A critical analysis of the critiques surrounding the sustainability of circular economy: An authenticity assessment of circular economy practices in the plastic industry in Ghana.

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2026

Dissertation submitted in partial fulfilment of the requirement for
the Master of Science (Research) in the area of Sustainable Development.

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Declaration

I hereby certify that this dissertation was written by me and that this submission is a result of my independent work under the supervision of Dr. Margaret Camilleri Fenech and Dr. Thérèse Bajada of the University of Malta.

No portion of this work has been submitted in support of an application for another degree or qualification of this or any other university or institution of higher education

Besides citing from authorities whom I have duly acknowledged, I am herein responsible for any error, omissions, and oversight.

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Acknowledgement

Firstly, I would like to thank Almighty Allah for his benevolence in gifting me this opportunity and seeing me through successfully. The success of this work came about as a result of the huge contributions made by several parties. It is my deepest desire that;

I hereby express my gratitude to my supportive and dynamic supervisors' Dr Margaret Camilleri Fenech and Dr Thérèse Bajada for their patience, guidance, and regular council in and out of their regular schedule. I appreciate their efforts in equipping me with the skills and knowledge necessary to carry out this work to the fullest and future endeavours.

I would like to express my gratitude to Yakubu A. Zakari (PhD), Dr. Shariff-deen Y Karim, and Amina Smaoui for their help and council. Each was essential to my study analysis and fieldwork. I would want to thank Imam Laiq Ahmed Atif, Mr. Mohammed Zuhairu, Mr. Stephen Abela, Dr. Anand Kumar, Mr. Zangu Samuel, Eng. QS Qamar Abdul Razak, and Mr. Divyendu Kashyap for all of their help in getting me to and through the University of Malta.

To my colleagues, family, and friends, I appreciate the help rendered to me in whatever capacity.

Lastly, I wish to thank all the participants in this study for their time and acknowledge the authors of numerous Reports and articles which were consulted during the study and are listed in the references.

Faisal Mohammed Zakari

Abstract

The circular economy (CE) has gained prominence as a strategy to reduce waste and decouple economic growth from resource depletion. However, the practical implementation of circular business models (CBMs) in developing-country contexts remains poorly understood. This study evaluates the adoption, challenges, and sustainability outcomes of CE practices in Ghana's plastic sector, through a mixed-methods design involving surveys and semi-structured interviews with manufacturers, packaging companies, recyclers, diversified firms, and informal actors.

The findings reveal a sector engaged in early, reformist circularity, active yet constrained, pragmatic yet fragmented. The research indicates that CE understanding is often limited to recycling, with minimal attention to upstream strategies such as redesign, reuse, and product life extension. Business type and size significantly shape CE adoption patterns: packaging firms exhibit the lowest uptake of recycled content, manufacturers remain dependent on virgin materials due to strict quality requirements, while medium-to-large firms demonstrate the most balanced and dynamic engagement through industrial symbiosis and structured waste systems. SMEs and cottage industries practice grassroots circularity driven by necessity rather than strategy.

Across all groups, contextual barriers including weak enforcement, high technology costs, dependence on fossil energy, and inadequate infrastructure limit environmental and social outcomes. Social sustainability remains inconsistently integrated, with informal waste workers facing persistent inequities despite their central role in material recovery. To synthesise these dynamics, the study proposes an emergent conceptual framework positioning business characteristics (type and size) as key determinants of environmental and social CE outcomes, moderated by regulatory, market, and technological conditions termed as contextual factors. The analysis recommends corporate strategies for implementing circularity are tailored to firm size and business model. It further positions Ghana's CE landscape as a mirror of worldwide CE critiques, ambitious in theory but limited in practice while emphasizing the importance of livelihood, equality, and adaptive rationality in building sustainable transitions in developing countries.

Keywords: circular economy, critiques, plastic industry, circular business models, sustainability

Dedication

Dedicated to the memory of my uncle and father

Abdul Razak Mohammed and Zakaria Mohammed

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Chapter 1

Introduction

1.0 Introduction

In the recent past, consumer interest for plastic and related commodities has surged more than that of any other material (WEF et al., 2016; IPCC WG III, 2023). The fact that plastic is so rooted in and essential to contemporary existence that acknowledging its negative effects has become difficult is extremely concerning (WEF et al., 2016; IFC, 2023; UNEP, 2023). To this end, global plastic output has increased annually from 2 million Mt in 1950 to more than 400Mt in 2022, with a large discrepancy between supply and demand concentrations around the world (Houssini et al., 2025). Plastic's reputation as a representation of the "wear and tear of consumer society" is strengthened by the fact that we continue to produce it based on immediate needs rather than long-term design requirements (Lindahl et al., 2022).

The consequences of such ephemeral production model are the environmental and social challenge plastic presents. According to the 2022 plastic life cycle findings of the Organisation for Economic Co-operation and Development (OECD), the negative environmental impact of plastic cuts across their production, use and end-of-life management (OECD, 2022). Thus, in terms of emissions, plastic produced, used and discarded emitted 1.8 billion tons of greenhouse gas emissions (3.4% of the world's total) in 2019 (OECD, 2022). Mostly generated from fossil feedstock that contributes to global warming, causing extensive pollution and environmental damage (OECD, 2022: and OECD, 2022b). In their more comprehensive analysis of the lifecycle of various plastic types, Karali et al. (2024) calculate that the manufacture of plastics accounts for 5.3% (2.24 GtCO2eq) of worldwide greenhouse gas emissions. Furthermore, with a total accumulated stock of 139 Mt in aquatic ecosystems, the environmental exposure and impact of plastic pollution were anticipated to be around 22 Mt in 2019 (OECD, 2022b). Nearly every aspect of the environment contains plastics and micro-plastics (Kanan and Vimalkumar, 2021; Prata et al., 2020; and Huang et al., 2021).

According to literature, global plastic demand is expected to rise, especially in emerging economies of Sub-Saharan Africa and Asia, driven by economic and population growth (CIEL, 2019; OECD, 2022). The Republic of Ghana, a West African country bordered by Côte d'Ivoire, Burkina Faso, Togo, and the Gulf of Guinea serves as a pertinent example. Ghana has experienced rapid urbanisation, with its urban population increasing from approximately 4 million in 1984 to nearly 14 million in 2020 (Osama, 2023). Its economy, driven by services, manufacturing,

agriculture, mining, and trade, has raised material demand and waste generation. Its capital, Accra, as the leading industrial and commercial hub (Acheampong, 2021), faces severe plastic pollution linked to rapid urbanisation and inadequate infrastructure (EACDS & SEURECA, 2019; Asare et al., 2019). Plastic waste accounts for most of Ghana's waste (Ofori et al., 2021), with only 2–5% reprocessed; the remainder ends up in landfills, dumpsites, oceans, or is burnt (Hervie et al., 2021). Significant obstacles to plastic management include lack of funding, insufficient law enforcement, and low public awareness (Adjibolosoo, 2022; Debrah et al., 2023). However, beyond environmental harm, Ghana has suffered reputational damage as the seventh dirtiest country in the world (Smith-Asante, 2015; Adu-Gyamfi, 2018; Appiah-Sekyere & Oppong, 2019). With a population growth rate of 2.2% per year and per-capita plastic consumption rising at 3.4% per year (GNPAP, 2021), the pollution problem is exacerbated, particularly in coastal areas and waterways (EACDS & SEURECA, 2019). Thus, Ghana and Accra in particular offer a crucial case for examining plastic waste management challenges in emerging economies.

International organisations predict that if no deliberate modifications are implemented to existing systems, the ongoing expansion in production and demand would likely lead to an increase in emissions and waste, exacerbating already-existing environmental pressure (IEA, 2018; OECD, 2022b). For this reason, in Europe, the European Union (EU) published its first plastics plan in January 2018 in an effort to address plastic waste while fostering economic expansion and innovation (Rasimus, 2020). In Africa, countries like Rwanda, Nigeria and South Africa launched an alliance in late 2017 with the idea to develop a single alliance that steer Africans transformation towards industrial symbiosis and economic growth (UNEP, 2022). Ghana joined the Global Plastic Action Partnership (GPAP) in 2019 as the first African nation, and it also established business initiatives and regulatory attempts to accommodate the plastic situation. For example, the Ghanaian government has invested in collection, sorting, and recycling to achieve its goal of zero plastic leakage into the oceans and waterways, whiles also implementing the National Plastic Management Policy (GPAP 2020; MESTI, 2020).

Plastic pollution persists globally largely because it remains embedded within a predominantly linear economic system characterised by extraction, production, consumption, and disposal, resulting in significant environmental degradation and public health risks (Diggle & Walker, 2022). Within this model, plastics are commonly designed for short-term use, while waste

generation and environmental externalities receive limited consideration. Consequently, the system encourages continuous resource extraction, generates persistent waste streams, and creates substantial ecological, social, and economic costs. Although the linear economy has historically facilitated industrial growth, economic expansion, and consumer convenience, its continued reliance on virgin raw materials and downstream disposal practices has become increasingly unsustainable. In Ghana, these tensions are particularly visible through the growing accumulation of plastic waste, inadequate waste recovery infrastructure, and the broader environmental and social pressures associated with unmanaged disposal practices.

Nevertheless, the increasing focus on plastic today goes beyond its negative impacts as a material or product. Plastic is seen as an environmental solution and one of modern life's omnipresent material is significant in the sustainable development discourse (Bucknall, 2020; Khan et al., 2020). Strategically, due to their lightweight, resilient, and versatile nature, it has enormous potential to lower energy usage, resource flow, and waste production, opening the door to a more sustainable, circular, and resource-efficient future (Lindahl et al., 2022; British Plastic Federation, 2023; EMF et al., 2017). The sustainability potential and detrimental environmental impact of plastic could be balanced by a systematic shift in plastic production from a linear economy to a circular economy (CE), where value stays in resource loops (Lit et al., 2024). This would involve managing resource flow, reducing energy footprints, and eliminating waste from production systems. As such, material that was previously considered waste is now viewed as a resource, which lessens the burden on the earth by minimizing the mining of new raw materials and their disposal through landfills (Geissdoerfer et al., 2017; van Opstal and Borms, 2023).

Academics, decision-makers, and corporate organisations propose the idea of the CE as a strategy to move away from the single production system (Khan 2020). Consequently, the CE has emerged during the past few decades, and as a result, the circular plastic economy has drawn more attention due to its appeal as a system that can overcome the linear pattern of production and consumption (Merli, Preziosi and Acampora 2018). In addition to maintaining the earth's carrying capacity to support renewal, the principles of the CE have become increasingly significant in fostering social and economic growth (e.g., job creation and net material cost savings) (Olsson et al., 2014: EMF 2013). Despite this growing interest, the literature on CE theory currently distinguishes two primary approaches to CE implementation: an application with a focus on a particular group of

substances, items, components, and sectors (such the plastic industry) and structural economy-wide deployment, such as at the local, regional, national, and international levels (Kalmykovaa et al., 2018). However, Covellec et al., (2022) have criticized the circular implementation of any direction mentioned in the previous research. According to these authors, circularity remains a "theoretically, practically, and ideologically" contested concept, with many circular business models reproducing existing structural limitations rather than transforming production and consumption systems. This critique highlights the need for context-specific research that critically evaluates not only the implementation and outcomes of circular plastic economy models, but also the extent to which they address broader sustainability and systemic concerns. It is within this context that the present study focuses on the implementation of circularity at the sector and product level within Ghana's plastic industry.

1.2 The Research problem

The transition toward a CE for plastics is widely promoted as a key strategy for reducing environmental pollution, conserving resources, and advancing sustainable development. However, much of the existing research on circularity in plastics has been narrowly focused on specific technologies, materials, or products, often overlooking the central role of circular business model implementation in determining whether circular solutions are economically viable and scalable (King and Locock, 2022; Lit et al., 2024). As a result, technical innovations are frequently assessed in isolation, without sufficient consideration of how organisational structures, market dynamics, and policy environments shape real-world outcomes. In Ghana, there exists little evidence of endeavours and executions concerning the CE (Appiah et al., 2023), and its tangible effect remains to be observed (Kusi-Sarpong et al., 2021). Although the plastic industry plays a significant role in economic activity, it is also a major contributor to environmental pollution and public health risks. While CE practices are increasingly promoted as a pathway to address these challenges, their actual implementation, effectiveness, and sustainability impacts remain underexplored, particularly within a developing economy context.

Globally, empirical research on sectorial implementation CE in the plastic industry has been dominated by studies from developed economies such as Finland's best CE strategies (Rasimus, 2020), Sweden's business model typologies (Khan, 2020), and the Netherlands' circular start-ups'

role in implementing the circular plastic economy (Lit et al., 2024). Although some studies have looked at circular business models in the plastics value chain in developing nations like India, these assessments frequently overlooked important aspects such as model processes and outcomes, as well as emerging criticisms of circularity as a sustainability approach. While studies have begun to map CE awareness and potential in Ghana (e.g., Boateng et al., 2023; Boon and Anuga, 2020; Asante et al., 2022; Erdiaw-Kwasie et al., 2023), there is a notable absence in systematic assessments of CE practices (Veleva et al., 2017). Specifically, there is limited research evaluating the authenticity of corporate CE models, their conformity to global CE principles, and their resilience to the noted criticisms. This lack of evaluation risks promoting a transition that is not "just," but potentially perpetuating or greenwashing practices that do not align with established best practices. This gap is critical, as scholars increasingly argue that CE frameworks are conceptually incomplete, risk reproducing linear production logics, and may generate unintended environmental and social consequences (Corvellec et al., 2022; Paech et al., 2007; Korhonen et al., 2018).

To this end, the research problem addressed in this study is the lack of a critical, context-specific assessments of CE practices in Ghana's plastic industry that examines not only adoption patterns, but also their processes, outcomes, critiques, and policy underpinnings. Without such an evaluation, efforts to advance circularity risk remaining fragmented, inequitable, and misaligned with both CE principles and broader sustainable development goals. This study therefore seeks to assess the characteristics, processes, and outcomes of circular business models in Ghana's plastic sector, evaluate their alignment with global critiques, and identify the conditions necessary to support a fair, inclusive, and genuinely transformative circular transition. Providing actionable insights for policymakers, businesses, and stakeholders in Ghana and similar developing regions.

1.2.1 Research aim and objectives

The aim of this study is to critically evaluate the implementation of CE (CE) practices in Ghana's plastics industry by assessing the alignment of existing business models with core CE and sustainability principles, examining the role of government policy in enabling a just and effective transition, and developing a context-specific framework to explain the challenges and systemic requirements of circular plastics in a developing economy.

Objectives:

1. To assess the sustainability critiques associated with CE practices in Ghana's plastic industry.
2. To evaluate the processes and outcomes of CE practices implemented by businesses in the Ghanaian plastic sector.
3. To evaluate the CE landscape of the plastic sector due to the identified outcomes and processes.
4. To analyse the influence of government policies on supporting a sustainable CE transition in the plastic industry.

1.2.2 Research questions

The four research questions which guide the whole research study are:

1. What are the different criticisms related to the implementation and practices of circularity as a driver of sustainable development?
2. What are the primary critiques surrounding the CE as applied to the plastic industry in Ghana?
3. What distinctive attributes are evident in the outcomes and processes of CE initiatives in Ghana's plastic industry?
4. How have government legislative initiatives contributed to a sustainable transition toward circularity in Ghana's plastic industry?

1.3 Dissertation structure

This dissertation is organised into seven chapters that systematically develop the research problem, methodology, analysis, and conclusions. Chapters 1 to 3 establish the foundation of the study by addressing the why, what, and where of the research. Chapter 1 introduces the research problem, objectives, and questions, situating the study within the global CE and plastic pollution discourse. Chapter 2 critically reviews existing literature on CE theory, circular business models, and emerging critiques, highlighting key gaps. Meanwhile, Chapter 3 contextualizes the study within Ghana's plastic sector, outlining the institutional, regulatory, and socio-economic conditions shaping CE implementation. Following this overview is Chapter 4 that explains the how of the

study by detailing the research design, data collection methods, analytical approaches, and ethical considerations. This chapter ensures methodological rigor and transparency.

Chapters 5 and 6 constitute the analytical core of the dissertation. Chapter 5 presents the empirical findings from the quantitative and qualitative analyses, while Chapter 6 critically discusses these findings in relation to existing theory, global CE critiques, and Ghana's contextual realities. This separation enhances analytical clarity and theoretical integration. Finally, Chapter 7 concludes the study by synthesizing key findings, outlining theoretical and practical contributions, and translating insights into policy and business recommendations. It also reflects on study limitations and identifies directions for future research, positioning the Ghanaian case within broader CE debates.

Chapter 2

Literature Review

2.1 Conceptual understanding of the CE

In the face of growing tensions related to production, use, and waste on global resources (European Commission: Directorate-General for Environment, 2014), which is perceived as a fundamental outcome of direct manufacturing processes, the CE paradigm has emerged as a groundbreaking notion capable of transforming corporate conduct with regard to resource utilisation (Ofori, 2023). Recent investigations indicate that, despite the recognition of the limitations of capital and the absorptive capacities of the planet, the global extraction of resources has tripled from 1970 to 2017 and it continues to grow due to population growth, rising consumption levels (International Resource Panel (IRP), 2017; Oberle et al., 2019; Kruse and Wedemeier, 2022). However, the importance of materials and their strategic management is increasingly emphasizd through the lens of CE principles (Wilts and von Griese, 2017; Wilts, 2017; Abbas et al., 2023). Throughout time, essential materials have been employed to cultivate food, construct infrastructure, manufacture consumer products, or generate energy. But once their usefulness are over, these materials are frequently thrown away as waste. (European Commission: Directorate-General for Environment, 2014). Conversely, the CE is vital for the reclamation of these resources, based on the reality that numerous resources are challenging to replenish once they have been excessively exploited or consumed (Ofori, 2023).

The early research of Pearce and Turner (1990) is where CE first emerged, who introduced the concept in their foundational text, “Economics of Natural Resources and the Environment” (Pearce andTurner, 1990). Since then, CE has developed significantly, extending its applications across various sectors such as “waste management, sustainable design, construction, and food production” (EMF, 2012; EMF, 2024). The Ellen MacArthur Foundation (EMF) report in 2012 has demonstrated that CE has 3 main features, the first being designed to eliminate waste from the onset of every product, allowing for products manufactured to go through a recovery and reuse process at the end of life. Hence, with materials recovered at end-of-life, tomorrow's resources are obtained from today's generated product (Gheorghiu and Szajczyk, 2018; Stahel, 1982). Secondly, goods produced should come with non-toxic material substances that are quickly beneficial and less harmful to the ecosystem when exposed to them, and finally, CE principles are guided by using more natural, renewable energy as the fuel needed for the cyclical process.

2.1.1 Critique of CE foundational definitions

While traditional economic systems operate on a “linear model” featured by a “take, make, dispose” approach (Kirchherr et al. 2023), the CE emphasizes either restricting, reducing, or stopping the flow of new resources continuously. Presented as a regenerative design system that attempts to maintain the worth of items and commodities over time, which aligns with global sustainability goals by limiting the extraction of finite resources and usage of clean energy (Geissdoerfer et al., 2017). Additional works by De Jesus et al. (2019) support this claim by depicting the CE to involve a change to technological advances that takes sustainability concerns into account and has a positive ecological consequence. The authors went on to suggest that the path to CE should encourage a rethink of system design rather than just better resource usage.

Lieder and Rashid (2016) emphasize that CE is an opportunity to shift from non-renewable resource extraction to processes that recover valuable materials, supporting both environmental and economic sustainability. This notion, supported by Luttenberger (2020), suggests that CE functions as a "bridging concept," encouraging a closer relationship between resource use and emissions reduction through waste prevention, recycling, and reuse practices. This bridging capability, Luttenberger asserts, allows CE to align environmental and economic policies under a single, cohesive framework. Meanwhile, considering how comprehensive these definitions might seem to be, (De Jesus and Mendonça, 2018; Kirchherr et al., 2017a; Korsunova et al., 2022), all seem to agree that the CE remains a contested and evolving concept due to the rapid development and varied perspectives within different stakeholders and fields of application, making it difficult to place CE with a widely recognized definition (Kirchher et al.,2017a). For instance, human geographers view CE as a framework to harmonize connections between the environment and the economy (Kopnina, 2015a; Rochman, 2016), while earth scientists concentrate on its macro level technical implementionl (Sauvé et al., 2016), and innovation scientists emphasize its role in fostering systemic innovation (de Jesus and Mendonça, 2018d; Kirchherr et al., 2017). This plurality of perspectives on CE’s foundational principles has contributed to a broad yet fragmented understanding of the concept. Additionally, researchers increasingly highlight definitional ambiguities and conceptual limitations, particularly regarding how CE addresses the social elements of sustainability (Corvellec et al., 2022).

