

# Zero-Plastic Waste: Examining Product Packaging Circularity to Mitigate Environmental Pollution

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## ABSTRACT

The problem of plastics pollution has become one of the most urgent issues in the world now especially plastic packaging materials. The study aimed at examining packaging circularity to achieve zero plastic waste to reducing environmental pollution. Further, this study sought to determine appropriate package circularity and sustainability practices for the Fast-Moving Consumer Goods (FMCG) sector in Ghana. Purposive sampling technique was adopted for the study to sample to 14 Fast-Moving Consumer Goods Companies in the Greater Accra Region of Ghana. Primary data was collected from 217 participants using a survey instrument (questionnaire). The data was analysed quantitatively through descriptive statistics using Stata. The findings revealed that FMCG firms could minimize waste and address environmental pollution caused by plastic packaging by adopting circular economy principles. Further, this study aligns with The United Nations Sustainable Development Goal 12: Responsible Consumption and Production, Goal 14: Life Below Water and Goal 15: Life on Land to combat environmental pollution. The study provides useful directions for FMCG firms and policy makers in Ghana and globally towards zero plastic waste to fight against environmental pollution as well as the promotion of sustainable practices and ESG strategy within FMCG industry.

**Keywords:** Zero-plastic waste; FMCG; circular economy; sustainability; product packaging circularity; environmental pollution

## INTRODUCTION

Plastic packaging has a fundamental role in preserve quality and safety of food, increasing its shelf life and reducing food waste. However, current linear management is not sustainable and an urgent transition to an effective circular economy is needed, according to the 2020 European Union action plan for the Circular Economy [1]. Despite the benefit derived from plastic packaging in terms of food applications, low cost. The great number of polymer types and the various applications in several sectors, the recycling plastic waste is very difficult [2].

Globally, there is also a significant waste in packaging. From the total volume of plastics used, Fast Moving Consuming Goods (FMCG) packaging represents 26%, of which only 14% is recycled (and just 5% of plastic packaging material value is retained for subsequent use due to poor sorting technology) [3]. Coca-Cola is a top target for consumer, investor and environmental groups concerned about petroleum-based plastic single-use bottles clogging oceans, among other problems. The company was the world's worst plastic polluter for the fourth year in a row in 2021, according to the global coalition, Break Free from Plastic's annual report released in October 2023 [4]. Moreover, it was estimated that 70,000 metric tons of mismanaged plastic waste, that is burnt or dumped, is created by Unilever every year across six developing nations (China, Brazil, India, Mexico, the Philippines and Nigeria). This plastic waste can cover more than 11 football pitches a day [5].

Stoler [6] stated that many African countries, single-use plastics have become an enduring menace. Plastic

bags are indiscriminately used by vendors in cities and towns across Africa, and it is common for drinking water to be sold in plastic sachets and food packed in single use Styrofoam packaging. Almost 8.24 billion sachets of water are consumed in Ghana. Although exact data on total plastic production and importation is lacking, it was estimated that more than 3,000 metric tons daily and one million tonnes yearly of plastic waste are generated. An estimated 86 percent of Ghana's waste plastic load, is improperly disposed of resulting in plastics clogging up storm water drains, rivers, and streams and ending up in the oceans. An estimate of 250,000 metric tons of plastic waste is dumped from Ghana into the Atlantic Ocean [7]. In African countries, especially Ghana, there are not effective and sustainable solutions to tackle the widespread use of single-use plastics and their improper disposal. While plastics waste has been recognised as an issue, there is still a need for research which will seek to identify and implement strategies and measures to reduce their consumption, support good waste management practice and transition towards more sustainable alternatives. Therefore, this study sought to determine effective package circularity sustainability practices for the Fast-Moving Consumer Goods (FMCG) sector in Ghana. The importance of sustainable management practices, reduction in pollution and ecosystem protection was highlighted by the study.

## LITERATURE REVIEW

### Zero-Plastic Waste and Environment Pollution

Plastic possesses a diverse range of unique properties: it can withstand a wide range of temperatures, resist chemicals and light, demonstrate high strength and toughness, and can be easily shaped when heated as a hot melt [8]. Manufacturers utilize the diversity of polymers and the versatility of their properties to produce a wide array of products like packaging, electronics, construction materials and many more. Plastic, chemically composed of chainlike molecules known as polymers, are created by combining simpler chemicals called monomers. The term "poly" signifies "many", "mono" means "one" and "mer" indicates "units". Hence, multiple monomers unite to form a polymer [9].

