that consumers find the rapid physical accumulation of waste within their residences to be the most intrusive effect. This consensus suggests a convenience-waste paradox, where the ease of digital ordering shifts the logistical burden of waste management from the retailer to the individual household. Unlike traditional shopping, e-commerce necessitates extensive unboxing sequences involving layers of bubble wrap and poly mailers. For this coastal community, such an influx saturates domestic bins and requires frequent disposal, making the household a primary pressure point for localized waste interventions.

A pivotal demographic revelation is that the highest-frequency shopper generates a disproportionate volume of waste due to e-commerce affiliation. This model incentivizes frequent orders for social media unboxing content and aesthetic reviews. Consequently, her residence becomes a terminal for camera-ready parcels employing excessive protective packaging to prevent superficial scuffs. This dynamic creates a self-sustaining loop where every follower's purchase via an affiliate link triggers new logistical cycles, transforming a dwelling into a high-volume transit point for non-biodegradable residuals that strain local infrastructure. This surge in volume is intrinsically linked to grave secondary threats, Water Pollution (Rank 2) and Soil Pollution (Rank 3). These rankings reflect anxiety that lightweight materials will leak into the Ragay Gulf or degrade into microplastics, compromising the ecological health of the maritime community. Furthermore, the ranking of "Harm marine animals" (Rank 5.5) underscores a recognition of the connectivity between household consumption and marine health. Conversely, the lowest-ranked impact is "Increases long-term environmental cleanup costs" (Rank 13). This stark contrast suggests a perceptual gap, while residents are sensitized to visible litter and clogged drains (Rank 9), they do not yet strongly associate shopping habits with the hidden economic liabilities of landfill expansion or ecological restoration.

The prioritization of "increased household garbage volume" directly challenges the mandates of Republic Act 9003, as traditional systems are ill-equipped for the surge of low-density e-commerce plastics. The EcoWaste Coalition (2022) identifies that the free sample economy creates a unique waste stream that often bypasses municipal reduction ordinances. These findings align with industry trends from Shopee PH (2023), noting that affiliate programs drive single-shipment packages, leading to logistical fragmentation. Furthermore, Mazaheri et al. (2021) highlight how unboxing culture prioritizes marketing appeal over sustainability, a trend the World Bank (2021) warns contributes heavily to plastic entering Philippine municipal streams. Ultimately, the public's focus on visible litter over long-term rehabilitation costs highlights a critical need for policy interventions that hold platforms accountable for the full lifecycle of their packaging (Global Plastic Policy Centre, 2022).

3.3 Consumers' Level of Awareness on the Environmental Impacts of Online Shopping Packaging Waste

Table 3.3
Respondents' Level of Awareness on Environmental Impacts

Environmental Impacts	Response Category					Sum	Mean
	STA	A	MA	SLA	NA		
Packaging waste from online shopping can cause soil and water pollution.	18	10	2	0	0	30	4.53
Burning packaging waste can release harmful chemicals that affect human health and the environment.	13	17	0	0	0	30	4.43

The production of online shopping packaging materials consumes natural resources such as trees, fossil fuels, and water.	12	16	2	0	0	30	4.33
Packaging waste can harm marine animals and coastal ecosystems.	11	14	4	1	0	30	4.17
Improper disposal of packaging waste can contribute to flooding and clogged drainage systems.	8	12	8	2	0	30	3.87
OVERALL MEAN = 4.27							

Table 3.3 presents consumer awareness regarding the environmental impacts of e-commerce packaging waste in Barangay Caranan, Pasacao. The data yielded an overall mean of 4.27, interpreted as Strongly Aware, indicating a high level of consciousness. This robust baseline suggests the community is mentally prepared to support structured environmental interventions and local ordinances. Among the indicators, Item 1 (Soil and Water Pollution) obtained the highest mean ($\bar{x}$ = 4.53). This reflects high cognizance of physical contamination, likely heightened by the community's proximity to coastal areas and exposure to global eco-conscious narratives. Conversely, Item 3 (Flooding and Clogged Drainage) recorded the lowest mean ($\bar{x}$ = 3.87, Aware). While still a healthy score, this lower result suggests that because Caranan may not experience severe flash flooding compared to urban centers, residents view packaging primarily as a pollution issue rather than a disaster risk. As e-commerce volumes grow, however, cumulative plastic accumulation in canals could eventually trigger the drainage issues currently underestimated by the public.