Although CE is often framed within the broader discourse of sustainable development (Kirchherr et al., 2017; Suárez-Eiroa et al., 2019), the extent to which it integrates core sustainability principles remains questionable, exemplified by the aforementioned definitions discussed. A closer examination reveals that only 38% of CE-related publications explicitly associate themselves with sustainability or sustainable development, indicating a gap between CE rhetoric and practice (Velenturf and Purnell, 2021). Moreover, there is a notable underrepresentation of key social themes. For example, references to equity or equality, social values and human attitudes, poverty and participation, and inclusion (Christmann, 2018; Fioramonti et al., 2019; Afshari et al., 2020; Todeschini et al., 2017; Cheng et al., 2019; Liu et al., 2005; Hao et al., 2020; Inigo and Blok, 2019), all essential foundations of sustainable development, are covered in only 1–2% of the literature (Velenturf and Purnell, 2021).

Additional works by Sharma et al. (2021) advocate CE to establish that balance for environmental resilience, economic performance, and social inclusion, with Camilleri (2019) further asserting that approaches to CE require a more explicit integration of all three sustainability ethos to avoid unintended consequences. Kirchherr et al. (2017a) argued in support of this notion that relying solely on one or two dimensions of sustainability risks promoting unsustainable practices under the guise of CE, thus reinforcing the need for a comprehensive and inclusive conceptual definition. Literature shows that the theoretical underpinnings of CE should be further developed to unify these diverse interpretations, as the possibility of a consensual conception of CE has been the subject of numerous academic endeavors (Merli et al., 2018; Nobre and Tavares, 2021; Prieto-Sandoval et al., 2018). Thus, a cohesive theoretical foundation would help solidify CE's potential as a sustainable model, circumventing the divergent views that currently characterize the discourse (Agyei et al., 2023). An attempt at conceptualizing CE was made by Kirchherr et al. (2017a), the scholars characterize the circular economy as a systemic shift from a linear "end-of-life" concept to one of restoration and closed-loop material flows. By prioritizing reduction, reuse, and recovery across supply chains, it aims for sustainable development. Implementation occurs at multiple interconnected scales: micro (products/companies), meso (industrial symbiosis networks), and macro (city/regional/national planning). Yet, this definition has faced critique, with Geissdoerfer et al. (2017) questioning its comprehensiveness and applicability across different contexts.

2.1.2 Foundational approaches of CE conceptual framework

Central to the CE application is the "3R" approach: “reduce”, “reuse”, and “recycle” fundamentals. As some scholars may call these approaches or strategies aim to optimize resource usage by extending the life and value of materials, integrating them into new processes, and reducing waste (Nußholz, 2017; and Romero-Hernández and Romero, 2018). However, the reductionist view of CE as “recycle”, which is most popular, has led to criticisms suggesting that CE as recycling oversimplifies the hurdles of sustainable CE implementation. For instance, Reike et al. (2018) highlight the non-similarity in understanding the R-approaches of CE among different disciplines. Although this has become a norm in approaching CE, the authors assert that CE goes beyond the 3R concept as different “R-strategies” have emerged, each with its own emphasis. Morseletto (2020) demonstrates the expansion of CE’s strategies to include ten R strategies, such as " reduce, rethink, refuse, recover, reuse, recycling, repurpose, refurbish, repair, remanufacture”. These expanded strategies accordig to (Agyei et al., 2023) offer a more comprehensive approach, encompassing various forms of waste prevention, product life extension, and innovative manufacturing practices.

Similarly, Korsunova et al. (2022) critique the simplicity of the R- approach, particularly in developing economic systems, where activities labeled as "recycling" often overlook the diversity of methods used to maintain material value, such as repurposing and repairing are often concealed by a narrow focus on recycling, which limits the scope of CE in these contexts. However, the presence of multiple “R-strategies” within the concept of circularity is known to have different implications and applications for different scholars Nußholz, (2017), which eventually points out a lack of standardisation and consistency in CE conceptualisation across scholars and sectors affecting its implementation (Agyei et al., 2023).

2.2 Philosophical foundation and critiques of the CE

Despite the widespread adoption of CE in policy and corporate strategies, the concept has faced significant criticism from scholars across disciplines. This review systematically synthesizes the comprehensive critiques presented by (Corvellec et al., 2022), which challenge the CE efficacy, theoretical foundations, and ideological underpinnings as a driver for sustainable development. As a systematic secondary analysis of Corvellec et al. (2022), this study categorizes theses critiques

into three broad categories: theoretical, practical, and ideological, and supported by in-depth analysis and arguments considering the work done by the previous authors. This structure provides the framework for later analysis of CE critiques in Ghana's plastics sector.

2.2.1 Theoretical critiques: comprehensiveness, alignment, and scientific limits

2.2.1.1 Comprehensiveness and alignment with sustainability

The CE has gained traction as a framework to reconcile economic growth with environmental preservation by promoting closed-loop systems and minimizing waste (Ghisellini et al., 2016). However, its theoretical and practical implementation has raised concerns among scholars. The development of CE has been primarily led by practitioners, which has contributed to its fragmented conceptual foundation and a lack of explicit integration with sustainable development goals (Velenturf and Purnell, 2021). Earlier works, Buchmann-Duck and Beazley (2020), Cullen (2018), Giampietro and Funtowicz (2020), Hobson and Lynch (2016), Skene (2018), and Velenturf et al. (2019a), highlight the weaknesses of the CE concept as its definitions and implementations lacks the expected comprehensive focus on holistic sustainability.

Korhonen et al. (2018a) emphasize that CE strategies focused solely on reverse material flows, such as recycling or remanufacturing, do little to address deeper sustainability challenges like overproduction and overconsumption. Critics argue that CE may reinforce harmful patterns of overconsumption by stimulating demand for circular products and triggering rebound effects if CE is solely focused on material circularity and waste capture (Schröder et al., 2019). Ghisellini et al. (2016) and Zink and Geyer (2017), warn against the so-called "CE rebound" effect, in which improvements in resource efficiency paradoxically lead to increased overall resource consumption. For example, the marketing of recycled products may lead to higher demand for secondary materials, offsetting any environmental gains as mentioned by the authors. This raises the possibility that, in the absence of more drastic systemic change, the CE may just function as a version of the very linear economic model it aims to replace (Blum et al., 2020; Corvellec et al., 2022). To ensure genuine sustainability, CE must adopt broader strategies that include reducing material throughput and shifting consumption patterns, and challenge conventional growth models.

The CE concept has been criticized for its narrow emphasis on material flows, often at the expense of broader sustainability dimensions such as biodiversity protection, land use, and social equity (Murray et al., 2017; Inigo and Blok, 2019). This technocentric focus tends to obscure the social –political realities (Niskanen et al., 2020), embedded within material circulation systems, particularly the fact that a substantial share of waste management and recycling activities is carried out by the informal sector, especially in the Global South (Luthra, 2019; Zapata Campos and Zapata, 2013). As a result, critical issues related to labor practices, working conditions, power asymmetries, and interdependencies within waste value chains are frequently overlooked (Laser and Stowell, 2020b; Schulz et al., 2019). The failure to adequately integrate these social dimensions reinforces persistent inequities and limits the inclusiveness of CE transitions, raising concerns about who benefits from circularity and who bears its associated social and economic costs (Inigo and Blok, 2019; Niskanen et al., 2020).

These concerns have contributed to broader debates regarding the relationship between CE and sustainable development (SD). Although CE is often promoted as a pathway toward sustainability, scholars argue that current CE practices remain heavily biased toward economic and technical efficiency rather than social justice or ecological transformation (Geissdoerfer et al., 2017; Kirchherr et al., 2017; Eduljee, 2023). While CE practices such as recycling, resource optimisation, and material recovery can generate environmental and economic benefits including reduced greenhouse gas emissions, cost savings, and employment opportunities (Darkoh, 2024), they do not automatically guarantee socially equitable or environmentally regenerative outcomes. Scholars such as Ghisellini et al. (2016) argue that CE should simultaneously balance environmental, economic, and social dimensions; however, existing research and implementation often underemphasise the social pillar and its integration into broader sustainability objectives (Velenturf & Purnell, 2021; Dakoh, 2024; Río et al., 2021). In some instances, CE has therefore been criticised as a reformist or market-oriented framework that repackages existing sustainability discourse without fundamentally challenging unsustainable production and consumption systems (Abadia & Carvalho, 2018).

Within this debate, the overlap between CE and sustainable development is substantial but not absolute. CE contributes directly to the environmental dimension of sustainability by promoting resource efficiency, waste reduction, and material recirculation, while also supporting aspects of

economic sustainability through innovation, job creation, and reduced material dependence. Nevertheless, CE alone does not inherently resolve issues of social equity, overconsumption, or ecological limits. For example, a circular system powered by fossil-based energy may reduce material waste while continuing to contribute significantly to climate change. Similarly, circular business models that rely on poorly compensated or unsafe informal labour undermine the social pillar of sustainable development. As argued by Schroeder et al. (2019), Millar et al. (2019), and Ibrahim (2024), CE can only meaningfully contribute to sustainable development when coupled with broader structural interventions, including renewable energy transitions, inclusive governance systems, social protection mechanisms, and equitable labour practices. This requires a long-term perspective that integrates environmental integrity with intra- and inter-generational equity (Velenturf & Purnell, 2021). Accordingly, this study adopts the position that CE should be understood not as sustainability itself, but rather as a potentially important driver toward sustainable development, whose transformative capacity depends on how effectively environmental, economic, and social objectives are integrated within practice and policy.

2.2.1.2 Neglect of scientific and physical limits

As discussed by Corvellec et al. (2022), a major critique of the CE is its neglect of scientific and systemic knowledge. Scholars argue that CE often overlooks fundamental principles that dictate that material and energy losses (dissipation and entropy) are inevitable, making truly closed loops impossible (Cullen, 2017; Giampietro and Funtowicz, 2020). While CE promotes zero waste ideals, it fails to account for material degradation (Baxter et al., 2017), materials wear (Parrique et al., 2019), technological limits, and the dynamic nature of ecosystems, which are not closed or static systems (Skene, 2018).

Research highlights that CE underestimates the complexity of waste management, ignoring the variability of waste types, contamination, and the role of the informal sector. Recycling markets are unstable, hazardous waste cannot be reused (Johansson et al., 2020; Traven, 2019), and the concept of "waste as a resource" may paradoxically incentivize more waste generation (Zink and Geyer, 2017; Mavropoulos and Nilsen, 2020). Furthermore, CE advocacy often adopts a simplistic view of consumption, reducing it to purchasing and recycling, while overlooking the vast quantities of materials stored in households, businesses, and infrastructure (Casson and Welch,

2021; Fellner et al., 2017; Moreau et al., 2017). The rebound effect (such as Jevon's Paradox) poses a threat to counteract efficiency gains at the individual product level by raising overall consumption when CE focuses on produced flows rather than stockpiles (Schröder et al., 2019; Siderius andPoldner, 2021). Calisto Friant et al. (2020) stress the exclusion of indigenous and Global South perspectives, warning that CE risks replicating Western-centric, anthropocentric models rather than embracing more inclusive, regenerative, and ecocentric worldviews. While it can be argued that CE reduces raw material dependency (Geissdoerfer et al., 2017), its benefits depend on deeper systemic shifts, including renewable energy transition (Haas et al., 2015) and cultural changes in consumption.

2.2.2 Practical critiques: implementation barriers, levels, and greenwashing

Although the CE has been widely embraced in theory, its real-world implementation remains limited and fragmented (Kirchherr et al., 2018). In essence, while many companies publicly support the idea of a CE, such as reducing waste or reusing materials, they often only apply these practices to a small part of their business (Stål and Corvellec, 2018), rather than making full, system-wide changes. This selective approach can give the impression of being sustainable without addressing the company's broader environmental impact.

Barriers to CE implementation have been emphasized across three key levels: "policy, organisations, and individual consumers", hindering its success (Corvellec et al., 2022). At the policy level, CE initiatives, for instance in the EU, lack clarity regarding system boundaries and tend to prioritize economic goals like growth and competitiveness over social and ecological transformation (Inigo and Blok, 2019; Korhonen et al., 2018a; Calisto Friant et al., 2021). Other factors such as top-down approaches, inflexible infrastructure decisions, and poor stakeholder engagement, all hinder implementation (Inigo and Blok, 2019; Winans et al., 2017), measurable progress (Haas et al., 2015; Schröder et al., 2019) and create "suboptimal outcomes" (Webster, 2013). Meanwhile, policy tools often support circulation rather than confronting the entrenched linear economy (Corvellec et al., 2022).

At the organisational levels, businesses face multiple barriers: technological, economic, regulatory, profit uncertainty, training and technical support, and cultural (de Jesus and Mendonça, 2018). Many companies find it difficult to integrate CBM (Pieroni et al., 2021); those who can

limit circular practices to certain activities struggle to validate new models (Corvellec et al., 2022; Khan et al., 2021) and lack the capacity to measure circularity (Veleva et al., 2017). At the consumer level, the CE suffers substantial structural barriers, particularly due to a lack of awareness, interest, and engagement in circular offerings (Hobson and Lynch, 2016; Kirchherr et al., 2018). Unlike simpler green shifts like switching to biofuels, CE demands a fundamental shift in consumer identity, from owner to user (Lazarevic and Valve, 2017). However, circular models such as product-service systems, sharing platforms, and dematerialised consumption frequently conflict with established consumer habits, cultural expectations, convenience, and perceptions of ownership (Hobson, 2019; Vonk, 2018). Scholars further argue that the assumption that consumers will willingly adopt radically different consumption behaviours on a large scale remains weakly supported empirically and often overlooks deeper structural issues relating to power relations, ownership systems, inequality, and socio-cultural norms (Valenzuela and Böhm, 2017; Korhonen et al., 2018a; Ghisellini et al., 2016; Velis and Vrancken, 2015). Consequently, the transition toward circular consumption is not merely a technical or behavioural challenge, but also a broader social, cultural, and political transformation.

2.2.3 Ideological critiques: just transition and directional risk of CE implementation

The concepts of Just Transition (JT) and CE have gained prominence as frameworks aimed at achieving sustainable development by addressing environmental degradation and socio-economic inequalities (Ding and Hirvilammi, 2024; Härri and Levänen, 2024; Morrissey, 2023). While each has evolved through distinct theoretical and practical pathways, their intersection, what McCauley (2025) terms "Just Circularities," offers a compelling opportunity for integrated action in environmental governance and social justice. In contrast to the CE, which emphasizes production-consumption loops and resource efficiency, the JT, a concept initially focused on labour rights and protection (Luke, 2023), has evolved to encompass broader social and environmental justice issues (Wilgosh et al., 2022; McCauley and Heffron, 2018). Contemporary JT frameworks now emphasize "distributional, procedural, and restorative justice" (McCauley et al., 2023; Vona, 2023), making it multidimensional in scope.

The growing emphasis on a just CE is becoming increasingly significant in discussions about sustainability. Often, the two concepts operate in silos, overlooking important considerations

related to the intersection of human rights, waste management, and decolonisation strategies. These factors are crucial for ensuring a just transition but are frequently ignored in the CE discourse (McCauley, 2025; Härri and Levänen, 2024). On the other hand, the principles of sustainable production and consumption that support CE initiatives can provide pathways to achieving the equity goals of a just transition (McCauley, 2025). By integrating these concepts, we can rethink sustainability through a holistic perspective that balances ecological, social, and economic imperatives. This approach is particularly relevant in transitional regions, where challenges such as informal labor, weak institutions, and technological disparities complicate the implementation of both CE and just transition strategies (McCauley, 2025; Otlhogile and Shirley, 2023).

The shift toward a CE ought to be grounded not only in environmental goals but also in justice and inclusivity. Yet, current CE implementation often lacks the participatory, whole-system coordination necessary for meaningful change (Kalmykova et al., 2018; Kirchherr et al., 2017; Reike et al., 2018). Without clear integration of community-led action across policy levels and sectors, well-intended innovations can yield unintended consequences. For instance, the widespread use of bioplastics, if introduced without proper public education and waste separation systems, can contaminate recycling streams and compromise CE goals (Ghisellini et al., 2016; Mathews and Tan, 2016; Lieder and Rashid, 2016).

While CE strategies increasingly recognize the roles of both producers and consumers, studies show that genuine citizen engagement remains rare (Yuan et al., 2006; Geng et al., 2009). True inclusivity in CE requires empowering citizens to co-create circular solutions that reflect their needs, values, and living conditions. Such engagement enables not just technical success but social legitimacy, enhancing both the fairness and the effectiveness of circular transitions. In a transformative CE, the evolution of societal values, community practices, and individual lifestyles is essential. However, CE solutions are not universally transferable. Stakeholders face varying environmental, social, and economic challenges depending on their local context (Przywojska et al., 2019). Therefore, embedding CE efforts in local realities is essential to avoid one-size-fits-all models and to co-design contextually appropriate solutions. Doing so ensures that diverse voices are included in visioning and decision-making processes, making the transition more just and resilient.

Achieving a transformative, sustainable CE requires intermediaries such as industry champions, third-party organisations, and government bodies to navigate and overcome systemic dependencies that hinder CE practices. These actors help bridge gaps among stakeholders, foster coordination, and ensure that no group is left behind in the transition. This coordinated approach helps establish common values for a sustainable CE and translates these values into actions that are inclusive of various perspectives (Hobson, 2013; RRfW, 2019; Velenturf and Jopson, 2019). A commons-based approach, inspired by "re-commoning" from resilience literature, has been proposed to support this shift. In this model, communities, governments, and businesses co-manage resources, creating collective ownership and shared responsibility (Ostrom, 1990; Petrescu et al., 2016; Brown et al., 2012). Such participatory governance can deepen public buy-in and generate place-based solutions that reflect real community priorities. Empowering citizens with responsibility and agency in a circular society is crucial. Studies indicate that citizen involvement leads to more resilient and context-specific solutions. However, citizens often disengage from sustainable practices if they perceive a lack of control or if government structures do not support their actions (Petrescu et al., 2016; Sorkun, 2018). Therefore, a just transition in CE must provide citizens with both the resources and power to influence decision-making.

The contextual flexibility of CE allows businesses to implement false circular practices that appear sustainable but may not achieve substantive environmental benefits (Velenturf and Purnell, 2021). For instance, Scholars distinguish between "reformists" and "transformative" CE approaches. Reformist approaches focus on integrating CE practices within existing economic systems without challenging the broader growth model. In contrast, transformative approaches advocate for radical shifts in political-economic structures to achieve genuine sustainability, as mere adjustments may only maintain the status quo without addressing the root causes of environmental degradation (Schröder et al., 2019; Reike et al., 2018).

The limited conceptual clarity of CE allows the promotion of "circular solutions" that can inadvertently harm the environment. Historical examples, such as industrial symbiosis where by-products from one industry are used as inputs for another demonstrate how CE can sometimes reinforce unsustainable practices by locking in dependence on harmful material systems, like petrochemical networks, which perpetuate fossil fuel use (Desrochers and Leppala, 2010; Bansal and McKnight, 2009). CE's reliance on practices such as waste-to-energy reveals additional

limitations. Diverting waste to energy production can lead to significant trade-offs: it often releases carbon emissions embedded in materials and can reduce the availability of recycling materials, thus maintaining a dependency on raw materials. Such practices, while beneficial in diverting waste from landfills, may counteract the sustainability goals of CE by promoting a "recovery" approach that falls short of achieving true circularity (European Commission, 2017; Farmer et al., 2015).

Additionally, attempts to replace finite resources with biological alternatives (such as using palm oil for biofuels) highlight the limitations of CE in addressing broader environmental concerns. The production of biofuels can lead to overexploitation of water resources and has driven deforestation and biodiversity loss, particularly in regions like Borneo, as land is cleared for biofuel crops (Murray et al., 2017; Barrett and Scott, 2012; Giampietro and Funtowicz, 2020). These examples indicate that without whole-system thinking, CE can shift environmental pressures rather than eliminate them. CE's alignment with weak sustainability strategies, where the aim is to maintain resource availability rather than preserving natural capital, imposes a directional risk. Velenturf et al., (2019a) asserts that maximising resource stock and flows remains the challenge as compared to closing of loops.

The issue of managing a CE transition is how to establish a vision that accommodates various perspectives (e.g., Petrescu et al., 2016; Velenturf and Purnell, 2020). To correct these directional risks, scholars call for a stronger integration of CE with sustainable development principles. Earlier works by McCauley (2025) provide key thematic convergence between the Just transition and CE. Especially around core areas such as livelihoods, technology, justice, and governance. Broadly, these include the importance of protecting work and community well-being, ensuring technological transitions are inclusive, addressing distributional and procedural justice, and embedding ethical considerations into design and investment practices. The author introduces the concept of the "Just Circularities" Nexus, a strategic framework that integrates livelihoods, technology, and justice. Without this shift, the CE risks becoming an economically convenient narrative rather than a truly sustainable pathway (Schröder et al., 2019; Millar et al., 2019).