Ghana annually imports approximately 2.58 million metric tons of raw plastics. Out of this quantity, 1,883,400 metric tons, accounting for 73%, become waste materials. About 490,200 metric tons, representing 19% of the total imported raw plastics, find secondary use while meagre 0.1% of plastic waste gets recycled [10]. The bulk remaining waste accumulates as plastic litter in open dumpsites, adversely affecting ecosystems and communities [11]. This accumulation of synthetic plastic products in the environment, resulting to detrimental effects on wildlife, habitats and human populations, is termed plastic pollution [12]. The urgency of this matter is worsened by rapid growth in disposable plastic production that surpasses the ability to manage it [13]. Adding to the concern, plastic durability means it takes hundreds of years to degrade, and recent studies suggest it may break down into microplastics rather than fully decomposing [14].

The term "waste" encompasses substances intended for disposal according to national laws [15]. In response to resource scarcity and pollution, various initiatives aim to create and implement production-consumption innovations that decouple economic growth from resource depletion and pollutant emissions [16]. The concept of "zero waste" aims to eliminate landfill contributions. It involves reducing consumption, reusing items whenever possible, minimizing recycling, and composting the remaining waste to enrich the soil [17]. In its purest form, the zero-waste approach requires that everything produced or used is either consumed (like a sandwich), reused (using a ceramic plate for the sandwich), recycled (the plastic bag the bread came in), or composted to nourish the soil (the core from a lettuce leaf on the sandwich). Zero-waste practices strictly avoid harming the environment through incineration or improper disposal in landfills or oceans [18].

Stakeholders, including citizens, producers, retailers, and policymakers, contribute to plastic waste within the plastic system (encompassing fabrication, supply, use, and waste collection/processing) through their specific actions [19]. Consequently, understanding behaviour and indicating the factors that influence behavioural change are critical in addressing plastic waste reduction [20]. Government intervention also plays a critical role, especially in tackling proper disposal and management of plastic waste. This involves setting collection

targets to ensure efficient waste gathering, establishing guidelines for transboundary plastic movement to prevent improper disposal, and implementing recycling facility standards to enhance processes and efficiency [21].

Plastic waste has become a critical global environmental issue due to its extensive production and impact on ecosystems. The continuous growth in plastic waste generation results from factors such as population growth, urbanization, and the rise of consumerism [22]. A transformation away from disposable plastics and a shift towards a circular economy for plastics is imperative worldwide. The urgency and severity of plastics as an environmental threat caused by industrial sectors and governments find support in scientific evidence [23].

Plastics have unparalleled properties for packaging applications, providing benefits to both consumers and suppliers. Plastic packaging ensures safety and hygiene by acting as a robust barrier against moisture, oxygen, and aromas, thus safeguarding food quality [2]. However, despite once being hailed as a versatile and convenient material, plastics have gained a notorious reputation due to their detrimental effects on the environment and human health. In the United States, plastics represent 15-25% of all hospital waste. While some newer plastics are biodegradable, the majority are incinerated, disposed of in landfills, or recycled, all of which come with ecological risks [24].

One of the major challenges posed by plastics in the environment is the considerable uncertainty surrounding the extent of damage caused. There are still significant gaps in the understanding of the links between plastics, health and the biosphere. Additionally, uncertainties persist regarding the quantities of plastics entering the environment and their accumulation. While the precise volume of plastic leakage may be hard to estimate, the fundamental message from all these studies is clear: plastic leakage is a significant environmental problem that is worsening. Due to the long lifespan of plastics, the effects of today's plastic leakage could escalate in the future, causing long term and potentially irreversible damage [25].

### **Sustainable Practices for Plastic Packaging Circularity**

Morashti et al., [26] employed quantitative analysis to thoroughly examine journal articles published between 1993 and 2020. In-depth interviews with experts in the field of sustainability and packaging was conducted to source for primary data. Data was analysed using two quantitative methods, SLR and big data analysis. The findings revealed that, sustainable packaging primarily concentrated on science and engineering fields, but there is now a growing focus across diverse disciplines. This shift is accompanied by an increasing emphasis on the circular economy, which advocates for packaging materials to be designed, used, and disposed of in a sustainable manner. By adopting circular economy principles, it is possible to minimize waste and address environmental pollution caused by packaging. Collaborative efforts between various industries and disciplines are vital in promoting sustainable packaging practices for a better future [26].

[27] conducted an analysis of sustainable practices implemented by Italian firms to improve the circularity of packaging and assessed the resulting environmental improvements. To conduct this research, they utilized publicly available data from the National Consortium of Packaging (CONAI) in Italy, which consisted of 603 circular packaging projects. The data was analysed using descriptive and prescriptive means for the study. The study's findings revealed that firms tended to focus more on individual sustainable practices rather than implementing portfolios of practices to achieve packaging circularity. The most frequently adopted sustainable practices were raw material saving and logistics optimization, which proved to be effective in enhancing the circularity of packaging. This suggests that adopting circular packaging practices can lead to positive environmental impacts in multiple areas.