This high awareness is largely attributed to the demographic composition of the participants, many of whom are Generation Z. This cohort's digital fluency and immersion in climate change discourse bridge the gap between local consumption and global ecological consequences. Consequently, the challenge for local authorities shifts from public education to providing the how the physical infrastructure and incentive programs necessary to translate awareness into measurable waste reduction. These findings mirror a WWF-Philippines (2020) report noting that Filipino consumers are increasingly mindful of their plastic pollution footprint. The high score in Item 5 ($\bar{x}$ = 4.43), regarding the chemical risks of burning plastics, aligns with Magtuloy (2021) and suggests a community-wide rejection of illegal open burning in favor of scientific waste management. Furthermore, the results are consistent with Liang et al. (2022), who observed that localized impacts like drainage clogging often receive lower scores in communities that do not perceive an immediate flood threat. Additionally, the high score in Item 4 ($\bar{x}$ = 4.33) aligns with Greenpeace International (2021), confirming that consumers are increasingly aware of the resource depletion required for packaging production. Collectively, the data suggests that respondents are exceptionally well-informed and their perspectives align with international environmental trends.

3.4 Proposed Waste Management Plan to Mitigate the Environmental Effects of Online Shopping Platform in Caranan, Pasacao, Camarines Sur

Table 3.4
Respondents' Preferred Waste Management Strategies for Barangay Caranan

Waste Management Strategies	Frequency	Rank
Incentive System: Rewards and recognition for compliant households.	22	1
Take-Back Programs: Partnerships with couriers and recyclers for recovery.	18	2
IEC Campaigns: Regular education on packaging segregation and recycling.	15	3.5
Eco-Packaging: Promotion of reusable alternatives for sellers and buyers.	15	3.5
Barangay Ordinance: Policy to reduce single-use e-commerce plastic.	13	5
Drop-off Points: Designated hubs for bubble wrap and poly mailers.	12	6.5
Clean-up Drives: Monthly community events targeting packaging waste.	12	6.5
Strict Monitoring: Enhanced enforcement of segregation at the source.	9	8

Table 3.4 outlines preferred interventions to mitigate e-commerce waste. The highest-ranked strategy is the Incentive System (Rank 1, Frequency: 22), indicating that positive reinforcement and tangible rewards are more effective than mandatory requirements in Barangay Caranan. This preference suggests a psychological shift where

residents are motivated by a return on investment, such as material goods or social recognition, to undertake the effort of cleaning and drying plastic films. Ranking second is Take-Back Programs, reflecting a strong community interest in circular waste systems. In a coastal area like Pasacao with limited LDPE recycling facilities, residents recognize that Extended Producer Responsibility (EPR) is essential. By partnering with couriers to recover packaging, the logistical burden is shared with the private sector, ensuring materials like bubble wrap are diverted from landfills. Ranking third (Rank 3.5) are IEC Campaigns and Eco-Packaging. While the community is already "Strongly Aware" of general impacts, they value specialized education, such as removing adhesive labels to ensure recycling feasibility. This equal weighting suggests a recognition of the synergy between material innovation and behavioral change.

Conversely, Strict Monitoring and Enforcement ranked lowest (Rank 8, revealing significant resistance toward top-down policing. This reluctance likely stems from the perceived difficulty of complying with complex segregation rules and a fear of punitive financial penalties, which are viewed as an additional socio-economic burden. This underscores that collaborative, benefit-sharing programs are perceived as more sustainable than coercive enforcement in this residential setting. The preference for incentive-based systems aligns with Republic Act 9003, which encourages local government rewards to foster solid waste management. This is supported by Bernardo (2021), who found that trash-to-cash programs significantly improve compliance. Furthermore, the interest in take-back programs echoes Vince (2022), who argued that private sector integration is vital for materials that individual barangays cannot process alone. Finally, these findings align with Troschinetz and Mihelcic (2020), who noted that social motivation is the most sustainable driver for participation in developing regions. As e-commerce grows, implementing these cooperative strategies is critical to prevent plastic waste from reaching marine ecosystems and threatening biodiversity (Jambeck et al., 2015).

Proposed Waste Management Plan - Based on the results, a community-based waste management plan was proposed for Barangay Caranan. The plan focuses on several key components, including incentive-based segregation programs, partnerships with private sector stakeholders, environmental education campaigns, and the promotion of eco-friendly packaging materials. These strategies aim to reduce the accumulation of packaging waste from online shopping while encouraging responsible consumption and waste management practices among residents. Furthermore, the proposed waste management plan emphasizes the importance of collaboration between households, barangay officials, local government units, and private sector partners. Effective waste management requires coordinated efforts among different stakeholders to ensure that environmental policies and programs are successfully implemented. According to the United Nations Environment Programme (2023), multi-sectoral cooperation is essential for addressing plastic pollution and promoting sustainable waste management systems. Here is the proposed waste management plan for Barangay Caranan, designed to address the environmental impacts of online shopping packaging waste. This plan is directly based on the top-ranked preferences from the 30 respondents.