2.3 CE models and implementation

2.3.1 Circular business models and their role in CE transition

Integrating CE principles into an organisation's processes, goods, and services entails streamlining resources, reducing waste production, and maximizing material utilisation (Schmidt et al., 2021). Both academics and business professionals are commonly seen in the literature offering a range of modalities, guidelines, and tools intended to support the pursuit towards circularity (Bocken et al., 2019; Blomsma et al., 2019; Chirumalla et al., 2022; Dawson and Spedding, 2010; Frishammar and Parida, 2019; Mohamed Sultan et al., 2017; Mendoza et al., 2017; Thorley et al., 2022).

However, research also attests to the complication of employing strategies necessary for circularity implementation by businesses (Chhimwal et al., 2022; Jaeger and Upadhyay, 2020), despite the proposed innovative tools and guidelines, as seen in the literature. Most importantly, in the transition to CE, a holistic approach is required. One that considers every facet of a business, from the behavioral thinking of workers and customers to operations and, more significantly, the business supply chain (Bjornbet et al., 2021; Frishammar and Parida, 2019; Song et al., 2024). Broadly, a systemic approach is necessary to move towards CE (Hopkinson et al., 2020; Rashid et al., 2020) in terms of supply chains (Amir et al., 2022; Taddei et al., 2022), business models (da Costa Fernandes et al., 2020; Geissdoerfer et al., 2020), product design (Bocken et al., 2016; den Hollander et al., 2017), and with digital technologies used as a system enabler (Bressanelli et al., 2018a; Pagoropoulos et al., 2017). According to Geanina et al., (2024), in order to facilitate change, it is crucial to identify those corporate values that promote CE. Barboza et al. (2022) identified "commitment, collaboration, sustainability, ethics, engagement with business ecosystems, innovation, systems thinking, future orientation, and waste reduction" as values supporting the shift to CE in relation to circular principles and sustainability.

The need for a holistic approach to CE transition is well-supported in CE literature (Blomsma et al., 2019; Lozano et al., 2021; Reich et al., 2023), while others emphasize that a fragmented approach is insufficient for achieving true circularity. Rashid et al. (2013) and Schulte (2013) assert that organisations aiming to adopt a CE model need to undergo a fundamental transformation of their structure, culture, and operational processes. Based on this, Geissdoerfer et al. (2020), among other researchers, stress the significance of circular business models (CBM).

According to Geissdoerfer et al. (2020), the successful implementation of a CE system requires a business model that prioritizes the efficient utilisation of finite resources. In simple terms, to be circular means businesses will be required to integrate a new form of thinking and business model that finds value in every aspect of its operation, leading to cost reduction, efficiency, and effectiveness in performance and benefits environment (Barros et al., 2021).

While there are varying perspectives on the implications of circular business models for different organisations, their importance in the shift to a CE is widely recognized (Geissdoerfer et al., 2020). This has led to the development of conceptual frameworks that have been discussed in recent literature (Pieroni et al., 2019; Rosa et al., 2019). These frameworks are particularly pertinent when analysing practices that lead to tangible business outcomes, specifically in terms of "value proposition, value capture, value delivery" (which involves customer engagement), and "value creation" (related to supply chain management) (Rosa et al., 2019) (See Table 2.1).

Table 2.1: Characteristics of the circular business model framework

Business Model	**Value Proposition**	**Value Creation**	**Value Capture**
CBM Specific Characteristics	Offer goods or services that improve social and economic effects while reducing environmental impacts. It is necessary to better align with customers.	For reparability, longevity, and future-proofing, significant modifications may be made to the industrial design and value chain. Relationships with partners, suppliers, and customers become more integrated.	A new revenue model should be created in addition to a potential new offering's cost structure.

Source: (Oghazi and Mostaghel, 2018, adapted from Bocken et al., 2016).

Oghazi and Mostaghel (2018) support the idea that Mentink's (2014) paradigm serves as the basis for the widely accepted view of CBM. This perspective emphasizes that businesses can create, deliver, and capture value by slowing down, closing, or limiting the flow of resources (Bocken et

al., 2016). CBMs function by shifting business priorities from volume-driven production to value-driven sustainability Fordism (Lovering et al., 2009). They aim not only to reduce waste and resource input but also to optimize product lifecycles and regenerate ecosystems.

2.3.1 Definitions and interpretations of circular business models

CBMs can be operationalized through various strategic typologies, each offering a distinct mechanism for enabling circularity within business operations. However, CBMs have been met with different definitions and interpretations, like the CE. A review of 14 CBM definitions by (Geissdoerfer et al. 2020) concluded partly that 12 out of the definitions synthesized speak to value creation (Richardson, 2008) and follow the notion of "value proposition, value creation, delivery, and capture" (Osterwalder and Pigneur (2010); Linder and Williander, (2017); Nußholz, (2017); and Lahti et al., (2018)), defining the specific features of an authentic circular business model presented earlier in Table 2.1 (p.23).

Based on these recurring characteristics, Geissdoerfer et al. (2020) define a circular business model as one that cycles, extends, intensifies, and/or dematerializes material and energy flows to minimize resource inputs and reduce waste and emissions within an entity. This includes recycling efforts (cycling), prolonging product use (extending), increasing the efficiency of use (intensifying), and replacing physical products with services or digital solutions (dematerializing). Oghazi and Mostaghel (2018) assert that what makes CBM different from traditional business strategy is the outcomes of CBM, which are of three aspects: economic, social, and environmental value (Bocken et al., 2016; and De Winter, 2014). CBMs are meant to drive CE transition with a focus that extends beyond economic profit, emphasizing a balance between economic, environmental, and social objectives (Stubbs and Cocklin, 2008). As articulated by Manninen et al. (2018), CBMs ought to deliver an environmental value proposition articulated in quantitative terms, a commitment to ecological enhancement.

However, such an interpretation fails to see value in other principles of sustainable development. Thus, by looking at the environment and society as crucial stakeholders, the concept of CBM advocates for an inclusive approach that finds equal value in the opinions of other stakeholders, such as communities, shareholders, and customers. An approach well aligned with the principles of sustainability and a subset of sustainable business models. Emphasizing that long-term business

growth depends on thriving ecosystems and equitable societies. CBM do not operate in isolation; they require what is known as Circular Business Model Innovation (CBMI) to ensure their effectiveness. Previous studies categorize CBMI into four types: CBM metamorphosis and CBM broadening (both of which are internal to a business), as well as circular start-ups and CBM acquisition, which are external processes (Geissdoerfer et al., 2018).

Integrating the potential different definitions of CBMI, Geissdoerfer et al. (2020), as developed from Geissdoerfer et al. (2018) in their systematic review, stipulates that the term "circular business model innovation" refers to the development and application of circular business models. This can include the creation of circular start-ups, the acquiring of circular business models, the broadening of current businesses into circular models, or the alteration of an existing business model into a circular one. The authors concluded that such innovations can be implemented to influence the whole business modality or just an aspect of it, the interrelations between aspects of the model and the value network.

2.3.2 Strategic typologies of circular business models

Typologies in the context of CBM are practical tools for designing interventions that reduce resource consumption, extend product life, and close material loops. A well-known reference for such CBM typologies is Bocken et al. (2016). The authors define these typologies in terms of “slowing and closing resource loops”. To slow the flow of resources, they proposed several CBM strategies that limit resource use in production. These include “access-based business models”, “product life extension”, “classic long-life models”, and “sufficiency models” (Bocken et al., 2016). On the other hand, closing the loop focuses on strategies extending product value after initial use, exemplified by approaches like industrial symbiosis.

Through a systematic review of circular business model literature, four overarching strategic categories were developed by Geissdoerfer et al. (2020): Cycling strategies that focus on maintaining the flow of materials within the system by enabling reuse, remanufacturing, refurbishing, and recycling. Extending strategies aimed to prolong the lifespan of products through durable design, regular maintenance, and repair. Intensifying strategies centred on maximizing product utilisation, often through shared-use platforms typical of the sharing economy. Finally,

dematerializing strategies to reduce the need for physical products by offering equivalent utility through digital or service-based solutions, such as software or leasing models.

The “ReSOLVE” framework, developed by the Ellen MacArthur Foundation in 2015 categorizes CE strategies into six categories: “Regenerate, Share, Optimize, Loop, Virtualize, and Exchange”. For plastics, the most relevant categories are "Loop," which includes recycling and reuse; "Regenerate," encompassing bioplastics and energy recovery; and "Exchange," which focuses on material substitution. Accenture a business consulting organisation did identify five major circular business models (CBMs) that include: circular supply chains (which incorporate biodegradable and recycled plastics), resource recovery and recycling, product life extension (involving durable and modular plastic goods), sharing platforms (such as refill systems and reusable containers), and product-as-a-service (for instance, reusable packaging-as-a-service) (Lacy et al., 2014; and Lacy et al., 2020).

Additionally, the IMSA Institute provides a different typology based on six value creation cycles: short cycles (repair), long cycles (life extension), cascade cycles (repurposing materials), closed loops (full material reuse), dematerialisation (digital alternatives), and production to order (Van Renswoude et al., 2019). These models emphasize the importance of plastic circularity in terms of implementation, extending beyond mere recycling to include modular reuse and repair. As cited by Smol et al., (2024), the R2π project aligns CBM patterns to CE stages such as closed-loop supply, by-product and raw material recovery, access-based models, and repair or product modification, and product as a service strategy. Many of which are applicable to plastic packaging, manufacturing, and reuse streams. Similarly, the BS 8001 standard (British Standards Institution, 2017) offers practical CBMs such as on-demand production, dematerialisation, life cycle extension, by-product recovery, product as a service, and sharing economy. All aimed at reducing overproduction and promoting reusability.

Smol et al., (2024) noted that the CBM should assess the organisation’s potential to implement CE concepts while preserving or expanding revenues. However, the practical transferability and applicability of each identified Circular Business Model (CBM) across different industries remain questionable. Each CBM has unique features related to its implementation process and outcomes (Smol et al., 2024). Businesses can opt to implement either as standalone models or in combination

with others to enhance resource efficiency. This approach can lead to increased differentiation and customer value, reduced operating and ownership costs, the generation of new revenues, and a decrease in risks (Lacy et al., 2014).

2.3.3 Implementation challenges and success factors

Despite the variety of typologies, their practical transferability in industry remains limited. Literature shows that CBM is an integrated one, which takes a variety of strategies, frameworks, techniques, and tools that are coordinated and interrelated (Bocken et al., 2016). The sustainable shift is accompanied by crucial components such as Infrastructure, enabling technology, supply chain design, product design, etc. (Bocken et al., 2016), alongside modifications to logistics, services, business offerings, production procedures, economic, political, and cultural factors and general internal operations (Grant, 2010; and Genovese et al. 2017).

While focusing specifically on circular start-ups, Lit et al. (2024) highlighted key barriers to CBM implementation, including technology dependence, low trust, limited resources, limitations in working together, weak institutional backing and limited expertise. Further reviews (Westblom, 2015; Linder and Williander, 2015; Bechtel et al., 2013; Rizos et al., 2016; Kok et al., 2013; Bocken et al., 2016; Planing, 2015; and Barquet et al., 2016) all point to the aforementioned influencing factors. Considering the plethora of challenges encountered in the CBM implementation, Liu and Bai (2013) in their study went on to establish a preference for consideration. The authors assert that skills and resource challenges in the transformation to CBM are not as critical as issues of cultural and institutional barriers to implementation. This implies that the challenges organisations face in adopting CBMs are not merely due to a lack of technical expertise or insufficient financial resources but rather the deeply ingrained cultural norms and institutional structures that shape business behaviours and outcomes.

To push beyond the challenges influencing the implementation of CBM and achieve measurable performance, expanding the focus beyond traditional business indicators is important (Oghazi and Mostaghel, 2018). Besides financial outcomes, other dimensions of sustainability (environmental and social impacts) must be integrated to ensure an inclusive outcome and evaluation of CBM performance. For example, Lee et al. (2012) highlighted the environmental, economic, and social dimensions of CBM performance at both macro and micro levels across various cases. This

underscores the need for a comprehensive performance management system tailored to the unique requirements of CBMs. Although there are many lists of performance indicators, Veleva et al., (2001) contends that these lists don't offer much information on how businesses may update their current indicators to better measure sustainability. However, Lit et al. (2024) identified four critical success factors essential for achieving inclusive outcomes in CBMs: a well-defined circular value proposition, sensitivity to market dynamics, robust networking capabilities, and circular ambidexterity. These elements are vital for gaining a competitive advantage, particularly within the circular plastics economy. Beyond business-specific strategies, achieving success in CBMs may also necessitate shifts in government policies, cultural transformations towards sustainability, and concerted efforts to educate both businesses and consumers about the long-term benefits of circular practices.

2.4 Circular business models in the plastic industry

The business case for a CE is a growing one (Murray et al., 2017), with studies showing that its influence to change how we see and do business highly lies in the circular business models propagated by businesses in the private sector (EC, 2020; Henry et al., 2020; Santa-Maria et al., 2021). Rashid et al., (2013) and Schulte, (2013) have both attested that innovations are important to implementing a CE by industries, ensuring a strategic move in their business paradigm. The plastic industry presents a unique opportunity for CE implementation due to its widespread application and significant environmental impact. As discussed in chapter one and two, plastics are integral to modern economies but are also a leading cause of environmental degradation and social problems in terms of health and disease outbreaks.

The significance of this change and integration in the plastics industry is to increase the economic feasibility of recycling and reusing plastics, prevent plastic pollution in the environment, separate the production of plastics from fossil fuel feedstock, and emphasize the adoption of renewable feedstock as a means of promoting sustainable production and consumption in the plastic industry (Global Environment Facility GEF, 2018). A popular environmental, social, and economic model for attaining responsible plastic waste management and resource preservation is the "circular plastic economy" (Addor et al., 2022a, 2022b; Bucknall, 2020; Ellen MacArthur Foundation EMF, 2013; GEF, 2018; Grigore, 2017; Ledsham, 2023; Nunez, 2021).

However, Addor et al. (2022b) and GEF (2018) contend that a circular plastic economy in its whole is unsustainable due to the global crises of population expansion, urbanisation, and industrialisation, which lead to an exponential increase in the extraction and manufacturing of virgin plastics. According to earlier research, achieving a sustainable circular plastic economy will necessitate a closed system in which the manufacturing of plastic in all its forms utilizing fresh material resources is discontinued (Addor et al., 2022a, 2022b; Wiah et al., 2022). The concept of constructing a circular plastic economy based on generating and conserving value in resources is supported by Lit et al. (2024). The authors came to the conclusion that the circular plastic economy would ensure a balance between plastic's negative environmental effects and its potential for sustainability. To date, a wide range of CBM has been applied within the plastic industry to facilitate business transitions as seen in Table 2.2.

Table 2.2: An overview of circular plastic economy models.

CE Solution	**Description**	**Some Examples**
Robust information platforms	platforms that facilitate the exchange of data and information on plastics.	- RECPnet encourages knowledge sharing and resource-frindly, cleaner production.
Policy instruments	Economic, policy, and regulatory measures (e.g., taxes, bans, EPR, design standards).	- Bangladesh banned lightweight plastic bags (2002). - Rwanda banned single-use plastic bags. - Italy banned plastic shopping bags (2011). - Kenya implemented a single-use plastic bag ban.
Plastic from alternative feedstock	Making plastics from bio-based and waste-based materials (e.g., sugarcane, CO_2, biopolymers).	- AirCarbon tech converts methane/CO_2 into plastic: - Covestro converts CO_2: - Sugarcane-based plastics:
Plastic waste as a resource	Repurposing plastic waste to make valuable items or new plastics..	- Bricks/composites from plastic waste - Roads built from plastic waste: - Shoes/clothing from recycled plastic:
Redesign and innovation	Designing plastics for longevity, reusability, and recyclability; incorporating waste prevention.	- Bulk delivery of products in refillable containers to eliminate single-use plastic:

CE Solution	Description	Some Examples
Business and consumer cooperation	Encouraging industrial symbiosis and consumer engagement to turn waste/by-products into raw materials.	- Urban-industrial symbiosis in China and Japan; shared use of plastic by-products across sectors. (References in Section 2.3 of source text.)
Sustainable Business Models	Promoting product-as-a-service, sharing, and leasing to optimize use and reduce material throughput.	- Leasing water dispensers and refillable bottles - Lego's Pley subscription model where consumers rent and return Lego sets.

Source: GEF, 2018

Existing research indicate that circular plastic business models are more concerned with end-of-life solutions such as recycling (Cruz Sanchez et al., 2020; Huysman et al., 2017; Payne et al., 2019; Sheldon and Notron, 2020), which align with the CBM cycling typology rather than upstream approaches like supply chain sustainability (King and Locock, 2022), adopting a life-cycle approach that includes cleaner production, extended use, and product as a service (GEF, 2018). Meanwhile, the focus of recycling being a central circular plastic business model has been challenged, not because it does not form a critical model for plastic circularity and sustainability, but because a key concern is the sufficiency of recyclable plastic waste (Jehanno et al., 2022; Chen et al., 2024; Shukla et al., 2025), which is critical to maintaining the cycle effectively.

As part of existing gaps in previous studies (King and Locock, 2022) further stipulate that discussions around circular plastic business models often centre on technology, plastic products, and materials, with limited work done emphasizing the entire value chain. For instance, biobased green chemistry (Sheldon and Norton, 2020), additive manufacturing (Cruz Sanchez et al., 2020), blockchain for traceability (Khadke et al., 2021), chemical recycling (George and Kurian, 2014), mechanical recycling innovations (Babaremu et al., 2024), pyrolysis (Sharuddin et al., 2016a), and plastic packaging (Meys et al., 2020). Such comprehensive assessment is important in understanding and ensuring success in a circular plastic economy transition (King and Locock, 2022). Lit et al. (2024), in their analysis of overcoming barriers in the circular plastic economy, emphasize that relying solely on technical solutions will not yield optimal outcomes. Instead, they argue that business models are essential to assessing the viability of these solutions. This perspective is reinforced by Barford and Ahmad (2023), Henry et al. (2023), and van Opstal and

Borms (2023), who stress that every business has a critical role in advancing the circular plastic economy through innovative business model strategies.

Different strategic models are revealed by case studies conducted worldwide. The Dutch plastics sector, for example, offers a unique example of how start-ups and early-stage businesses are essential to promoting circularity. It was discovered that Dutch circular start-ups were primarily focused on recycling, which limited their ability to spearhead a more drastic shift along the waste hierarchy. Despite the existence of success characteristics including market sensitivity, networking skills, and circular value proposition design (Lit et a., 2024). Sweden's experience, as demonstrated by Trioplast Industries AB in the plastic packaging industry, reveals that the instance company is using tactics like changing their product offers and providing services in addition to their goods. Additionally, they are creating goods that may be manufactured using a higher percentage of recycled resources in order to accomplish the vision of closed loop material flow (Khan, 2020).

Remanufacturing, recycling, and reverse logistics are examples of the "cycling" business model strategy used in the Indian plastics industry (Retamal et al., 2021). In India, recycling, technological platforms to support extended producer responsibility (EPR) programs, and the replacement of plastic materials are the most prevalent business model types. This is comparable to the global literature, where the majority of instances focus on recycling and replacing bio-based products with plastics. In the authors practice evaluation, "intensifying" business models were the least prevalent (sharing models, rental/leasing/access etc.). Repair, reuse, and second-hand sales; packaging avoidance services; recycling facilities; and waste-to-energy facilities are examples of well-established CBM (Retamal et al., 2021). In Finland's case, it was discovered that leveraging the CE requires interaction among all sectors along a product's whole value chain. According to Rasimus (2020), it is crucial to prioritize product design in order to ensure that the product is easy to recycle and reuse and that their entire value chain is sustainable

2.4.1 Circular business models in Ghana’s plastic industry

Industries with high consumption and production rates, such as construction waste management (including plastics and e-waste streams), similar to those in Ghana, have a significant environmental impact and hold substantial potential for CE integration, although their awareness and adoption remains limited (Hemkhaus et al., 2020). Kessman (2019) has demonstrated that

industrial efforts primarily focus on the Obsolescence phase of waste management rather than addressing treatment and proper disposition. According to the author, this reflects a tendency for CE practices in Ghana to emphasize final waste collection and its movement rather than comprehensive cycling and resource recovery. Such scenarios illustrate missed opportunities to enhance material recovery and reuse, minimize environmental impact, and hinder progress towards a circular plastic economy, resulting in both environmental, social, and economic costs.