[28] utilized literature review and interviews in the study, towards plastic circularity: current practices in plastic waste management in Japan and Sri Lanka. The focus of the interviews was to address the information gap identified during the literature review [28]. According to the study findings, technological and policy advancements like the application of Extended Producer Responsibility (EPR) in PWM in Japan can be used as a means of achieving circularity in Sri Lanka.

## METHODOLOGY

A quantitative research approach was employed for the study. The targeted population for the study comprised of all fast-moving consumer goods (FMCG) companies operating within the Greater Accra Region of Ghana. The study adopted purposive sampling technique to select 14 Fast-Moving Consumer Goods Companies in the Greater Accra Region of Ghana. To ensure selected FMCG companies aligned with our research objective, The companies were purposively sampled based on the following criteria developed by the study: Companies with publicly stated commitments or initiatives to reduce plastic usage in packaging, companies operating in Ghana with a significant market presence and diverse plastic packaging practices and companies with a proven record of implementing sustainable packaging practices in Ghana. Also, the Ghana Recycling Initiative by Private Enterprises (GRIPE), a business-led coalition established under the Association of Ghana Industries (AGI) with a stake in the plastics sector to incorporate environmentally waste management strategies, particularly regarding plastics. As a result, GRIPE associated companies were sampled for the study.

Primary data was collected from 217 participants by administering questionnaire to Sustainability Manager, Environmental Manager, Supply Chain Manager, Marketing/Brand Manager, Procurement Manager, Operations Manager, Corporate Social Responsibility (CSR) Manager, Executive Management, Product Development/Innovation Team, Quality Control/Assurance Manager among others. Following the responses from the participants in the 14 selected FMCG companies which included 217 observations, the acquired data was analysed using Stata/MP 17.0. The descriptive statistics included mean, standard deviation, tables and percentages were used to display the results of the study.

## RESULTS

Table 1. Sustainable Practices for Product Packaging Circularity

Sustainable Practices for Packaging Circularity	Scale					Mean	STD
	SD	D	N	A	SA		
Our company actively implements sustainable packaging practices in our products.	14 (6.45%)	12 (5.53%)	53 (24.42%)	86 (39.63%)	52 (23.96%)	2.520	1.385
Our company educates consumers and stakeholders about the importance of sustainable packaging.	18 (8.29%)	26 (11.98%)	58 (26.73%)	75 (34.56%)	40 (18.43%)	2.539	1.347
Our company actively seeks innovative and eco-friendly packaging solutions.	15 (6.91%)	22 (10.14%)	36 (16.59%)	91 (41.94%)	53 (24.42%)	2.442	1.413
We regularly assess and measure the environmental impact of our product packaging materials.	23 (10.60%)	21 (9.68%)	35 (16.13%)	83 (38.25%)	55 (25.35%)	2.604	1.468
We actively engage with customers and suppliers to foster a circular economy for packaging materials.	13 (5.99%)	22 (10.14%)	52 (23.96%)	91 (41.94%)	39 (17.97%)	2.359	1.340



We prioritize the use of locally sourced and recycled materials in our packaging.	18 (8.29%)	16 (7.37%)	65 (29.95%)	71 (32.72%)	47 (21.66%)	2.654	1.349
Sustainable packaging is an integral part of our corporate sustainability strategy.	17 (7.83%)	15 (6.91%)	41 (18.89%)	82 (37.79%)	62 (28.57%)	2.617	1.429
We have set specific targets and goals for reducing waste and increasing recycling in our packaging materials.	19 (8.76%)	21 (9.68%)	41 (18.89%)	67 (30.88%)	69 (31.80%)	2.778	1.400
Industry associations in the sector contribute to advancing circular packaging practices.	11 (5.07%)	19 (8.76%)	52 (23.96%)	91 (41.94%)	44 (20.28%)	2.378	1.338
Our company supports and advocates for government policies that encourage sustainable packaging practices.	16 (7.37%)	16 (7.37%)	40 (18.43%)	71 (32.72%)	74 (34.10%)	2.760	1.403

SD-strongly disagree, D- disagree, N-normal, A- agree, SA- strongly agree, STD- standard deviation.