Table 3.4.1
Proposed CY 2027 Waste Management Plan for Online Shopping Packaging Waste Management in Barangay Caranan, Pasacao, Camarines Sur

Project / Activity	Targets	Means of Verification (MOV)	Person Responsible	Timeframe	Fund Source / Amount
1. Incentive System: Rewards and recognition for compliant households.	75% of households actively segregating and surrendering bubble wrap/mailers.	Segregation Logbooks, Redemption receipts for rewards (rice/supplies).	Brgy. Captain, Treasurer, Barangay Councils	Monthly Collection Days	Brgy. Solid Waste Management Fund / PHP 25,000
2. Take-Back Programs: Partnerships with couriers and recyclers for recovery.	Establishment of 1 central drop-off hub, 2 partner courier companies (e.g., J&T, Shopee).	Signed Memorandum of Agreement (MOA),	MENRO, Courier Companies / Brgy. Council, SK Chairperson	Quarterly Coordination	Private Sector / External Partner

3. IEC Campaigns: Regular education on packaging segregation and recycling.	100% of Purok leaders trained, 4 community assemblies conducted.	Attendance Sheets, Distributed brochures, Photos of assemblies.	SK Council, Brgy. Secretary	Quarterly of the year	Brgy. Fund / PHP 10,000
4. Eco-Packaging: Promotion of reusable alternatives for sellers and buyers.	20+ Local online sellers and affiliates adopting eco-friendly packaging links.	List of participating sellers, Samples of alternative packaging used.	Committee on Environment & Trade	Semi-Annually (June & Dec)	SK Fund / PHP 5,000

Implementation through Policy Integration - The practical application of this study was formalized through its institutional adoption into local governance, marking a transition from academic theory to a legally mandated community framework. On April 24, 2026, the Sangguniang Barangay of Caranan officially enacted a resolution adopting the research findings of the Central Bicol State University of Agriculture - Pasacao Environmental Science students, thereby mandating the proper management and reduction of e-commerce packaging waste within the jurisdiction. This policy integration provides the necessary administrative authority to operationalize the "Smart Segregation" plan, specifically by institutionalizing a four-pronged approach: mandatory source segregation of e-commerce residuals, a "Clean and Dry" requirement for collection to prevent contamination, the "Add to Cart Responsibility" awareness campaign, and the establishment of a "Packaging Reuse Station" at the local Material Recovery Facility (MRF). By embedding these strategies into a formal resolution, the implementation is directly integrated into the regular operations of the Barangay Solid Waste Management Committee (BSWMC), ensuring that the study's recommendations are supported by local enforcement and the active participation of zone leaders. This institutional legitimacy not only addresses the immediate household waste volume identified in the research but also establishes a sustainable, circular economy model that minimizes plastic leakage into the coastal environment of Pasacao as digital commerce continues to expand.

4. Summary of Findings, Conclusion, and Recommendations

Summary of Findings - The research conducted in Barangay Caranan, Pasacao, reveals a critical environmental challenge driven by digital commerce, where a one-month study of top shoppers identified 7.085 kg of plastic waste dominated by bubble wrap and poly mailers. While consumers demonstrate a "Strongly Aware" level of environmental consciousness with an overall mean of 4.27, they paradoxically perceive clogged drainage and localized flooding as a lower risk factor compared to general waste accumulation. This awareness-behavior gap is further fueled by "unboxing culture" and e-commerce affiliation, where the pressure to maintain "camera-ready" packaging leads to a rapid saturation of domestic waste bins. The findings indicate that while thin-film plastics like bubble wrap are immediately discarded due to a lack of local resale value, more durable materials such as cardboard boxes and zip-lock bags represent a "latent" waste stream. These items are frequently repurposed for household organization or travel, suggesting that the community instinctively practices certain forms of circularity for higher-utility materials. However, the leakage of lightweight plastics into the coastal waters of Pasacao remains a primary concern for residents, even if they do not yet fully associate their individual shopping habits with the broader economic liabilities of long-term environmental restoration. Consequently, the resulting "CY 2027 Waste Management Plan," officially institutionalized via a Barangay Resolution, focuses on a non-punitive, benefit-sharing model to secure community cooperation. By prioritizing an incentive system that provides tangible rewards for compliant households and establishing logistical "take-back" partnerships with major courier hubs, the plan aims to transform the barangay from a final waste destination into a strategic recovery node. This community-driven framework bridges the gap between digital consumerism and ecological sustainability, ensuring that environmental governance is grounded in the economic and social realities of the residents.