As evident in literature, the private sector, start-ups, and entrepreneurs have recognized the plastic problem, capitalizing on public concerns and working towards sustainable production by limiting plastic use or initiating products made from recycled plastics (Vince and Hardesty, 2017 and Dijkstra et al., 2020). In Ghana, collected plastic waste is typically sent to one of the 25 small- and medium-sized plastic recycling enterprises, (Hervie et al., 2021) where it is processed into various products, underscoring the need for enhanced policy support and industry-wide adoption of CE. Earlier works by Bungert (2022) identify two key features, first, Ghanaian plastic manufacturers utilize recycled plastics as a raw material, which helps decrease their reliance on new materials. However, this raises a crucial question regarding the percentage of new production that is derived from recycled materials, as there are currently no established laws to guide this integration. Second, recycling and reuse are the primary circular business models in the plastic industry, with upcycling also capable of playing a significant role in managing plastic waste in Ghana (Jonathan et al., 2023).

Additional studies show that most efforts remain concentrated on waste collection and product innovation, rather than full value chain circularity. For instance, some emerging models focus on transforming plastic waste into pavement blocks (Tulashie et al., 2020; 2022), road construction (Appiah et al., 2017), and even fuel alternatives (Tulashie et al., 2019), offering localized innovation potential well-suited for commercialisation and industrialisation in Ghana (Debrah et al., 2021; Abota, 2012). These models often involve partnerships between different stakeholders to scale technical solutions. However, these models primarily focus on the 'cycling' category and give little attention to upstream strategies, functioning as standalone solutions for CE plastics, rather than providing a comprehensive assessment of the entire value cycle of plastic solutions, including their implementation and sustainability implications.

2.4.2 Authenticity and sustainability alignment of circular plastic business models

The growing interest in CE strategies across the corporate landscape is often portrayed as a progressive shift toward sustainability (Farahmand and Rahimiaghdas, 2024). However, literature also suggest that many corporate-led CE initiatives suffer from a lack of authenticity, raising concerns over "circular-washing", a phenomenon where companies superficially adopt CE language and practices without enacting deep, systemic changes. As is evident in the plastics industry, companies frequently invest in recycling technologies and establish voluntary sustainability alliances while simultaneously increasing their production of virgin plastics and risky CE technologies (Mah, 2021). This contradictory behaviour creates a paradox in which corporate discourse on circularity masks ongoing environmental degradation (Mah, 2021).

Much of the critique centres on corporations' reliance on technological fixes, such as advanced recycling, which are often used to maintain business-as-usual models under a more palatable CE label. This overreliance not only diverts attention from root causes such as overconsumption and linear production systems but also allows companies to continue expanding their operations under the guise of innovation. For instance, petrochemical corporations have publicly framed the plastics crisis as a "moment of reflection" rather than addressing the systemic issue of excessive production (Mah, 2021). Vendries et al. (2020) argue that products made from recycled content may, in some cases, result in greater environmental harm than those made from virgin materials, depending on the energy intensity and toxicity of the recycling process. Similarly, studies by Umair et al. (2013) and Arushanyan et al. (2014) caution that informal recycling systems, particularly prevalent in low-income contexts, can exacerbate health risks and social inequalities. Circular technology-developed oxo-degradable plastic bags are another example. To this end such plastic bags are more environmentally damaging to produce since they consume more energy and still contribute to the amount of plastic waste that ends up in the oceans, leading to microplastic integration as they degrade through UV radiation (Walzberg et al., 2021; and Imbeault-Tétreault, 2017).

These examples illustrate that without holistic oversight and critical evaluation, corporate CE practices risk reinforcing unsustainable patterns rather than discontinuing them. Earlier studies raise doubts about the authenticity and transformative potential of current corporate CE strategies. Without holistic sustainability metrics that incorporate environmental limits, social justice, and

governance accountability, CE risks becoming a strategic delay mechanism rather than a genuine pathway toward systemic change. The transition to a truly CE requires stronger regulatory enforcement, integrated value-chain reforms, and a shift in executive incentives from recycling outputs to absolute reductions in resource use and emissions.

2.5 Policy influence on circular plastic economy and models

A slew of policies and measures aiming at fostering the adoption and transformation of traditional linear (take-make-dispose) to circular systems have been institutionalized (Ahenkan et al., 2024). Achieving this goal required the deployment of multiple R-strategies (Försterling et al., 2023), industrial symbiosis (Ayres and Simonis, 1994), and sustained value generation (Vanegas et al., 2018). Through these organisations are seen to minimize natural resource consumption, become more cost-efficient, increase income production, gain a competitive advantage, and create value toward new market access (Ahenkan et al., 2024). Businesses have found alternative business models that support the CE because of external pressure regarding environmental regulations and societal protection (Zhu et al., 2011), as well as worldwide objectives and standards, such as the need to limit emissions globally and reduce the mining of natural resources (Bai et al., 2015; Dong et al., 2016).

CE is used in many different industries and geographical areas. According to research by Dada et al. (2024), consumer awareness, environmental movements, and municipal zero-waste initiatives have all played a significant role in the United States' shift to circular economy (CE) principles. This shift has also been supported by legislative and regulatory developments that promote sustainable practices and penalise wasteful ones (Awasthi, 2023). Previous studies show that American households and businesses have increasingly adopted waste prevention, reuse, and recycling practices, while manufacturers are shifting from selling products to offering services, a model that retains producer responsibility and incentivises eco-design (Dada et al., 2024). In the meantime, even while communities across the United States have adopted zero-waste plans, the deeply ingrained linear consumption model continues to be a significant obstacle, and advancement will require ongoing education, innovative policy, and voluntary business action (Awasthi, 2023; Bogusz et al., 2023).

Japan stands out as one of the earliest adopters of CE-oriented legislation. The country's Basic Act on Establishing a Sound Material-Cycle Society (SMCS) enshrined the 3Rs (reduce, reuse, recycle) and environmentally sound waste management as national goals (Arai et al., 2023; and MoE, 2018c). However, examination of Japanese CE discourses indicates a largely "reformist" perspective that places little emphasis on social fairness or planetary boundaries in favour of scientific advancements and economic expansion. NGOs and local governments, who frequently have more transformational viewpoints, are under-represented in policy discussions, while business and academic voices predominate (Arai et al., 2023). Whereas, China has adopted a distinct pathway, implementing a top-down legislative framework (Ghisellini et al., 2016). The principles of Circular Economy (CE) have been incorporated into successive five-year plans, and the enactment of the 2009 Circular Economy Promotion Law positioned China as the inaugural nation to codify CE as a national strategy, emphasizing sustainable production, industrial ecology, and pilot initiatives in urban areas (de Melo et al., 2022). Wu et al. (2014) assert that the advocacy for CE principles by the Chinese government commenced as early as 2003, predating the formal implementation of the legislation. Conversely, the European Union has established a comprehensive policy framework that encompasses augmented producer responsibility, legally mandated recycling objectives, and a Circular Economy Action Plan (2015, revised 2020) (Europe Commission, 2015a).

Kirchherr et al. (2018) indicate that the European Commission committed on a global scale in 2015 to promote the integration of CE and to eliminate regulatory barriers. The EU characterizes CE as the preservation of the value of goods, materials, and resources within the economy for the maximum duration possible; this characterization underscores a significant focus on waste minimization and resource efficiency (de Melo et al., 2022). China and the European Union both reflect ecological modernisation thinking, but their strategies differ: China adopts a more top-down, prescriptive approach, whereas the EU combines regulation, economic incentives, and voluntary initiatives (Geissdoerfer et al., 2017; de Melo et al., 2022). The varied experiences of the United States, Japan, the EU, and China demonstrate that circular economy implementation must be adapted to local institutional, economic, and social conditions. Although the EU offers one of the most comprehensive and well-documented circular economy frameworks internationally, this study like many others does not treat the EU as an unproblematic model. EU policies have been criticised for favouring economic competitiveness over social and

environmental considerations, a point that aligns with broader circular economy critiques (Corvellec et al., 2022). For Ghana, the key lesson is not to emulate any single blueprint but to develop a bespoke policy mix that combines regulation, economic incentives, infrastructure investment, and stakeholder engagement, thereby addressing the country's specific waste challenges, informal sector dynamics, and development priorities.

2.5.1.1 The role of government and policy mixes

According to Ahenkan et al. (2024), although modern businesses are transitioning through circular business models aided by several green policies, the role of governments can't be overlooked in their transformation. Thus, by creating the requisite business ecosystems and policy, standards, and guidance, businesses can innovate and implement their circularity initiatives. Previous research demonstrates that government policies have taken the form of financial support and incentives to mitigate transition costs (Ahenkan et al., 2024), because CE often involves high initial investment costs depending on the business model type. One example is the EU's financial assistance for the agriculture sector, which has gained popularity as a flexible instrument (Hodge et al., 2015). National governments and international organisations have also launched campaigns to raise awareness about plastic's environmental and social ramifications (Ahenkan et al., 2024; Neilson, 2018). Such campaigns aim to influence behavioural change among manufacturers and consumers, create urgency, and justify policy interventions.

Without supportive policies and governance arrangements, market forces alone may struggle to encourage investment and innovative interest in circular business models. Hence, businesses often require favourable institutional conditions, coordinated governance and enabling policy instruments to make circular practices economically viable and operational feasible (Försterling & Orth, 2023). Previous literature suggests that the transition from a linear to a circular economy requires the use of integrated "policy mixes," where multiple complementary policy instruments operate simultaneously rather than through isolated interventions (Försterling & Orth, 2023). This is because circular transitions involve interconnected economic, technological, institutional, and social changes that cannot be effectively addressed through a single policy mechanism. Within CE literature, these instruments are broadly categorised into four groups: economic instruments, which use financial incentives or disincentives such as taxes, subsidies, and landfill fees to influence behaviour; regulatory instruments, including laws, standards, and mandatory requirements such as

Extended Producer Responsibility (EPR) schemes; research and capacity-building instruments, which support innovation, technical development, and knowledge generation through education and training; and information-based instruments, which promote transparency, awareness, and behavioural change through tools such as eco-labels, public campaigns, and sustainability reporting systems (Försterling & Orth, 2023). Additionally, although these policy categories frequently overlap in practice and are not always sharply separable, they provide a useful analytical framework for understanding the diverse mechanisms through which governments and institutions attempt to stimulate circular transitions (Försterling & Orth, 2023). More importantly, the literature increasingly emphasises that the effectiveness of such instruments depends not only on their existence, but also on how they interact with broader economic conditions, technological systems, institutional capacity, infrastructure availability, market incentives, and societal participation.

Policy represents only one category of the multiple drivers influencing circular economy (CE) adoption and implementation. A growing body of literature suggests that CE transitions emerge through the interaction of environmental, economic, technological, organisational, social, institutional, and market-related factors rather than through regulation alone. Systematic reviews of CE implementation drivers identify at least ten major categories shaping organisational engagement with circularity. Environmental drivers include concerns regarding resource scarcity, climate change, pollution reduction, and waste minimisation (Kumar et al., 2019; Tura et al., 2019; Nohra et al., 2020). Supply chain drivers relate to material efficiency, collaboration, and transparency across production systems (Ritzén and Sandström, 2017; Tura et al., 2019). Economic drivers such as cost reduction, new revenue streams from by-products (Gusmerotti et al., 2019; Tura et al., 2019; Ababio and Lu, 2023; Nohra et al., 2020). Information-based drivers including training, education, and knowledge exchange also influence adoption (Masi et al., 2017; Tura et al., 2019; Nohra et al., 2020), while legal drivers encompass laws and regulations that either mandate or encourage circularity (Kumar et al., 2019; Ababio and Lu, 2023).

Furthermore, market drivers such as consumer awareness and demand for sustainable products (Kirchherr et al., 2018; Guldmann and Huulgaard, 2020), organisational drivers including competitiveness, reputation, employee engagement, and partnerships (Govindan and Hasanagic, 2018; Kumar et al., 2019; Jia et al., 2020), and public drivers such as government financial support and waste collection systems (Geng and Doberstein, 2008) significantly shape circular transitions.

Social drivers including job creation, public health, and community expectations (Masi et al., 2017; Kumar et al., 2019; Ababio and Lu, 2023), alongside technological drivers such as investment in innovation, recycling technologies, and scientific development (Kirchherr et al., 2018; Ritzén and Sandström, 2017; Tura et al., 2019), further demonstrate that CE implementation is influenced by interconnected socio-technical systems rather than policy interventions alone. Consequently, the literature increasingly conceptualises CE transitions as multidimensional processes requiring alignment between governance systems, infrastructure, markets, organisational capacity, technology, and societal participation.

2.5.2 Strategies and policies driving transition to circular plastic economy in Ghana

2.5.2.1 Policy landscape

Foundational laws and policies include the Constitution of the Republic of Ghana Act (1992, amended in 1996), the National Environmental Sanitation Policy (1999, revised in 2010), the Environmental Protection Agency Act 490 (1994), Environmental Sanitation By-Laws (2003), the National Environmental Policy (2012), and the Public Health Act (2012). These frameworks emphasize sanitation and environmental safety, requiring Metropolitan, Municipal, and District Assemblies (MMDAs) to enforce strategies under the Local Governance Act 936 (2016).

With national expectations geared towards a greener economy with the CE at the centre, the Government of Ghana has exhibited its commitment through intended policies and strategies (see Table 2.3) to transform the country while also assisting in its journey towards achieving sustainable development goals (Ahenkan et al., 2024). Concerning plastic circularity, a plethora of policies and regulatory instruments have been seen in Ghana over the years (Awewomom et al. 2024). According to Ashai (2021), such initiatives must be comprehensive and inclusive, covering all Ghanaians to encourage their participation in plastic waste management. Indicating that for such an instrument to achieve its goals truly, all stakeholders in the plastic sector, manufacturers, recyclers, and consumers, must be covered. The challenge with a one-sided policy instrument is that policies may fail to achieve widespread behavioural change and adoption when enacted into a law. This limits their total influence on plastic waste reduction, and underscores the deployment of circular economies and plastic circular business models.

Table 2.3: Policies and strategies towards CE transition in Ghana

Policy / Strategy	**Year**	**Primary Focus**
National Environmental Policy	2014	Targets waste minimization, resource optimization, and sustainable growth.
National Environmental Sanitation Policy	2010	To decrease the combustion of waste, encourage recycling and composting, and enhance waste handling techniques.
National Climate Change Policy	2013	Tackles matters concerning environmentally conscious consumption and manufacturing, emphasizing resource efficiency, waste minimization, and recycling..
National Waste Management Strategy	2010	This strategy focuses on improving how we manage waste, cutting down on how much trash we create, and boosting recycling and programs that turn waste into energy
National Plastics Management Policy	2020	It specifically targets plastic waste by switching to biodegradable alternatives, building better systems to collect and recycle plastics, and making producers responsible for their products.
Renewable Energy Act	2011	To encourage the growth of renewable energy to help create a circular economy, which lessens our reliance on limited resources and lowers harmful emissions.

Source: (Ahenkan et al., 2024).

The Government of Ghana developed the National Plastics Management Policy (NPMP), which aims to establish large-scale market-driven plastic recycling initiatives, employment and protect the environment based on four focus components: "(1) Behavioural change, (2) Strategic planning and cross-sectoral collaboration, (3) Resource mobilisation towards a CE, and (4) Good governance, inclusiveness, and shared accountability". Complementing this, Ghan**a** became the first African country to associate with the Global Plastic Action Partnership (GPAP) in 2019, launching the Ghana National Plastic Action Partnership (NPAP).

This initiative promotes multistakeholder cooperation as recommended, funding, and scaling of projects that address plastic pollution while advancing Sustainable Development Goals (SDGs) (GPAP, 2020). To promote easy recycling and reusability of waste, the National Environmental Sanitation Strategy and Action Plan (NESSAP) was developed. The plan underscores the value of public-private collaborations in bolstering waste management systems and stresses tactics like recycling and separation of waste as successful ways to lessen environmental effects (GEF, 2019). For example, the Association of Ghana Industries (AGI) founded the Ghana Recycling Initiative by Private Enterprises (GRIPE), which unites eight pioneering manufacturing companies to implement sustainable solutions for managing plastic waste (University of Ghana, 2018; GEF, 2019; GRIPE, 2021).

2. 5.2.2 Stakeholder inclusion and resource mobilisation

Managing a circular plastic economy relies on the collaboration of all stakeholders. In Ghana, such stakeholders driving circular plastic are the “plastic waste collectors”. Approximately 10,000 – 30,000 individuals in Ghana collect plastic informally, with some plastics transferred to nations nearby (GEF, 2019). Formal initiatives such as the Plastic Waste Collectors Association (PWCA), established in 2006, now boast a countrywide membership of approximately 20,000 (GEF, 2019). According to (Odei et al., 2019), the country has several other unregistered groups that gather plastics and either upscale or recycle them into market bags or sale to other parties that use them as raw materials.

The systems for waste management have encountered significant financial limitations, rendering many of these systems ineffective and inefficient. Globally, the implementation of plastic levies has emerged as a crucial component of the transformation process. The most notable example is the European Union's plastic levy, which is assessed based on the volume of non-recycled plastic packaging waste generated by each Member State (MS). In Ghana, the introduction of the Environmental Tax (Act 863) was aimed at bolstering the Plastic Waste Recycling Fund and addressing critical environmental issues. This initiative was further supported by the proposed establishment of a Plastic Levy Fund Authority, designed to augment resources dedicated to the management of plastic waste (GEF, 2019).

In addition to policy interventions, Ghana has explored organisational structures to improve waste management. According to the Global Environment Facility (GEF) Operations, as far as in the 1980s to 1990s, committees had been set up at any unique instant to investigate the plastic waste menace of Ghana (GEF, 2019). In the 2000s a managerial and operation approach was instituted. The establishment of task forces, such as the National Plastic Waste Management Taskforce (2004), led to public campaigns encouraging plastic waste collection and recycling. However, these efforts were often short-lived due to financial constraints (Quartey et al., 2015).

2. 5.2.3 Technical capacity, education, awareness, and behavioural change

More recently, the plastic producers and importers in the country witnessed the introduction of instructions for biodegradable plastics, including banning plastics under 20 microns and mandating oxo-biodegradable additives (Smith-Asante, 2015). However, this directive has its challenges in terms of understanding and environmental reliability. According to the European Environmental Agency, (EEA, 2021), oxo-biodegradable polymers are unable to achieve total degradability unless the appropriate ambient temperature, microorganism availability, moisture, oxygen, and other factors are present. Kwansa (2021) claims that under such a policy structure, the country may amass more plastic that is marginally eco-friendly when compared to regular plastic.

A content assessment further reveals that experimental community and educational initiatives have also been piloted, such as the “Cash Your Trash” Program (2010), which incentivized household waste separation (GEF, 2019). Similarly, a pilot education program in 2015 introduced waste segregation bins in schools and higher education institutions. Additionally, the United Nation Development Programme (UNDP) launched the Waste Recovery Platform in 2018 to improve data sharing and collaboration on garbage recovery in Ghana, demonstrating the embrace of digital innovation (GEF, 2019). It has been argued that digital innovation can be used as a business model to promote a circular plastic economy (Liu et al. 2021; Liu et al., 2022; Kolade et al. 2022: Berg et al., 2018; Cagno et al., 2021).

One could argue of all the policy instruments geared toward waste management in the country, the country's National Plastic Management Policy (NPMP) and its focus areas (See Appendix I) is the most specifically tailored policy tool for the country's plastic industry to support the circular plastic economy. This as earlier mentioned, is complemented by the joining of the Global Plastic Action

Partnership (GPAP), leading to the launch of the Ghana National Plastic Action Partnership (GNPAP). This can be stipulated that the joining of the pack was an indication of the country's intention to establish a circularity methodology and enforce its legal and regulatory directives. Meanwhile, Ghana's National Plastics Management Policy (GNPMP) instrument cites barriers to achieving a CE in the plastics sector. These challenges include "limited public awareness, inadequate resource mobilisation, weak waste collection services, insufficient recycling facilities and technical expertise, and unclear accountability due to the cross-cutting nature of plastic-related issues" (MESTI, 2020).

2. 5.2.4 Legislative and regulatory barriers

At the policy level, significant obstacles comprise a weak legal structure, poor compliance, and a lack of policy incentives. Currently, there is no comprehensive legislation addressing CE approaches for the plastic sector, encompassing production, reuse, recycling, or waste management (GEF, 2019). Simply put, this establishes gaps in driving sector-specific reforms, especially within the plastic industry, and fostering private-sector engagement. Additionally, the absence of strong enforcement mechanisms and insufficient stakeholder collaboration further exacerbate inefficiencies in waste management. Meanwhile, generalistic research fails to address localized challenges in the plastic industry, limiting actionable insights and innovation needed to transition effectively to a CE plastic model. Consequently, these barriers perpetuate environmental pollution, resource inefficiencies, and missed economic opportunities in the green market.