From Table I, 39.63% of the respondents indicated the adoption of sustainable packaging practices by their companies in their production with a mean of 2.52. The high mean implies that these manufacturers are committed to incorporation of green solutions whereas low standard deviation of 1.38 shows variations in extent of implementing greener operations. 34.56% of the respondents emphasized on the importance of educating consumers and other stakeholders regarding sustainable packaging and this corresponded with a mean score nearly equivalent to 2.54 which denotes a significant effort for spreading awareness. A standard deviation of about 1.35 signified disparities among educational efforts. However, more than 41.94% of the respondents indicated that they were actively searching for environmentally friendly, innovative packages for their companies. An average score of about 2.44 shows strong commitment towards an environmentally friendly position and variation as observed in company’s strategies with a standard deviation of about 1.41. Conversely, 38.25% of the companies had an environmental assessment plan of product packaging materials as one of their main commitments. With a mean score of 2.60, this shows a worthwhile effort in keeping track of the environmental effect of packaged materials. Standard deviation of approximately 1.47 demonstrates disparities in the scope of these evaluations. However, 41.94% of these organizations actively engage customers and suppliers to foster a circular economy for packaging materials and recorded mean scores of about 2.36. With a high standard deviation of approximately 1.34. Over 32.72% of respondents agreed on prioritizing the use of locally sourced and recycled materials in their packaging. A mean score of 2.65 shows high adherence in sustainable material choice with a standard deviation close to 1.35 illustrating different degrees of materials priority. 37.79% responded that Sustainable packaging is an integral part of their corporate sustainability strategy. A strong commitment to strategic integration is signified by a mean score of approximately 2.62 even though the differences are reflected through a standard deviation of around 1.43.

Additionally, 31.80% responded that their companies had set specific targets and goals for reducing waste and increasing recycling in their packaging materials. The mean score of 2.78 reveals substantial effort towards measured improvement. Standard deviation of about 1.40 is indicative of diverse ways of setting goals. 41.94 % of respondents recognized that industry associations in the sector contribute to advancing circular packaging practices. A mean score of 2.38 reveals significant efforts towards collaborative work. Also, a standard deviation of 1.34 indicates differences that people have on how much they are contributing to the industry.

Lastly, 32.72% of the respondents affirmed their pledge to embrace measures that supports and advocates for government sustainable policies that encourage sustainable packaging practices. This means that the mean score of about 2.76 shows a serious commitment towards the support since a standard deviation of roughly 1.40 demonstrated disparities regarding government policy backing.

## DISCUSSION

### Sustainable Practices for Product Packaging Circularity

From Table I, there is vital information that can help determine how organizations are adopting sustainable practices for packaging. Diverse results on sustainability have been indicated by the mean scores across all statements and by the calculated standard deviation across all the surveyed organizations. Some companies promote sustainable packaging, utilize local raw materials and recycled ones which underscores Hosbon [29] remark on circular economy as elucidated by Ellen MacArthur Foundation, it signifies an industrial system designed for restoration and regeneration. While others are slow in adopting environmentally friendly solutions, majority of the FMCG companies in Ghana believe in sustainable packaging as a key component in their broader corporate sustainability agenda. Though, some areas involving customers and suppliers on packaging materials, formulating objectives for waste reduction and recycling needs improvement in the FMCG sector. Circular packaging depends on industry players, with potentials for improvement through collaborations. The research by Morashti, confirms the findings of this study [26], that is adopting circular economy principles, firms can minimize waste and address environmental pollution caused by packaging. Collaborative efforts between various industries and disciplines are vital in promoting sustainable packaging practices for a better future.

## CONCLUSION

This research highlights the intricate linkage between the commitment of industry players toward zero-plastic waste; and the sustainable practices that could help mitigate environmental pollution by Ghana's Fast-Moving Consumer Goods Sector. However, there are many problems faced in the adoption of eco-friendly packaging by many corporations. To go for zero-plastic waste, there should be a comprehensive model addressing environmental obligations, community engagement, and effective management practices. In addition, this calls for targeted strategies that recognize and respond to the challenges and opportunities presented by the FMCG industry in Ghana. The final implication of the study presents sustainable packaging options and the need for eradication of environmental pollution resulting from plastic waste in Ghana.

## RECOMMENDATIONS

The study concluded that FMCG companies should actively engage with stakeholders, including government agencies, NGOs, and local communities, to address plastic waste issues collectively. Furthermore, Investment in research and development to identify innovative packaging materials and solutions that align with sustainability goals and are suitable for the Ghanaian context. This can be done through the allocation of resources and funding for dedicated Research and Development (R & D) teams, projects or pitch focused on sustainable packaging innovation. Also, collaboration with research institutions, universities, and experts in materials science and packaging technology will be essential in achieving this goal. Local material such as agricultural by-products or bio-based materials can be source to make packaging, taking advantage of Ghana's natural resources and then reducing cost of importation of raw materials. Consumers can be engaged through surveys, focus groups, and feedback mechanisms to understand their preferences and willingness to adopt innovative packaging solutions. This input will help to inform R&D efforts. Furthermore, massive public education on responsible plastics use, recycling and eco-friendly packaging must be provided. FMCG companies need to follow current legislation on plastic waste and join government efforts to minimize plastic pollution. Opportunities should be identified for optimising supply chain efficiencies through establishing a closed-loop relationship with suppliers, manufacturers and recyclers. These recommendations offer strategies

for FMCG businesses moving towards sustainable and circular packaging environment.

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