Conclusion - The data confirms that e-commerce has transformed residential dwellings into high-volume transit points for non-biodegradable waste, creating a distinct dual-stream accumulation of immediate residuals and latent waste. While durable materials like cartons are temporarily diverted through household reuse,

lightweight plastics like bubble wrap and poly mailers result in instant disposal due to their low structural value and the logistical prioritization of camera-ready packaging. This creates a self-sustaining loop of consumption that strains local infrastructure and aligns with broader national pollution trends. Furthermore, a significant perceptual gap exists in environmental literacy, while residents recognize immediate physical nuisances like clogged drains, they remain largely unaware of the hidden systemic impacts, such as long-term economic liabilities for landfill expansion and the ecological degradation of the Bicol region. Despite these challenges, there is a robust psychological baseline for action, as the community's "Strongly Aware" status indicates they understand the necessity of environmental stewardship. However, because residents view waste primarily as a localized nuisance rather than a contributor to infrastructure failure, any successful intervention must be participatory and incentive-driven rather than punitive. The proposed "CY 2027 Waste Management Plan" addresses this by prioritizing a return on investment for the labor of segregation and establishing take-back programs that hold e-commerce entities accountable. Ultimately, this framework serves as a multi-sectoral bridge that links household effort and local government funding with the principles of Extended Producer Responsibility to ensure long-term sustainability.

Recommendation - To address the study's findings, the Barangay Council should leverage the community's high environmental awareness by transitioning from general advocacy to skill-building interventions, such as appointing youth Eco-Ambassadors and launching Green Unboxing initiatives. Following the formal adoption of the "CY 2027 Waste Management Plan" via Barangay Resolution, immediate priority must be given to operationalizing the incentive system and establishing specialized Eco-Hubs for soft plastic recovery through formal agreements with courier hubs. These efforts should be supported by updated local ordinances that discourage package fragmentation, alongside technical campaigns that explicitly link thin-film plastics to localized flooding risks. Ultimately, by institutionalizing a dedicated portion of the Solid Waste Management Fund, the LGU can ensure that these recovery programs and last-mile packaging partnerships remain a permanent, sustainable fixture of the community's environmental governance. Furthermore, the integration of long-term longitudinal research will allow the council to monitor the use-life of repurposed materials and adjust landfill capacity projections as latent waste eventually enters the system. This proactive approach ensures that the barangay remains resilient against the evolving logistical demands of digital commerce while safeguarding the local coastal ecosystem for future generations.

Implications for Practitioners/Teachers. For educators and environmental practitioners, these findings underscore the necessity of evolving pedagogical strategies to address the value-action gap, where high environmental awareness does not automatically result in sustainable waste disposal habits. Teachers should move beyond general ecological theories and integrate localized, technical instruction, such as the specific identification of plastic resins and the proper removal of adhesive thermal labels into the curriculum to improve the recyclability of household waste. By utilizing the data from this study as a localized case study, practitioners can demonstrate the direct link between consumer behavior and local disaster risks, such as clogged drainage and flooding in coastal municipalities. Furthermore, educators are encouraged to foster a multiplier effect by training student leaders to act as technical hubs of information within their respective communities, ensuring that academic research translates into tangible behavioral change.

Implications for Students. For students, the study highlights a critical need to transition from passive awareness to active stewardship through the practice of add to cart responsibility. Recognizing that their demographic is a primary driver of digital commerce, students should take the lead in adopting smart segregation and adhering to clean and dry requirements for e-commerce residuals to maintain the integrity of recyclable materials. The findings suggest that students can play a pivotal role in the circular economy by participating in packaging reuse stations and school-based trash-to-cash systems that leverage their economic realities for environmental gain. Beyond individual habits, students are empowered to use their digital fluency to advocate for Extended Producer Responsibility (EPR), pressuring major platforms to adopt biodegradable alternatives like honeycomb paper and cassava bags.

Implications for Schools. For academic institutions, the results provide a roadmap for institutionalizing sustainability through formal partnerships with local government units and the private sector. Schools should go beyond classroom instruction by establishing on-campus infrastructure, such as specialized material recovery bins for e-commerce waste and drop-off hubs for take-back programs with couriers. By following the example of formal policy adoption through barangay resolutions, schools can model how academic research serves as the foundation for legally mandated community frameworks. Additionally, institutions must prioritize multi-sectoral collaboration, acting as a bridge between researchers, local officials, and entrepreneurs to ensure that the Solid Waste Management Fund is effectively utilized for incentive-based systems that reinforce long-term ecological preservation.

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