Supporting this, As cited by (Kwansa, 2022), a notable potential for successful implementation and transition would mean Ghana can potentially take back an estimated one million tonnes (thus 82%) of the country-generated plastic waste from all segments as entrenched in the Ministry of Environment, Science, Technology and Innovation (MESTI) 2019 policy report, challenged persist. According to MESTI (2019), research shows that there are still implementation gaps, including inadequate planning, inadequate coordination between important stakeholders, a lack of technology expertise, a lack of compelling legislative incentives, lax enforcement, and long-term financial viability.

This can be addressed by implementing recommendations like having a comprehensive and inclusive policy framework, standardizing plastic waste management across all sectors, and

ensuring adequate funding and incentives are available to address the systemic barriers that impede the country's plastic CE (MESTI, 2019; and GEF, 2019).

2.5.2.5 Synthesis

Taken together, the literature suggests that effective circular economy (CE) transitions require integrated policy mixes that combine economic, regulatory, research, and information-based instruments operating simultaneously rather than in isolation. However, policy represents only one component within a broader system of interconnected drivers influencing circular transitions. Factors such as market demand, technological innovation, organisational strategies, social norms, infrastructure availability, financing mechanisms, and stakeholder collaboration are equally important in shaping the adoption and effectiveness of CE practices. While policy frameworks may establish enabling conditions and strategic direction, these non-policy drivers often provide the immediate operational, economic, and social motivations necessary for businesses and institutions to engage in circular activities.

Within the Ghanaian context, the literature further reveals substantial gaps between CE policy formulation and practical implementation. Although Ghana has introduced several forward-looking initiatives, including the National Plastics Management Policy and related circularity strategies, these frameworks remain largely aspirational with limited systematic outcomes. Scholars argue that the absence of clearly defined legal implementation structures and enforcement mechanisms has weakened the practical effectiveness of these policies in driving systemic transformation (Mintah et al., 2023). Consequently, compliance frequently remains voluntary, resulting in inconsistent adoption of circular practices and limited accountability across the plastic value chain.

Researchers additionally highlight that economic incentives for businesses are unclear or insufficient, which contributes to superficial compliance. Many firms engage only in minimal recycling activities or partially participate in Extended Producer Responsibility (EPR) schemes, focusing more on cost-cutting than environmental and social impact. The fragmented institutional landscape with overlapping mandates among multiple ministries and agencies has also been critiqued for diluting accountability and slowing coordinated action. Another recurring theme in the literature is the lack of financial and technical support, which deters innovation and discourages

private sector involvement in CE transitions. Without accessible funding or capacity-building programs, businesses are unable to make the necessary operational shifts. Moreover, scholars argue that Ghana's policies are overly focused on end-of-pipe waste management, rather than designing waste out of the system. Insufficient emphasis is placed on upstream solutions such as eco-design, materials innovation, and production reduction. Public awareness and behavioural change are essential pillars for a functioning CE are similarly underdeveloped.

The literature indicates that the lack of education and enabling infrastructure undermines public participation in circular initiatives, while also expressing concern over Ghana's overreliance on external donors and partners, which threatens the sustainability and independence of CE efforts in the long term. They recommend building domestic institutional capacity and securing consistent local funding as a more resilient strategy. Even though Ghana has implemented policies to support a CE, scholars argue that these frameworks are insufficient because they lack incentives, enforcement, and structural alignment. This calls into doubt the efficacy and sincerity of Ghana's commitment to the transition to a sustainable CE.

2.6. Conclusion

The corpus of literature examined elucidates both the prospects and constraints inherent in CE (CE) practices on a global scale and within the context of Ghana's plastic sector. While CE is frequently lauded as a revolutionary strategy to mitigate sustainability challenges, this analysis indicates that a substantial portion of the prevailing discourse is characterized by conceptual fragmentation and practical limitations, particularly within the contexts of developing nations such as Ghana. Notwithstanding the potential of CE to enhance resource efficiency and mitigate environmental degradation, its implementation remains sporadic and inconsistent. Critiques of CE underscore its disproportionate focus on recycling, insufficient attention to social equity, and its disconnect from overarching sustainable development objectives. In the case of Ghana, these critiques resonate profoundly: the plastic industry continues to operate predominantly within a linear framework, with CE initiatives impeded by insufficient infrastructure, ineffective policy structures, and a lack of coordinated systemic efforts. Although several CE-related policies and strategic initiatives have emerged, the review highlights that policy alone cannot stimulate circular transitions in isolation. The success of CE implementation depends equally on economic

incentives, technological systems, infrastructure availability, market dynamics, stakeholder awareness, organisational structures, and broader societal participation.

What is unequivocally evident from this review is the pressing necessity for more localized, inclusive, and critical investigations into CE. The plastic sector in Ghana serves as a pertinent case study for exploring how circular business models can be operationalized not merely to mitigate waste but also to confront issues of justice, equity, and inclusivity, particularly about informal waste workers and marginalized populations. Furthermore, the review indicates that CE policies in Ghana are frequently aspirational, characterized by a deficiency in robust enforcement mechanisms and clear criteria for tracking progress. In the absence of effective governance, innovation within the private sector, or the empowerment of citizens, CE risks devolving into a superficial designation rather than a genuine catalyst for systemic transformation.

Consequently, this study addresses a notable research lacuna: the deficiency of authenticity assessments and critical evaluations concerning CE practices in the plastic sector of Ghana. By triangulating perspectives from recyclers, manufacturers, and producers in the Ghanaian sector, it assesses the applicability of established critiques in a context characterized, while also emphasizing the significance of governmental legislation. This research aspires to ascertain whether Ghana's trajectory towards circularity is not only meaningful but also sustainable and equitable. As noted by Dijkstra et al., (2020), plastic management research and its nexus in facilitating CE implementation are significant in emerging research and require a broader assessment that should cover segments of the “proposition, customer interface, infrastructure, and financial structure”. Ultimately, this literature review reaffirms the necessity of adopting a human-centred paradigm in CE research, one that encompasses livelihoods, policy frameworks, stakeholder collaboration, and social values, beyond mere material flows. Through this approach, this research contributes to the establishment of a genuinely inclusive and sustainable CE for the future of Ghana.

Chapter 3

Ghana's Plastic Industry

3.0 Overview of global plastic production and use

Plastic has become essential to contemporary society, considering the clear connection between rising incomes, increasing populations, and the growth in global plastic production. Data from the Organisation for Economic Cooperation and Development (OECD) report shows that between the years 2000 and 2019, the world saw a doubling in plastic production. Quantitatively, it increased from 234 million tonnes to 460 million tonnes (OECD, 2022). Current projections from the 2022 plastic outlook report indicate a threefold increase in plastic production from 2019 levels by 2060 (OECD, 2022).

With plastic production having different types and applications, literature suggests that single-use plastics, particularly high-density polyethylene (HDPE) bags, gained prominence as retail instruments in the 1970s and continue to be the predominant choice for grocery bags (Danquah et al., 2019). The authors further indicate that annually, between 500 billion and 1.5 trillion single-use plastics are utilized globally, highlighting their ubiquitous nature and ecological ramifications.

Two-thirds of plastic waste contributors are attributed to short lifespans (under 5 years) of application (OECD, 2022), highlighting the significance of prolonged product longevity. Packaging accounts for 40% of the application, followed by consumer goods at 12% and textiles at 11%. Meanwhile, waste generated has doubled from 156 Mt in 2000 to 353 Mt in 2019 (OECD, 2022). Sector-wise, the packaging sector leads the consumption of plastic at 31%, followed by building (17%) and transportation (12%), with OECD nations and China accounting for 66% of global usage (OECD, 2022).

Despite the direct increase in plastic consumption and waste produced, the management of this waste has seen little improvement. According to OECD (2022), global recycling rates remain alarmingly low, with only 9% of plastic waste recycled as of 2019. A substantial portion of the waste stream, 22 Mt, ends up as recycling residue requiring additional disposal. Furthermore, only 15% of plastic waste is collected for recycling, highlighting systemic inefficiencies and infrastructure deficits in global waste management systems. These limitations call into question the adequacy of recycling as a popular solution to the growing plastic waste crisis.

3.1 Plastic production, consumption, and waste in Ghana's economy.

Ghana's plastics political system is undergoing significant change. Growing domestic plastic usage and involvement in the international plastic waste trade have altered the country's plastics ecosystem (Akuoko et al., 2023). The key question remains: "how government, producers, and consumers can work together to address the issues of sustainability and management of plastics " (GCB, 2022). A quantitative research by Danquah et al. (2019) depicts that Ghana's average weekly plastic manufacturing output is 39,756 kilograms of plastic products, including 14,072 kilograms of single-use plastics and 24,204 kilograms of PET products, while reusable plastics average 1,802 kilograms. Notably, 46% of plastic manufacturers depend on imported resins, and 37% source them domestically. As the world has seen a rise in methods for producing polymers from petrochemical sources, so have there been advancements seen in the plastic industry manufacturing systems (Hopewell et al., 2009).

In Ghana, sales data underscore the economic significance of the sector, revealing that weekly average revenues attain 135,299 cedis (8,809.13 Euro), with 43% of this revenue originating from single-use plastic sales (Danquah et al. 2019). Single-use plastics account for about 44% of total plastic production and 6% of reusable plastics (Danquah et al. 2019). Table 3.1 provides the common types of plastic in Ghana, namely "density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), polystyrene (PS), polyvinyl chloride (PVC), and polyethylene terephthalate (PET)".

Table 3.1: Major end-use of polymer types in Ghana

Polymer	Predominantly used in Ghana as
Low-density polyethylene (LDPE),	Single-use water sachets and single-use shopping bags
High-density polyethylene (HDPE),	Single-use sachets, cosmetic containers, gallon, crates pallets and pipes
Polypropylene (PP),	Single-use cosmetic containers, blister, plastic furniture
polystyrene (PS)	Single-use food packs and cups
Polyethylene terephthalate (PET).	Single-use beverage bottles, single-use food packs, blisters

Source: (Global Plastic Action Partnership, 2024)

The aforementioned plastics are significant contributors to plastic waste, which makes up 14% of municipal solid waste and is expected to rise to 17% by 2030 as cited by (GEF, 2019; Ghosh et al., 2019). The distinctive characteristics of plastics have made them a valuable resource. For example, their broad integration across a variety of industries has been made possible by their lightness nature, water opposition, transparency, and, to some extent, recyclability (Andrady and Neal, 2009; Hopewell et al., 2009). Notwithstanding these advantages, the improper management of plastic materials presents considerable environmental, social, and economic challenges (Hopewell et al., 2009). Considering Ghana's per capita plastic use has increased by 3.4% annually (GNPAP, 2021), Lerner (2020) posits that a significant proportion of the plastic materials brought into Ghana possess no substantial economic value and present considerable challenges in terms of recycling. This can be said to possibly further exacerbate the challenges arising from plastic consumption and waste. Arguably, Oteng-Ababio (2014) maintains that one major incentive for plastic use is the ability to recycle plastic, which could help mitigate environmental pressures and socio-economic issues.

Approximately one million tonnes of plastic waste are produced each year and managed by both informal groups and formal institutions (MESTI, 2020). However, only 10% of this waste is being recycled, with the recycling rate for PET (polyethylene terephthalate) standing at just 2% (GNPAP, 2024). Despite being statistically low, collection and transportation have received a lot of attention (Ezeudu et al., 2024). It can be argued that many institutions involved in plastic production and plastic waste management in the country lack the necessary infrastructure due to their structure and operational systems. For example, in Greater Accra, the capital of Ghana and a major industrial hub, approximately 5,000 independent collectors are engaged in retrieving recyclables from various locations, with about 20,000 collectors nationwide (EACDS and Seureca, 2019; GEF, 2019).

This indicates a significant reliance on the informal sector, which has limited resources to operate effectively. Additionally, when evaluating the capacity and potential for the incorporation of innovations such as those of circular technologies into their pre- and post-production methodologies, only 10% of these manufacturers in Ghana can be classified as large-scale enterprises, whereas 25% are identified as small-scale manufacturers. The reality remains that

capacity plays a major role when looking into businesses and the ability to implement certain sustainable-oriented innovations.

3.1.1 Plastic industry value chain in Ghana: linear vs. circular approaches

The plastic manufacturing industry constitutes a substantial economic force in Ghana, characterized by 160 operational manufacturers that collectively generate over 28,000 direct employment opportunities and 4,200 indirect jobs (GPMA, 2019). This sector encompasses an estimated 3.7 million jobs within the plastic waste management domain and provides plastic packaging solutions to 87% of local industries as well as regional markets in Togo, Burkina Faso, Mali, and Niger (Danquah et al., 2019). Examining the value chain of the plastic sector, the Ghana Commercial Bank's plastic industrial report (GCB, 2022) indicates that various government and private entities are involved in overseeing and supporting the industry. The Ministry of Trade and Industry (MoTI) develops industrial policies, while the Ministry of Environment, Science, Technology and Innovation (MESTI) focuses on managing plastic waste. The Ghana Plastic Manufacturing Association advocates for industry interests and collaborates with MoTI and MESTI to address challenges. Key actors include local suppliers, importers, manufacturers, wholesalers, retailers, and regulatory bodies.

The plastic industry operates through a structured value chain involving input sourcing, production, distribution, and consumption. However, a key distinction emerges when comparing the traditional plastic industry value chain with a more circular, full-cycle model, as seen in the literature. Unlike conventional linear systems that emphasize raw material acquisition, manufacturing, and market distribution, indicating a predominant "take-make-dispose" approach, whereas a circular plastic model incorporates a comprehensive life-cycle approach by integrating upstream (input supply), midstream (manufacturing and consumption), and downstream (waste management) components (see Figure 3.1). As an emerging trend in the industry, the value chain explicitly acknowledges plastic waste recovery pathways, distinguishing between recovered waste (which is processed, recycled, or repurposed) and unrecovered waste (which contributes to land and water pollution). This structured waste stream highlights opportunities for improved plastic waste collection and recovery, which is critical for Ghana’s shift toward a circular plastic economy.

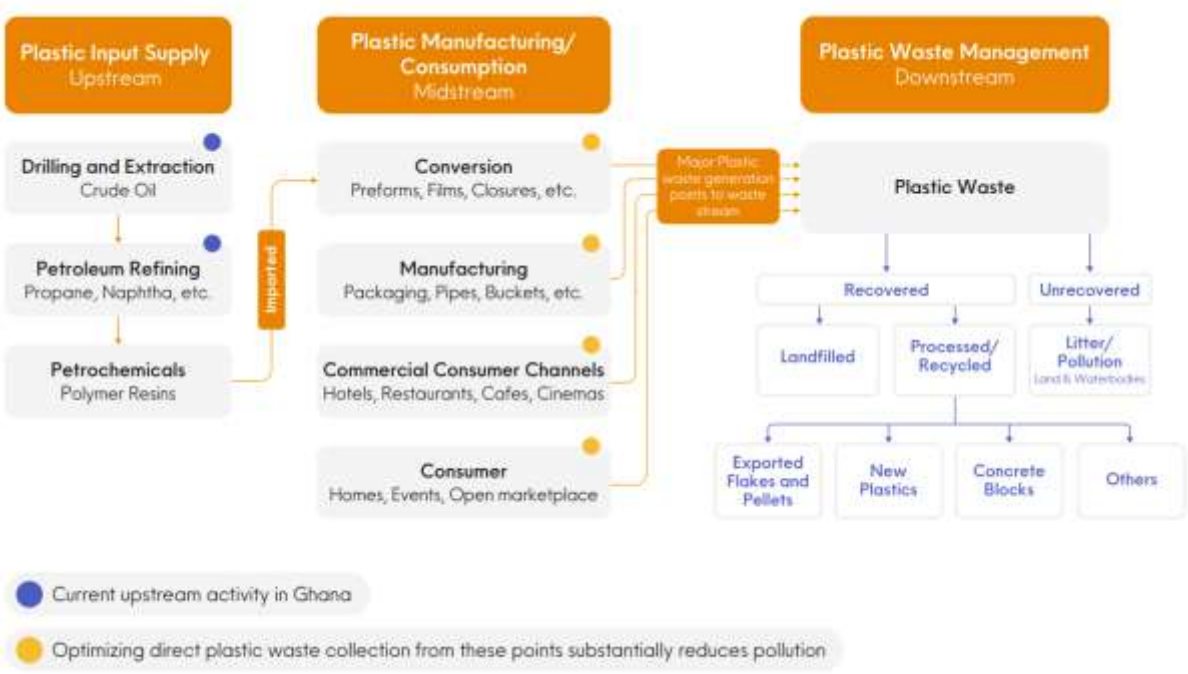


Figure 3.1: Ghana's plastic industry value chain.

Source: (GNPAP, 2024)

3.1.2. Environmental and social implications of the plastic industry in Ghana

The economic and social significance of the plastic industry in Ghana does not eliminate its challenges. This includes the reliance on the importation of resins for domestic manufacturing and the procurement of an estimated 2.58 million tonnes of raw plastics (Hervie et al., 2021), in addition to the importation of virgin pellets or finished commodities to augment local production on an annual basis (World Bank, 2020). According to the Ghana Environmental Protection Authority (EPA), a staggering 73 percent of plastic generated in Ghana ultimately results in waste (Hervie et al., 2021), attributable to the non-biodegradable characteristics of plastics (Owusu, 2010), whereas merely 19 percent is repurposed (Hervie et al., 2021). This reliance and its repercussions highlight the imperative for strategic initiatives aimed at enhancing local production capacities while emphasizing sustainability-focused innovations in the context of circular plastic business models.

International organisational findings, such as the UNDP stakeholder conference report (UNDP, 2019) indicate that one million tons of plastic waste is generated yearly in Ghana, with a

corresponding recycling rate of 2 -5 percent. It is safe to say that a greater proportion, as asserted by the EPA, goes to landfill sites (38%), land (28%), sea (23%), or burned (11%) (UNDP, 2019). According to the United Nations Environment Programme, just 9% of the 8 million tonnes of plastic that end up in the world's oceans get recycled (UNEP, 2022). This translates to a greater volume of plastic waste being exposed to the environment as cited by (Hervie et al., 2021).

A plethora of scholarly work provides similar evidence of the impact of current plastic production, consumption, and waste. Although the amount of final waste (solid or liquid) generated during Ghana's plastic manufacturing process is not well documented in the literature, there has been much discussion about the waste that accumulates during the end-of-life use of plastic products (Fobil and Hogarh, 2006; Hervie et al., 2021; Danquah et al., 2019). PET bottles, in particular, present a growing environmental hazard in Ghana. According to Danquah et al. (2019), Ghana produces approximately 4.8 billion PET bottles annually, in addition to an estimated 5-7 percent imported volume. As a result, the country exposes its environment to around 73,000,000 kilos of PET bottles each year due to production (GPMA, 2019).

Meanwhile, with a global recycling rate of 55% for PET waste and 12.4% reprocessed into new bottles, Ghana's plastic industry is only able to recycle a mere 2% of its PET bottles at the end of their life (Danquah et al., 2019). The authors further stipulate that the mismanagement of plastic waste in Ghana has led to health/disease outbreaks and environmental issues such as flooding due to choked drainage systems and air pollution due to harmful toxins (Debrah et al., 202; Adam et al., 2020; and Oteng-Ababio et al., 2017). Thus, these findings are supported by (Singh and Walker, 2024 and Adam, 2024) asserting that plastics are associated with adverse environmental and health consequences, encompassing waste accumulation, the degradation of ecological systems, carbon emissions, and the presence of hazardous chemicals; consequently, they have become a focal point of escalating global topic and dialogues in recent years.

3.1.3 Potential domestic markets for plastic waste in Ghana’s industry

According to the Global Plastic Action Partnership (GPAP) report for 2021, Ghana's plastic waste management system is largely informal. While the government has encouraged private sector participation, leading to investments in material recovery facilities (MRFs) like the Integrated Recycling and Compost Plant (IRECOP), the infrastructure remains insufficient. Addressing these

issues according to expert reports requires incentive initiatives for consumers and businesses to incentivize the return of plastic waste (GPAP, 2021).

Meanwhile, expanding Ghana's 25 formal recyclers, which process around 96,000 tons annually, could enhance waste recovery, although they currently struggle with high costs and limited funding (GPAP, 2021). According to the World Economic Forum-Ghana Trade and CE report for 2024, significant opportunities exist in industries such as consumer packaged goods (CPG), textiles, automotive, and construction (See Figure 3.2). For instance, food-grade recycled plastics could support packaging commitments, while synthetic fibre could replace declining cotton supplies. The growing real estate sector also presents an opportunity for eco-friendly housing certification, promoting the use of recycled plastic materials in building blocks, paving stones, and drainage pipes (GPAP, 2021).

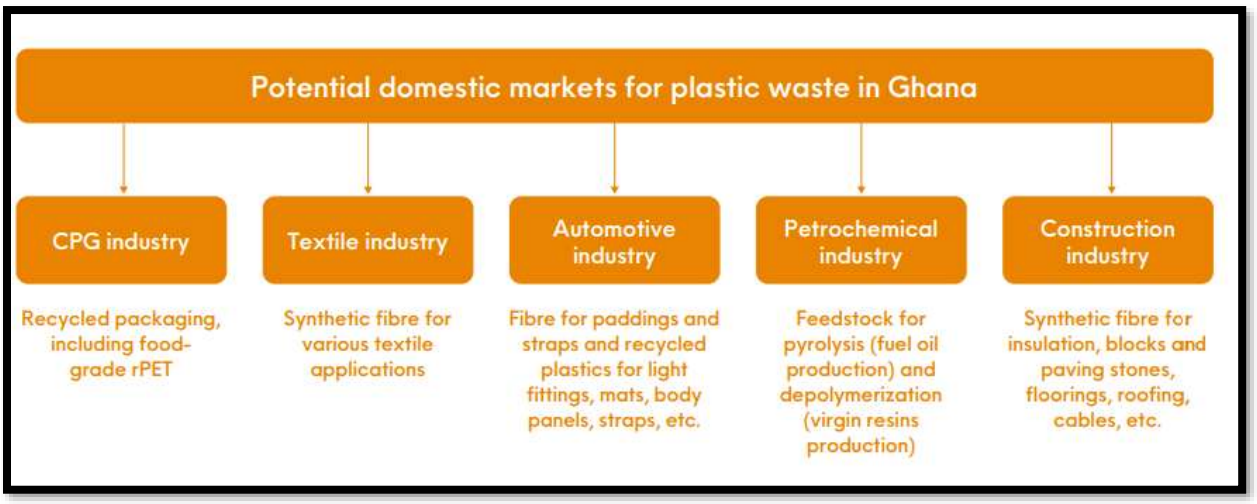


Figure 3.2: Potential domestic market for plastic waste in Ghana
Source: (Global Plastic Action Partnership, 2021)

Chapter 4

Research Methodology

4.0 Introduction

The aim of this research is to investigate the traits, techniques, and impacts associated with CE implementation in the scope of Ghana's plastic industry. An exhaustive examination of contemporary literature pertaining to circularity practices, encompassing the theoretical framework of the study, reveals that while advocates of the CE emphasise its capacity to foster sustainable development, detractors underscore its deficiencies in promoting sustainability across the triad of social equity, environmental integrity, and economic viability.

The design of the study questions targeted at addressing the current gaps and uncertainties, particularly within emerging economies where the idea of circularity continues in its early phases, is anchored in the critiques surrounding the implementation of CE. By scrutinizing the plastic industry in Ghana, the research contributes a perspective from a developing economy and provides an evidence-based evaluation of CE implementation among businesses. Presented below is a compilation of the research questions and the rationale for their significance to the study.

Research question 1: What are the different criticisms related to the implementation and practices of circularity as a driver of sustainable development?

This question aims to evaluate sustainability critiques of CE practices found in prior literature. While circularity is promoted as a sustainable development path, critics argue it may lack comprehensiveness. This question seeks to identify recent critiques to serve as a benchmark for comparing trends emerging from the study, providing a balanced perspective between existing literature and the study's findings.

Research question 2: What distinctive attributes are evident in the outcomes and processes of CE initiatives in Ghana's plastic industry?

The question aims to identify the key characteristics associated with the process and outcomes of circularity implemented in Ghana's plastic industry. Understanding these attributes is crucial for evaluating the effectiveness and efficiency of CE practices and for identifying best initiative that can be advanced or replicated. This aligns with the study’s goal of promoting sustainable development and ensuring that CE initiatives are in line with global circularity principles and sustainability objectives.

Research question 3: What are the primary critiques surrounding the CE as applied to the plastic industry in Ghana?

The focus of the question is specifically on the plastic industry in Ghana, where CE practices are still developing. Critics have expressed concerns regarding the dependence on conventional energy systems, the generation of waste and emissions, and the potential for social and economic inequities (Korhonen et al., 2018; Allwood, 2014). By identifying the primary critiques in this context, the study aims to highlight the unique challenges faced by Ghana's plastic sector, to promote a more sustainable and inclusive transition.

Research Question 4: How have government legislative initiatives contributed to a sustainable transition toward circularity in Ghana's plastic industry?

The question examines how policy influences the adoption of CE practices, particularly regarding government support for a sustainable transition in the plastic sector. Government initiatives play a vital role in shaping the circular economic landscape. However, their effectiveness may depend on several factors and alignment with local contexts that need to be identified.

This study employs methodological pluralism, an approach that integrates multiple research methods to capture the multifaceted nature of a phenomenon like the CE and its implementation in Ghana's plastic industry. By combining quantitative and qualitative methods within an exploratory descriptive research design, this study seeks to provide a comprehensive assessment of circularity practices and their alignment with global sustainability goals. This also helps to identify the characteristics that support a fair and inclusive transition. This chapter provides a detailed description of the research design, including the sample and population, data collection instruments, and procedures for data collection. Additionally, it outlines the data analysis process, explaining how the quantitative and qualitative data will be analysed and integrated to address the research questions and objectives.

4.1 Research design

This study employs an exploratory descriptive research design, effectively investigating complex phenomena while providing comprehensive descriptions of the findings. Additionally, the research methodology is strategically designed to address the research questions and objectives through a

robust mixed-methods approach that combines both quantitative and qualitative research methods. This next part gives a thorough description of the design and methods, including the rationale for selecting specific methods and how these choices align with the research questions and objectives.

4.1.1 Exploratory descriptive research design

An exploratory descriptive research design was chosen for this study because it is particularly well-suited for investigating a relatively under-researched area. This design allows for the exploration of complex phenomena while providing a detailed description and summary of the issues under investigation (Brink and Wood, 1998; Sandelowski, 2000). Additionally, Collis and Hussey (2003), describe it as particularly valuable when the research problem is broad and not clearly defined. It makes it possible for researchers to spot trends, produce testable hypotheses, and gain greater awareness of the topic they are studying.

Since the CE is a fairly recent concept in Ghana, the exploratory design will help clarify key concepts, such as circular plastic business models, and gather explanations relative to their implementation critique, process, and outcomes in Ghana's plastic industry. As the focus in Chapter Three specifically examines Ghana's plastic industry, it provides a localised context of the problem. This approach is highly flexible, qualitative, and unstructured, allowing the researcher to adapt the study as new insights emerge as cited by (Swaraj, 2010; Stebbins, 2008)

Swaraj, (2010), explains that exploratory design aims to generate new ideas and increase a researcher's familiarity with the problem using methods such as literature reviews, surveys, focus groups, and case studies, which are qualitative in their attributes. This study gathers information for clarifying concepts, such as the definition of CBM and their applicability in the Ghanaian context. Moreover, it determines the feasibility of conducting a more in-depth study, ensuring that the research design is practical and achievable.

The descriptive aspect of a design is used to answer the question, “What is?” While characterising the features of a phenomenon (Shields and Rangarajan, 2013). Providing a cohesive summary of the CE landscape as described by the participants. For instance, the study will describe the types of CE models implemented by businesses, their attributes, and the outcomes of these practices. This will provide a complete overview of the ongoing state of circularity in Ghana's plastic industry, providing insightful information’s for businesses and other stakeholders.

This indicates how explicitly major concepts and opinions about the phenomenon are discussed through the design. According to Manjunatha (2021), the descriptive research design is known for its purpose of describing, explaining, and validating research findings. In terms of characteristics, like exploratory, descriptive design is closely linked to common research methods such as surveys, correlation studies, observation studies, case studies, and quantitative methods that attempt to collect quantifiable information (Manjunatha, 2021).

Based on the explanation above, the two research designs were appropriate for the present study because it will examine Ghana's plastic industry, relying on secondary research such as reviewing available academic and grey literature, and quantitative and qualitative approaches such as survey questionnaires and in-depth interviews, respectively. The most suitable method for this study is the exploratory descriptive approach, which enables the examination of a comparatively unexplored field while offering a thorough explanation of the phenomenon being studied. By combining flexibility with a structured approach, this design ensures that the study addresses the research questions and objectives in a meaningful and impactful way

4.1.2 Mixed-method approach

The mixed-methods approach is employed to leverage the complementary strengths of both quantitative and qualitative research while mitigating their respective weaknesses (Creswell, 2003; Johnson and Onwuegbuzie, 2004). Mixed-methods research (MMR) is a technique that integrates many different approaches to solve research problems in a thorough and morally acceptable manner, according to Bryman (2012), Creswell (2015), and Creswell and Plano Clark (2011). This requires the systematic gathering, analysis, interpretation, and integration of both qualitative and quantitative data in order to provide a more thorough understanding of the study problem (Dawadi et al., 2021). Because the research topics require a thorough analysis, the mixed-method approach is especially well-suited for this study. According to Enosh et al. (2014), the MMR methodology combines "breadth and depth" of data.

This, in the context of this study, would mean using quantitative data to identify trends and patterns across a larger population and qualitative data to explore the nuances and contextual factors influencing CE practices in Ghana's plastic industry respectively. For instance, while quantitative data can reveal the percentage of businesses using recycled materials or the profitability of circular

business models, qualitative data can provide insights into the challenges, motivations, and experiences of stakeholders involved in these practices. This two-pronged strategy guarantees that the analysis includes both the quantifiable results and the underlying processes of CE activities.

Integration is a fundamental idea in mixed-methods research, which is the deliberate blending of quantitative and qualitative data to become intertwined and cooperate to accomplish a shared study objective (McLeod, 2024). The sort of mixed methods designs employed must be related to how the researcher integrates data (Creswell, 2015). According to proponent of the mixed method, various forms are linked to integration, dependent on the research design, such as explanatory sequential, exploratory sequential, and convergent design (Creswell and Plano Clark, 2018) (See Figure 4.1).

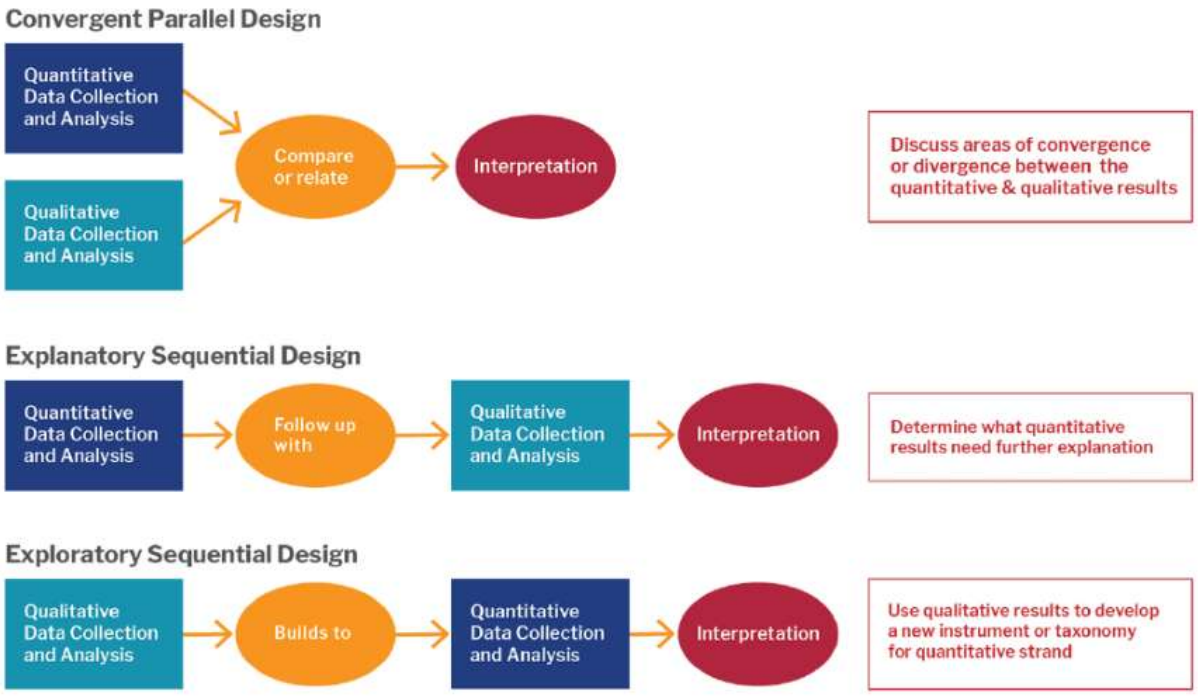


Figure 4.1: Approaches to combining qualitative and quantitative data
Source: McLeod, 2024.

In this study, integration is achieved through a convergent design, where both quantitative and qualitative data are collated concurrently, processed independently, and subsequently amalgamated to yield a comprehensive picture of the research issue. The motivation for utilizing a mixed-methods approach in this study is built in the necessity to tackle the complexity of the

research topics. The CE in Ghana's plastics sector is an interconnected issue with social, technological, economic, and environmental aspects. A mixed-methods approach allows the study to explore these dimensions in a way that neither quantitative nor qualitative methods could achieve independently. As explained by Onwuegbuzie and Collins (2007), the mixed-method approach in this study is justified by its convergent design, which uses triangulation to improve the findings' dependability and reliability by contrasting and contrasting results from both quantitative and qualitative data (Carter et al., 2014; McLeod, 2024), complementarity to establish a more holistic picture of the research problem, while initiation explores differences and contradictions in the findings, allowing for better understanding and interpretation of the CE practices (McLeod, 2024).

The mixed-method approach, as a research methodology in itself (Dawadi et al., 2021), has its strengths and limitations (see Table 4.1). However, its application in this study offers benefits, such that it enables an in-depth understanding of the research problem by combining the strengths of both quantitative and qualitative methods (Fetters, 2016), and ensures the validity of findings.

Table 4.1: Strengths and limitations of mixed-methods research (MMR)

Strengths of MMR	**Limitations of MMR**
Multiple Paradigms Supports (Creswell, 2009; Mertens, 2010; Shannon Baker, 2016).	It can be costly and time-consuming to gather and analyse data (Fauser, 2018; Hauken et al., 2019).
Provides flexibility in selecting methodological designs that best suit the study (Teddlie and Tashakkori, 2010).	Blending qualitative and quantitative data is a challenge for investigators (Wisdom and Creswell, 2013).
Offers core and complex designs to guide researchers (Creswell and Plano Clark, 2018).	Researchers in their early careers might not be confident in their ability to choose a suitable MMR design (Creswell, 2003).
Enhances the generalizability of qualitative findings through quantitative data (Onwuegbuzie and Leech, 2006).	Data collection and recruitment require a lot of work (David et al., 2018; Linnander et al., 2019).

The mixed-method approach and exploratory descriptive research design are chosen for several reasons. To begin with, the CE is a complicated and multidimensional concept that requires both contextual insights and numerical data to completely comprehend. By combining these two kinds of data, the mixed-method approach offers a more thorough comprehension of the event being studied. Second, the exploratory descriptive design is well-suited for addressing the research questions and objectives, as it allows for the exploration of a relatively under-researched area while providing a detailed description of the findings.

4.2 Study population and sampling strategy

About 120–160 registered businesses with an aggregate capacity of 52,000 tons make up Ghana's plastic manufacturing industry, which creates 4,200 indirect jobs and more than 28,000 direct employment prospects (GPMA, 2019; and GCB, 2022). The majority of small and medium-sized businesses (SMEs) manufacture a variety of goods, including office supplies, PVC pipes, and packaging materials. According to Ghana Plastic Manufacturing Association (GPMA), there are 27 cottage industries, 8 medium-to-large-scale, businesses, and 99 SMEs that recycle more than 241,530 metric tons of rigid and flexible plastics a year. Approximately 8,760 metric tons of PET recycling (PET Flakes) are produced annually by 46 SMEs and 2 large-scale businesses. On average, the sector imports 15,000 tonnes of resin annually to manufacture thermoplastic products, including water tanks, crates, and polyethylene bags. Per capita, plastic consumption in Ghana is about 8 kilograms per year (Babayemi et al., 2019; Ubomba-Jaswa and Kalebaila, 2020; GCB, 2022). According to the GPMA, as cited by Danquah et al. (2019), the industry provides plastic packaging solutions to 87% of local industries and regional markets in Togo, Burkina Faso, Mali, and Niger.

4.2.1 Population

Population and sample are significant features in research that aid researchers in drawing fundamental conclusions in their work (Ahmad et al., 2023). Garg (2016) emphasizes the importance of clearly articulating and understanding the research population and sample to ensure the validity, reliability, and applicability of findings. The population of any research enables the direct defining of a study interest group, which sets forth an important range for the study's conclusion (Ahmad et al., 2023). Jilcha Sileyew (2020) and Garg (2016) define a research

population as the complete set of elements that a researcher aims to investigate and draw conclusions about. Generally, it can be understood as the entire collection of individuals, objects, or events that share similar features and are the focus of the study (Ahmad et al., 2023). Defining a study population is important as it helps to establish the boundaries and scope of the research and its findings.

In this research, the focus is on understanding the sustainability of CE business models within the plastic industry in Ghana. That is having a firm grip on what goes into the process and outcomes of these models and how sustainability and circularity principles can be a concern. The plastic industry has diverse stakeholders within the value chain. The Ghana National Plastics Management Policy (MESTI, 2019) identifies stakeholders such as importers of finished goods, manufacturers and importers of raw materials, plastic users, consumers, waste pickers, collection and disposal entities, recyclers, and government agencies.

However, due to the specific research questions and objectives of this study, not all stakeholders having businesses in the value chain are included in the target population (subsets within the expansive cohort). Instead, the study focused on circular plastic innovation implementation hotspots within the value chain (See Table 4.2 p. 63). Additionally, a variety of selection criteria was used in this selection to enable data collection (Seawright and Gerring, 2008). This process made it possible to examine the potentially different CBM configurations that various stakeholders have chosen to adopt (Lit et al., 2024) and how the principles of circularity and sustainability feature in them. The business categories adopted in Table 4.2 represent distinct operational logics, resource capacities, and institutional pressures that shape circular economy (CE) adoption in Ghana's plastic industry value chain. Categories such as manufacturing, recycling, and packaging, were used to capture differences in production processes, resource dependencies, market relationships, and engagement with circular economy practices. For instance, packaging and manufacturers face direct consumer scrutiny, which may drive them toward visible circular practices (e.g., using recycled content) even when policies are weak. Similarly, distinctions between cottage industries, SMEs, and large-scale firms were considered important because businesses operating at different scales often experience varying levels of formalisation, access to financing, technological capacity, regulatory exposure, and infrastructural support. This categorisation reflects the understanding that Ghana's plastic sector is not homogeneous, but

composed of actors with diverse operational realities, incentives, and constraints. Recognising these differences is essential for interpreting the survey results (Chapter 5) and for ensuring that recommendations are tailored to each category, not one size fits all.

Table 4.2: Target population table for the study. Adapted from GPMA listing by author

Business Type	**Number of Businesses**	**Key Characteristics**	**Potential Motivations / Behaviour (Relevant to CE)**
Cottage Industries	27	Small-scale operations, in the plastic recycling sector.	Cost-driven, survival-oriented; may prioritise low-cost collection over formal CE practices
Medium-to-Large-Scale Businesses	8	Well-established firms with significant recycling capacity and advanced technologies.	Balance between cost reduction and regulatory compliance; may engage in informal sector to secure feedstock
Small and Medium Enterprises (SMEs)	99	SMEs produce a range of recycled products, including packaging materials, office supplies, etc.	Market-driven, brand reputation, access to finance; can invest in higher-tier R-strategies
PET Recycling SMEs	46	SMEs specializing in recycling PET (Polyethylene Terephthalate) into PET flakes.	Scale-driven, export-oriented; face different policy and market pressures than general manufacturers
Large-Scale PET Recyclers	2	Large-scale businesses with high-capacity PET recycling facilities.	Consumer-pressure sensitive (especially packaging); may adopt visible circular practices for brand image
General Plastic Manufacturers, packages, and Exporters	160	Companies that incorporate CE principles into their production processes. This group is not limited to businesses that use recycled materials or design products for reuse, repair, or recycling. And rely heavily on plastic	Economic necessity; lack legal recognition; their inclusion is critical but often exploited

Business Type	Number of Businesses	Key Characteristics	Potential Motivations / Behaviour (Relevant to CE)
		packaging but are adopting sustainable practices to reduce waste.	
Informal Waste Collectors Members	22	Informal waste sector actors are waste pickers, collectors, and intermediaries. These businesses are often part of the informal sector and are essential for collecting and aggregating plastic waste.	Not direct implementers; shape motivations through advocacy and policy recommendations
Environmental Experts and Advocacy Groups and NGO's	12	While these stakeholders don't directly implement CBM, their knowledge and advisory roles greatly impact the adoption and success of CE practices. Their insights are crucial for understanding policy frameworks, regulatory challenges, and strategic recommendations for scaling circular innovations.	

This categorisation reflects the understanding that Ghana's plastic sector is not homogeneous, but composed of actors with diverse operational realities, incentives, and constraints. Consequently, motivations for adopting circular economy practices, perceptions of policy effectiveness, and implementation capacities are expected to vary across categories. The analytical use of these groupings therefore allowed the study to examine how structural differences within the sector influence circular economy adoption, governance interactions, and business behaviour

4.2.2 Sampling and sample size

A prerequisite for data collection in research is sampling (Khan, 2020). This involves how to choose participants (sampling strategy) and how many participants to choose (sample size) in both quantitative and qualitative studies (Onwuegbuzie and Collins, 2007). As highlighted by the Onwuegbuzie and Collins, five probability sampling techniques (entailing the random selection of elements) are generally associated with quantitative research, whereas 19 non-random sampling

methods (indicating a lesser probability of an element being selected) are typically correlated with qualitative research. Nonetheless, the authors maintain that the selection of a sampling methodology ought to be contingent upon the nature of the statistical or analytic generalisation being pursued.

The integrity of the sample and its ability to accurately mirror the characteristics of the population is crucial in determining the validity and reliability of the findings (Shringarpure and Xing, 2014). Meanwhile, the determination of sample size is equally significant as the selection of the sampling strategy since it also influences the degree to which the researcher can derive statistical and/or analytic generalisations (Onwuegbuzie and Collins, 2007). Researchers utilize the sample size to draw implications and make inferences about the complete population because it is a more controlled and requires less effort to collect (Taherdoost, 2018; Bhardwaj, 2019). The study employed multiple sampling techniques. First criterion sampling was used to select the required population based on set criteria. Considering the quantitative and qualitative aspects of the study, stratified sampling and random sampling were introduced to select respondents for the survey questionnaires, while purposive sampling was used to sample respondents for the interviews. Additionally, Cochran's (1977) sample size formula was used to determine the sample size.

First, the author defines the population and criteria. In terms of population, the study is focused on small and large businesses involved in plastic manufacturing and service provision that are more aligned with circularity. To fulfil this objective, the following four criteria were established: (1) the focus on plastic manufacturing, packaging, and/or plastic waste; (2) the capability to implement circular strategies within their business model; (3) affiliation with either the GPMA, Environmental Service Providers Association (ESPA), or Plastic Recyclers and Aggregators Association of Ghana (PRAAG), and (4) should be in the geographical scope of the Greater Accra Region of Ghana. The selected geographical region is the industrial administrative centre of the nation. The above-listed four criteria were informed by the typologies of circular business models proposed by Geissdoerfer et al. (2018) and Konietzko et al. (2020a). That is, these entities should engage in strategies that "slow down, close, narrow, regenerate, or dematerialize loops." Consequently, they may either supply raw or waste plastic materials; manufacture products predominantly composed of plastic; or provide goods and services that facilitate circularity (Lit et al., 2024).

According to (Onwuegbuzie and Collins, 2007; Palinkas et al., 2015; Andrade, 2021; Saunders et al., 2023), criterion sampling is a non-probability sampling method where respondents or units are selected based on specific criteria set and met. Therefore, the author searched the websites of the affiliated institutions to review the list of companies eligible based on the established criteria and confirmed the groupings as depicted in Table 4.2 (p.63). Next was the calculation of the sample size necessary for data collection.

To determine the appropriate sample sizes for this mixed-method research, a structured approach was taken. Starting by applying the Cochran (1977) formula to estimate the sample size. The Cochran 1977 formula is a statistical tool used to determine the minimum sample size required for a study to achieve reliable and accurate results. It is particularly useful when working with large populations and ensures that the sample size is sufficient to generalize findings to the entire population.

The formula accounts for three key factors: (1) the desired confidence level (typically 95%), which reflects the certainty that the results fall within a specific range; (2) the margin of error (e.g., 5%), which indicates the acceptable deviation from the true population value; and (3) the estimated proportion of the population with a specific characteristic (if unknown, 0.5 is used to maximize variability). For finite populations, the formula adjusts the sample size to avoid oversampling. In essence, Cochran's formula provides a systematic way to balance precision, confidence, and practicality in determining sample size for research studies.

4.2.3 Allocating sample sizes for questionnaires and interview administrations

By using the Cochran's sample size formula, for a population of 376 with a 95% desired confidence level, 5% margin of error, and a 0.5 estimated proportion, a total of 190 respondents were selected for both questionnaire survey and interview. To determine the sample sizes for the survey and interviews, first, the new population was calculated for the survey by adding the number of businesses in each relevant category: 27 (Cottage Industries) + 8 (Medium-to-Large-Scale Businesses) + 99 (SMEs) + 46 (PET Recycling SMEs) + 2 (Large-Scale PET Recyclers) + 160 (General Plastic Manufacturers). This gives a total survey population of 342 businesses.

Next, the proportion of this survey population to the total population of 376 businesses was calculated, which is 342 ÷ 376 = 0.91. Applying this proportion to the total sample size of 190, the

number of respondents for the survey was determined: 190 × 0.91 = 173. Therefore, 173 respondents were selected for the survey.

For the interview sample size, the survey sample size was subtracted from the total sample size: 190 - 173 = 17. This means 17 participants were purposively selected for interviews. These participants will include representatives from all business groups to ensure a diverse and comprehensive understanding of the CE practices in Ghana's plastic industry. In summary, the study will involve 173 respondents for the survey and 17 participants for interviews, ensuring a balanced and representative approach to data collection.

4.2.4 Determining the number of respondents per business type

Stratified random sampling is suitable in situations where high-precision results are needed and exist population diversity. Thus, Stratified sampling requires that the sample frame be separated into subsections that represent the homogeneity of the heterogeneous samples (Onwuegbuzie and Collins, 2007). In each group often referred to as stratum (Reddy and Khan, 2023) one or more units are randomly selected. Generally, characterized as a process of partitioning the population into non-overlapping, mutually exclusive strata of sample units.

To ensure adequate representation of the diverse groups involved (recyclers, and manufacturers,) the study utilized stratified sampling. This approach allocated the sample size proportionally to each group according to their population size. Key considerations for this choice included ensuring that each group is adequately represented in the sample. Additionally, in cases where specific samples are difficult to find directly due to practical constraints, the proportional allocation of the sample size allows the author to employ alternative methods to identify the necessary participants more easily. The study further went on to randomly select 173 participants as survey respondents from the stratum while purposively selecting 17 interviewees from all units as postulated by (Creswell, 2006). Thus, with purposeful sampling, the researcher selectively selects people who are familiar with the main idea or phenomenon under investigation (Creswell, 2006).

Table 4.3: Distribution of Stratified Sampling Units.

Business Type	**Population Size**	**Proportion (%)**	**Sample Size**
Cottage Industries	27	7.89%	14
Medium-to-Large-Scale Businesses	8	2.34%	4
Small and Medium Enterprises (SMEs)	99	28.95%	50
PET Recycling SMEs	46	13.45%	23
Large-Scale PET Recyclers	2	0.58%	1
General Plastic Manufacturers	160	46.78%	81
Total	**342**	**100%**	**173**

As argued by Onwuegbuzie and Collins (2007), the sampling design and size for quantitative and qualitative samples must be well established. This, the authors say, includes the issues of time criteria and the relationship of the quantitative and qualitative samples. As earlier discussed, the study in terms of time orientation employed a convergent design. Hence, both qualitative and quantitative data collection happens simultaneously. In terms of relationships, the authors identified identical, parallel, nested, or multilevel relationships that could influence both quantitative and qualitative sampled respondents.

A nested relationship presents the best option for the sampled members. In a nested relationship, the sample members selected for one phase represent a subset of those chosen for the other phase, with additional participants included to capture diverse perspectives (Onwuegbuzie and Collins, 2007). In applying these approaches, the quantitative phase incorporates feedback from all sampled recycling, plastic manufacturing, and packaging companies through questionnaires. Meanwhile, in the qualitative phase, a select group of respondents from the quantitative phase is chosen for in-depth interviews, inclusive of informal waste collectors' groups, expert, and advocacy groups to provide their unique insights.

The chosen relationship type is crucial as it ensures that qualitative data enhances quantitative data, offering a more thorough understanding of the research problem. By selecting a subset of the quantitative sample for the qualitative phase, the study optimizes resources while capturing diverse viewpoints. Additionally, including more participants in the qualitative phase captures the insights of key stakeholders, such as informal waste pickers, who will be absent from the quantitative sample.

4.3 Data collection.

Data in research can be obtained in various formats and through different techniques, which can be broadly categorised into quantitative (numerical) data and qualitative (categorical) data (Zohrabi, 2013). In mixed-method research, data collection processes always differ due to differences in design (Creswell, 2006). However, techniques such as closed-ended questionnaires, open-ended questionnaires, interviews, and observations have been associated with mixed-method data collection (Zohrabi, 2013). Additionally, closed-ended questionnaires are most suitable for collecting quantitative data, while qualitative data is best gathered through open-ended questionnaires, interviews, and observations.

Questionnaires were used to collect quantitative data for the study, while semi-structured interviews were used to acquire qualitative data. This method makes it possible to gather both kinds of data separately, which were then combined to offer a thorough grasp of the research issue. However, questionnaires were not administered to the informal waste collectors nor the environmental, advocacy and expert groups sampled. It is assumed that these units are more service and knowledge providers enabling the concept of circularity in the plastic industry.

The sample sizes for the quantitative and qualitative components differ, with the survey targeting a larger (173), randomly selected sample groups (Cottage industry, Medium-to-Large-Scale Businesses, Small and Medium Enterprises (SMEs), PET Recycling SMEs, Large-Scale PET Recyclers, General Plastic Manufacturers). Meanwhile, interviews focus on smaller (17) purposively selected respondents (all groups). This disparity is managed by carefully analysing and integrating data to address the research questions effectively. By integrating the advantages of both quantitative and qualitative methods, the concurrent design allows a complete investigation

of the study problem. The data collection process is guided by rigorous procedures and a consent system to ensure validity and reliability.

4.3.1 Questionnaires

A mixture of structured closed-ended and open-ended questionnaires features in the study survey. The closed-ended questions were also in different forms constituting, category, multiple choice, and ranking type. Blaxter et al, (2006) recommended seven fundamental types of questions: "quantity or information, category, list or multiple choice, scale, ranking, complex grid or table, and open-ended." Which (Zohrabi, 2013) explained that one or more of these can be combined in a single study questionnaire developed.

Questionnaires can be collected in various formats, each with its strengths and weaknesses (Zohrabi, 2013). Brown (2001) and Zohrabi (2013) argue that while self-administered questionnaires, such as those sent by post or online, offer convenience, they often suffer from low response rates. Additionally, this method does not allow researchers to clarify ambiguous questions or monitor the conditions under which the questionnaires are completed. In contrast, group-administered questionnaires, where the researcher is present, tend to yield higher response rates. This format allows for immediate clarification of unclear questions and provides researchers with insights into the conditions under which the questionnaires are completed (Brown, 2001).

Face-to-face administration, as discussed by Zohrabi (2013) and Gillham (2000), also ensures high response rates and the ability to address ambiguities on the spot. Although disadvantaged by issues such as interviewer bias, time-consuming and limitations in terms of locations (Szolnoki and Hoffimann, 2013). In this study, the questionnaire was administered through a combination of personal visits (face-to-face) and web-based (online). This hybrid approach leverages the strengths of both methods. Where personal visits ensure high response rates and the ability to clarify questions, while online platforms offer convenience and accessibility for respondents who may not be reachable in person. This strategy aims to maximize participation and data quality while addressing the limitations of each method.

4.3.1.1 Questionnaire outline

The questionnaire is designed to gather comprehensive data on implementing CE practices within Ghana's plastic industry. It is structured into six sections (Appendix II), each focusing on a specific aspect of CE adoption, challenges, and impacts. The questionnaire targets businesses involved in plastic recycling, manufacturing, and packaging, aiming to capture various perspectives from small-scale enterprises to large-scale operations. The first section, General Business Information, collects basic details about the respondents' companies, including their business model, size, years of operation, and number of employees. This information provides context for understanding the diversity of businesses within the plastic sector and their ability to adopt CE practices. The second section, CBM in Operation, explores the familiarity of businesses with the concepts of CE and circular plastic economy. It also identifies the specific CE practices being implemented. This section is critical for assessing the level of awareness and engagement with CE principles among businesses in the sector.

The third section, Use of Virgin Plastics, Energy Consumption and Waste Generation, delves into the operational aspects of businesses, focusing on their reliance on virgin plastics, energy sources, and waste management practices. These are key indicators of their commitment to sustainability. The fourth section, Business Challenges and Economic Viability, addresses the financial and operational challenges faced by businesses in adopting circular economic models. This section is essential for understanding the economic barriers to CE adoption and identifying potential solutions to these challenges. The fifth section, Social Sustainability and Integration, focuses on the social aspects of circular economic practices, particularly the involvement of informal waste collectors. This section also explores how companies contribute to social sustainability through fair wages, training programs, and community engagement, providing a holistic view of their social impact.

The final section, policy and regulatory environment, examines the role of government policies in promoting CE practices. This section also includes a question about support for a Deposit Refund Scheme (DRS) for plastic bottles and packaging, which is a specific policy intervention aimed at increasing recycling rates. The questionnaire concludes with an open-ended question. This allows businesses to provide their insights and suggestions, which can be valuable for identifying innovative solutions and policy recommendations.

4.3.2 Interviews

Particularly in mixed-method research, interviews are a common way to gather qualitative data (Zohrabi, 2013; and Burns, 1999). Because of participant familiarity with the topic, it allows the researcher to often obtain first-hand information from particular respondents (Zohrabi 2013). It is intended to gather types of information and is sometimes referred to as a primary data source (Merriam, 1998). Two types of interview administration can be discussed. Either in individual or group settings. According to Merriam (1998), both have been described as goal-oriented. Johnson and Turner (2003) indicate that conducting interviews has several important advantages and disadvantages, including the ability to get detailed information, the ability to probe during the interview, a comparatively high response rate, the cost of doing so in person, the potential lack of anonymity among respondents, and time commitment.

Khan (2020) explains that it is important to allow the interviewee to speak for most of the time, as this facilitates the flow of valuable information. Although there may be pre-prepared questions, the interviewer is free to ask follow-up questions based on the interviewee's responses. Bryman and Bell (2015) emphasize the importance of giving the interviewee ample opportunity to speak, highlighting this as a key aspect of the interview process. There are two types of interviews: unstructured and semi-structured. In this research, seventeen semi-structured interviews were conducted to gather primary data, as will be discussed further below.

4.3.3 Semi-structured interviews (SSI)

Semi-structured interviews (SSIs) are a key data collection method due to their flexibility and versatility (Noor, 2008; Bryman and Bell, 2015; Kallio et al., 2016) yet structured manner, providing rich qualitative data that complement the quantitative findings. Additionally, the interviewer has more authority over the order and flow of questions, enabling a deeper exploration of the research topic (Barriball and While, 1994; Creswell, 2013). In this study, SSIs will be used to collect primary data from participants involved in Ghana's plastic product manufacturing and packaging businesses, Plastic recycling businesses, informal waste collectors' groups, and experts from environmental advocacy groups. The complete list of semi-structured interview questions is provided in Appendix III.

The interviews were conducted in a one-to-one format using a merger of physical meetings, telephone calls, and online platforms (Zoom), depending on the participants' preferences. This approach ensures accessibility and convenience for respondents while maintaining the flexibility of the SSI method. A total of 17 interviews were conducted. This number is sufficient to achieve data saturation (the point at which no new themes emerge) while remaining manageable within the study's scope. The aim of the interview is to:

1. Identify criticisms, which is to understand the criticisms related to CE practices in Ghana's plastic sector.

2. Explore Outcomes and Processes, which examines the distinctive attributes of CE economy initiatives in the plastic industry and their linkage to sustainability and CE principles.

3. Evaluate government initiatives by assessing the role of legislative and policy frameworks in promoting circularity.

Before each interview, a detailed interview guide (see Appendix IV for the guide structure) is prepared based on the research questions and analysed literature. The guide includes open-ended questions to allow for follow-up queries and in-depth discussions (Kallio et al., 2016; Bryman and Bell, 2015). Participants will receive the interview guide and a summary of the research proposal in advance to help them prepare for the discussion similar to (khan, 2020). To guarantee the accuracy of the information, comments and audio recordings will be made throughout the interview. This aligns with Noor's (2008) recommendation to record and document interviews to avoid data loss and ensure trustworthiness. Following the interview, participants will receive their raw responses for screening and clearance, similar to Khan (2020). This step ensures the accuracy of the information and allows participants to make corrections if necessary.

Semi-structured interviews are a valuable tool for this research, offering the flexibility to explore complex issues related to CE practices in Ghana's plastic industry. While the method is time-consuming and requires skilled interviewers, its advantages such as direct communication, adaptability, and the ability to gather in-depth insights make it well-suited for addressing the study research questions. By combining personal visits and online platforms, the researcher aims to

maximize participation and data quality, ensuring a complete knowhow of the difficulties and opportunities in implementing CE models.

Table 4.4: Interview Participants Distribution

Sampled Group	**Number of Participants**
Plastic Recycling Businesses	3
Plastic Product Manufacturers and Packaging Businesses	3
Informal Waste Collectors Groups	7
Experts From Environmental Advocacy Groups	4

4.4 Analytical methodology

Contingent upon the kind of information gathered and examined, the data analysis phase, which may be called the "integration analysis" (Creswell and Inoue, 2024), varies. In mixed research, this step entailed analysing the qualitative and quantitative data independently, creating an integration table, and drawing conclusions about discoveries from the combined display of findings (Creswell and Inoue, 2024). The questionnaire feedback was examined using descriptive and inferential statistics a in order to find trends, patterns, and connections. Descriptive statistics carried out using the IBM SPSS Statistics (Version 31.0) computer software were used to identify and summarise the prevalence of different circular business models and highlight key attributes. Cross tabulations were employed to examine the variations of CE adoption, the impact of policy support on adoption rates waste management practices, energy use, and perceived barriers across different business types and sizes. This quantitative analysis provides a broad overview of the CE landscape in Ghana's plastic industry.

The interview data is analysed using Braun and Clarke (2006) thematic analysis process to identify patterns, themes, and insights. The structure as per the authors consists of six steps: (1) becoming acquainted with the data; (2) creating preliminary codes; (3) looking for themes; (4) evaluating

themes; (5) identifying and labelling themes; and (6) creating the report. In this study, the researcher begins with transcribing the audio recordings and coding the interviews, followed by grouping codes into broader themes. Before coding the researcher read through the transcripts to get a sense of the data. Both manual coding and the use of generative AI as supplement for data processing and thematic analysis were used (Ross and Katz, 2024).

The aftermath of coding was the grouping of the identified codes into broader themes. A review took place to ensure the themes were coherent and supported by the data, followed by the development of a narrative passage to explain the themes in relation to the research questions. This qualitative analysis provides a deeper, contextual understanding of the CE landscape of businesses in Ghana's plastic industry. Grouping was a crucial part of the code and theme development process. Theoretical, practical and ideological were the major categories into which the codes and themes were divided. This step aids in ensuring qualitative findings reflect a range of viewpoints established by (Corvellec et al., 2022).

The integration of questionnaires and interview data is a critical step in the analysis process. Triangulation is used to compare and contrast the findings from both datasets, identifying areas of convergence (where both datasets support the same conclusion) and divergence (where the datasets provide different insights). The two datasets are then integrated using a joint display approach, where key themes and quantitative results are presented for easy comparison. Finally, a narrative integration weaves together the insights from both datasets, providing a cohesive explanation of the research findings.

4.5 Ethical considerations.

According to Bryman and Bell (2015), ethical considerations hold substantial significance within the realm of research and can be systematically categorized into four primary issues. These issues encompass research-related harm to participants, inadequacies in obtaining informed consent from the researcher, breaches of privacy, and instances of deception. Consequently, the participants had to sign an informed consent form to confirm that they were willingly agreeing to take part in the study. The execution of this document afforded them the prerogative to withdraw their consent at any moment without the obligation to provide a rationale. As articulated by Bryman and Bell (2015), the merit of such documents lies in their capacity to ensure that participants are thoroughly

cognizant of the research's context and the ramifications of their involvement in the study. Therefore, all participants were provided with a comprehensive overview of the study through the proposal disseminated before the interview, elucidating how the information they shared would be utilized.

The scheduling of the interview was arranged per their suitability and desired communication modality. Concerning questionnaires, participants were made aware that their involvement was strictly anonymous and voluntary, and could be terminated at any juncture of their choosing. A declaration affirming that no harm would be inflicted upon them was also communicated. Furthermore, when necessary, researchers could be contacted for clarification or rectification of data. To validate and substantiate ethical considerations, the proposed research methodology with application number (ARTS-2025-00167) underwent a human subject review and received ethical approval from the University of Malta Ethics Committee (UREC). This process was implemented to guarantee that the proposed methods and data collection procedures adhered to regulatory standards and that the well-being of the participants was not compromised in any manner.

4.6 Limitations

The study had its limitations. The first difficulty was obtaining the research population data required to determine the sample size. The researcher's use of many organisational databases to obtain demographic data resulted in inadequate presentation. This resulted in a slight time commitment because the researcher had to contact the organisation to obtain comprehensive descriptive information on the pertinent groups that comprised the study population.

Additionally, the study did not use independent environmental performance audits, lifecycle assessments, or direct observational field verification that could definitively validate declared circular practices. Rather, the study relied on self-reported survey data, which may be prone to greenwashing, meaning that participants may exaggerate their involvement in the circular economy (CE). Consequently, findings relating to business implementation of circular economy activities should be interpreted primarily as reported practices, perceptions, and institutional narratives rather than objectively verified measures of circular performance. The study used a triangulation approach to reduce this risk by integrating quantitative survey data with qualitative interviews with value chain participants. This made it possible for discrepancies, tensions, and

inconsistencies across stakeholder accounts to surface during analysis. This approach provided a transparent, if limited, means of addressing the risk of declared-practice discrepancies.

4.7 Conclusion

The methodological steps that were carefully considered during the research project are outlined in this chapter. This study specifically looked at the different research approaches that were applied and supported by descriptive justifications, which were in line with the goals of the study and answered the research questions. The analytical frameworks relevant to mixed-method research were examined in addition to the chosen methodology. The results of the analysis will be examined and evaluated in the following chapter to improve understanding and knowledge gain.

Chapter 5

Results

5.0 Results

This chapter introduces the findings from the survey and interviews conducted with selected businesses and persons operating within Ghana's plastic sector. The result seeks to explore the traits, practices, and outcomes originating from the implementation of CE (CE) plastic business types, with particular focus to the principles of CE and their role in advancing sustainable development.

The results description is organised in accordance with the study's research questions, beginning with a general overview of the demographic characteristics of the respondent businesses. The subsequent sections address the following core questions:

1. What are the criticisms associated with the implementation and practices of circularity as a driver of sustainable development?

2. What distinctive attributes are evident in the outcomes and processes of CE initiatives in Ghana's plastic industry?

3. What are the primary critiques surrounding the CE as applied to the plastic industry in Ghana?

4. How did the government legislative initiatives contribute to a sustainable transition toward circularity in Ghana's plastic industry?

The quantitative data collected from 173 respondents located in the Greater Accra Region of Ghana were analysed using IBM SPSS Statistics 31 (IBM Corp, 2025). Prior to the analysis, all questionnaire responses were coded, with categorical and multiple-choice variables assigned numeric values (1 for selected, 0 for not selected). Missing data and non-responses were systematically coded as "99" and treated as discrete missing values during analysis to prevent distortion of valid results. One respondent with no valid data across all variables was excluded from the dataset, leaving 172 valid cases for analysis.

Descriptive statistics were first conducted to summarise the demographic and business characteristics of participants. Importantly, since many of the survey questions allowed multiple selections, frequency distributions and percentages were generated with emphasis on *percent of*

respondents rather than *percent of responses* for multiple-response questions. To simply put: percentage of respondent indicates how many of the surveyed participants selected a particular response at least once, reflecting how widespread an activity is among participants. Hence percentage may exceed 100%. Whereas, percentage of responses to the share of the total responses recorded, reflecting how frequent an activity was selected relative to all response given, summing exactly to 100%. This distinction is important in interpreting results where respondents could select more than one option, ensuring clarity between prevalence and intensity of responses. This approach ensured that results reflected the proportion of businesses identifying each practice, challenge, or driver, rather than the total number of mentions.

Cross-tabulations were performed to explore relationships between key variables such as business size, business type, and adoption of circular practices. Where appropriate, chi-square tests were applied to test for statistical significance. Pairwise deletion was used for handling missing data, ensuring that each analysis utilised the maximum available valid cases. The results are presented below, beginning with the basic information of respondents in terms of size, type, and operational characteristics.

5.1 General business characteristics – questionnaire results

5.1.1 Business types represented in the study

The first step in analysing the implementation of CE practices in Ghana's plastic sector was to understand the distribution of business types among the respondents. This question was necessary because of the assumption that, the nature of a business, has a direct influence on the type and extent of circular practices and principles it can adopt. In addition to this, in the selection of this businesses, criteria set was based on their ability to integrate maximum circularity into their business operational scope. The data was tabulated using frequency counts and percentages in IBM SPSS Statistics 31 (IBM Corp, 2025), allowing for both the proportion of responses and the proportion of respondents to be assessed. This dual measure is important as some businesses indicated multiple activities, meaning the quantity of responses is marginally higher compared to the number of respondents. To provide an additional layer of insight, the mean values of responses within each business type were also computed, giving an indication of relative prevalence.

Table 5.1 shows that plastic packaging businesses represent the largest group, accounting for 46.5% of respondents, suggesting its centrality in Ghana's plastic sector. Plastic cycling (recycling, reuse, remanufacturing, repair) businesses followed closely, making up 41.9% of respondents. This could be seen as underscoring their crucial role in supplying plastic feedstock into the plastic value chain. Plastic product manufacturing companies were the third largest group (36.0%). A notable minority operate as integrated businesses ("All Above"). They engage in recycling, manufacturing, and packaging simultaneously and account for 9.9% of respondents.

Table 5.1: Distribution of sampled businesses by operational type

Business Type	**Count**	**% of Responses**	**% of Respondents**	**Mean**
Plastic Cycling	72	30.0%	41.9%	0.42
Plastic Product Manufacturing	62	25.8%	36.0%	0.36
Plastic Packaging	80	33.3%	46.5%	0.47
All Above	17	7.1%	9.9%	0.10
Other Models	9	3.8%	5.2%	0.05

Business types not directly specified in the questionnaire such as CE business incubators, advisories and scavengers or waste collectors and segregators accounted for 5.2% representing other business types. However, because the total number of reported operational activities (N = 240) exceeds the number of responding firms (N = 173), this indicates that the business categories are not mutually exclusive. In other words, participating businesses operate across more than one plastic-related activity. Hence, by summing the mean proportions of the different business types (0.42 + 0.36 + 0.47 + 0.10 + 0.05), it can be inferred that, on average, each business reported engagement in approximately 1.4 activities within the plastic value chain. This demonstrates a notable level of diversification, with firms often participating simultaneously in recycling, manufacturing, packaging, or related operations rather than occupying a single, discrete category.

5.1.2 Business type by size

In addition to categorizing businesses by type, the study also examined their scale of operation to better understand how organisational size may influence CE practices in Ghana's plastic sector. Figure 5.1 presents the distribution of businesses by size. The findings show that nearly half of the respondents (48.8%) operate as medium-to-large enterprises, making this the most common business type among participants.

Small and medium enterprises (SMEs) represent the second largest category at (29.7%). Potentially reflecting the importance of smaller, flexible firms that often operate at niche levels of the plastic value chain. Although less prominent, cottage industries still account for (11.0%) of the businesses surveyed, while large-scale businesses make up 10.5% of the sample.

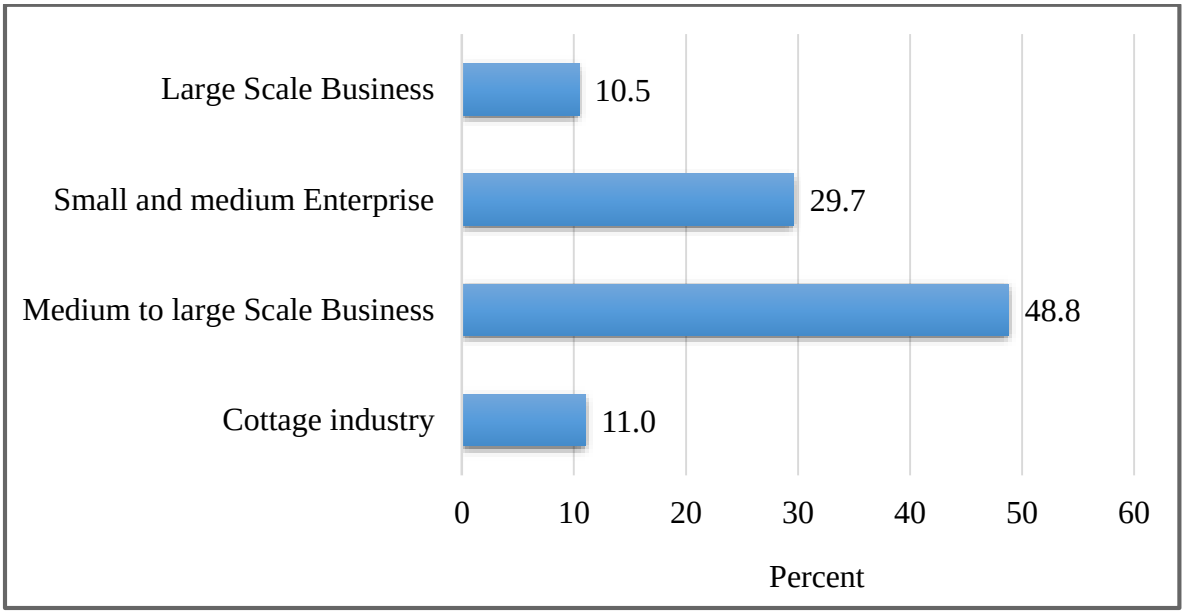


Figure 5.1 – Percentage distribution of businesses by size

5.1.3 Years in operation

Table 5.2 presents the distribution of businesses by their years in operation. The majority of respondents had been in existence between 1–10 years, with 43.6% operating for 1–5 years and 44.8% for 6–10 years, indicative of a young but established businesses. A smaller proportion, 8.1%, reported operating for more than 10 years, while 3.5% of businesses were very new, with

less than one year of operation. These new entrants likely reflect the growing opportunities and awareness surrounding CE practices.

Table 5.2 - Years in operation by businesses

Years	Count	Percentage
Less than 1 year	6	3.5
1-5 years	75	43.6
6-10 years	77	44.8
More than 10 years	14	8.1

5.1.4 Familiarity with CE

The study as depicted in Figure 5.2 also assessed the extent to which businesses were familiar with the concept of the CE. Results show that knowledge levels vary considerably across respondents. A combined 73.8% of the businesses described themselves as slightly familiar (37.2%) or moderately familiar (36.6%) with CE practices and its principles. While 17.4% of respondents reported not being familiar at all with the CE, highlighting a significant knowledge gap among some businesses. Only 8.7% claimed to be very familiar, suggesting that deep, applied understanding of circularity remains limited to a small group of actors.

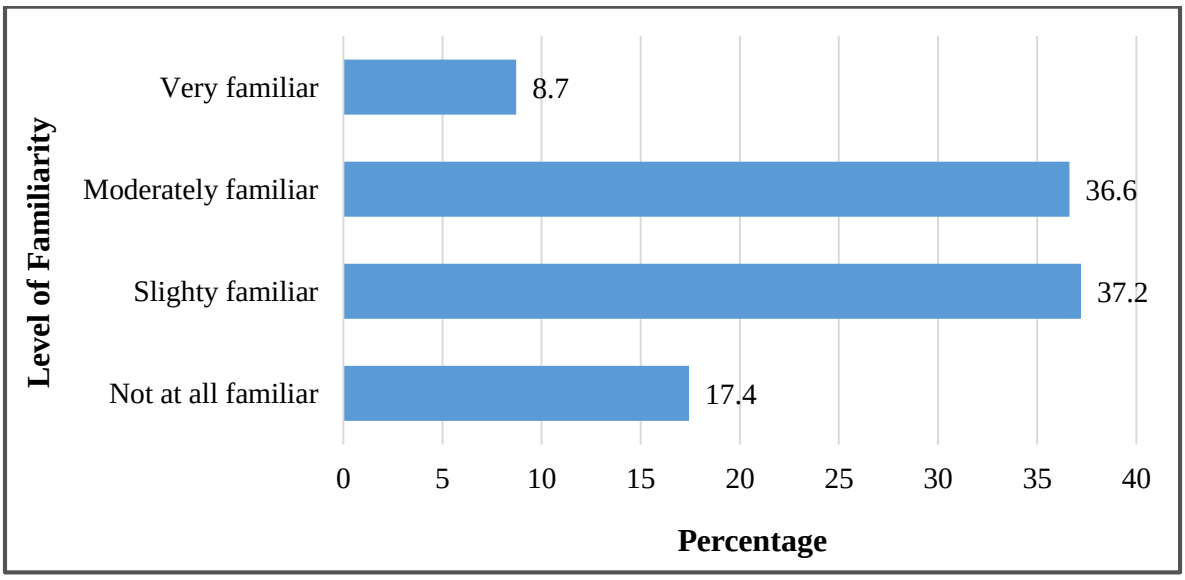


Figure 5.2- Distribution of CE familiarity levels

5.1.5 Familiarity with CE by years in operation

Earlier results showed that most businesses have been in operation between 1–10 years, and within this group, the majority indicated being either slightly familiar or moderately familiar with the CE, while only a small fraction reported being very familiar. This raised the question of whether business maturity, measured by years in operation, has a direct influence on how familiar companies are with CE practices. To investigate this relationship, a cross-tabulation analysis was conducted between years of operation and levels of CE familiarity, revealing noticeable variations across the different business age groups, confirming that operational tenure does influence familiarity levels as illustrated in the stacked bar chart (Figure 5.3).

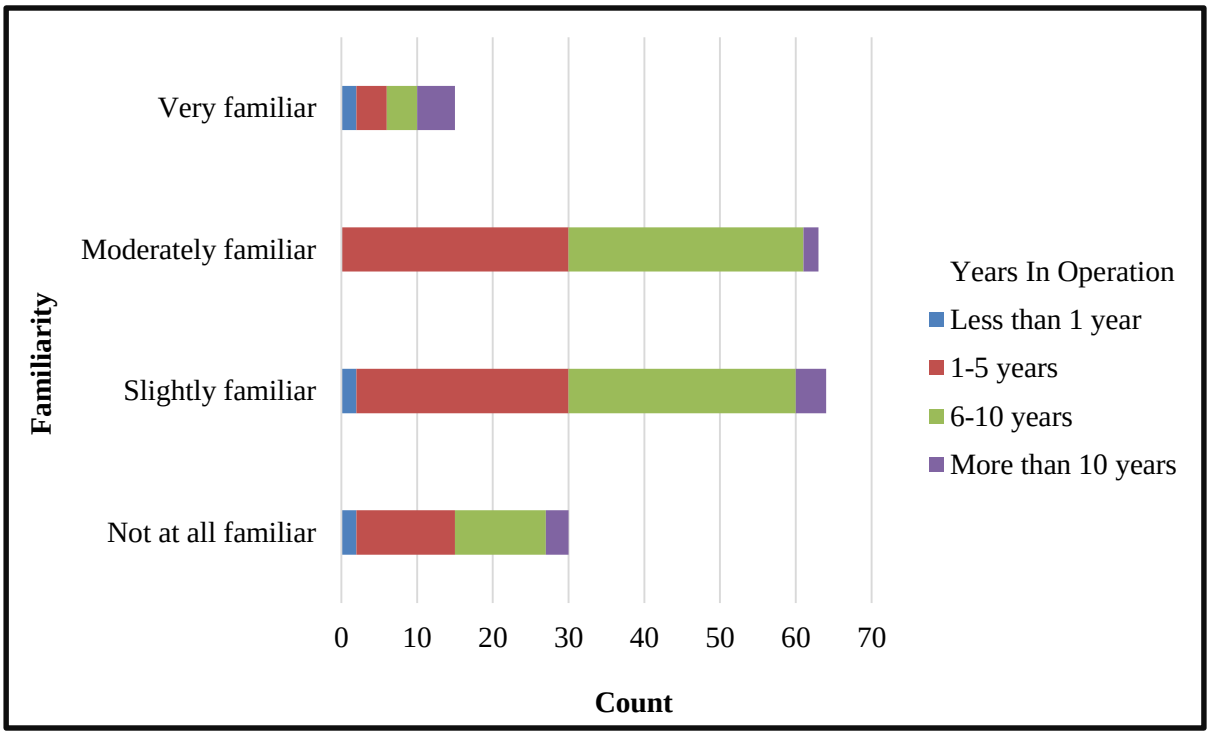


Figure 5.3 Business familiarity, measured by years in operation

Among businesses with less than one year of operation, familiarity levels were polarized. One-third (33.3%) reported being not at all familiar, another one-third (33.3%) were slightly familiar, and the remaining 33.3% were very familiar. Interestingly, none of these new entrants identified as moderately familiar. For those operating 1–5 years, familiarity was more balanced but tilted towards the middle levels. 40% described themselves as moderately familiar, while 37.3% were slightly familiar.

A smaller share (17.3%) reported no familiarity, and only 5.3% considered themselves very familiar. The group of businesses operating 6–10 years displayed very similar patterns. Here, 40.3% reported being moderately familiar, and 39.0% slightly familiar. About 15.6% indicated no familiarity, while 5.2% claimed to be very familiar. For the most experienced group, those in operation for more than 10 years, familiarity levels were mixed but with a higher proportion in the extremes.

While 28.6% were slightly familiar and 14.3% moderately familiar, a notable 35.7% reported being very familiar, the highest among all groups. At the same time, 21.4% indicated no familiarity at all. Meanwhile, a chi-square test ($\chi^2 = 24.083$, df = 9, p = 0.004) was performed to assess the association between the categorical variables (Years/Familiarity). The test conclusion (p-value, since 0.004 is less than the standard threshold of 0.05, association exist) confirms a statistically significant association between years in operation and familiarity with the CE.

5.1.6 Drivers of CE adoption

Understanding the motivations behind CE (CE) adoption is critical to identifying the forces shaping business behaviour in the plastics sector. Businesses often respond to a mixture of economic, social, and regulatory pressures when integrating CE principles, and the relative weight of these drivers provides insight into how sustainable practices can be further incentivized. Table 5.3 presents the distribution of responses across the main drivers. The results indicate that cost reduction could be considered the most influential driver, cited by nearly two-thirds of businesses. Closely following are (1) reduction in virgin material use (45.2%) and (2) inclusivity (44.6%), suggesting that material efficiency and social values are also widely recognized motivations. Other notable drivers include partnerships (40.4%) and competitive advantage (38.6%), Environmental concerns are reflected in addressing pollution impact (34.9%), while regulatory compliance (30.7%) and innovation (30.1%) show moderate influence. On the lower end, customer demand (29.5%), brand reputation (29.5%), and green financing (16.9%) demonstrate that consumer-driven pressures and financial incentives remain underdeveloped as motivators. The category of other drivers (1.8%) was negligible, and no further explanations were provided by respondents, suggesting that the predefined options captured nearly all relevant drivers identified by businesses. Indicating limited unique or sector-specific motivations outside the predefined list.

Table 5.3 - Drivers of CE adoption.

Driver for CE Adoption	Response Count (N)	Percent of Cases	Mean (M)	Std. Deviation
Cost Reduction	106	63.9%	0.64	0.482
Reduction on Virgin Material Use	75	45.2%	0.45	0.499
Inclusivity	74	44.6%	0.45	0.499
Competitive Advantage	64	38.6%	0.39	0.488
Partnership	67	40.4%	0.40	0.492
Addressing Pollution Impact	58	34.9%	0.35	0.478
Regulatory Compliance	51	30.7%	0.31	0.463
Innovation	50	30.1%	0.30	0.460
Customer Demand	49	29.5%	0.30	0.458
Brand Reputation	49	29.5%	0.30	0.458
Green Financing	28	16.9%	0.17	0.376
Other Drivers	3	1.8%	0.02	0.134

The mean values correspond directly to the proportion of businesses citing each driver, cost reduction (M = 0.64) stands out as the most consistently reported factor, while drivers such as green financing (M = 0.17) and other drivers (M = 0.02) had very low means, reinforcing their marginal role in the sector. The standard deviations (SDs) reveal the level of agreement across firms. Factors such as cost reduction (SD = 0.482) and virgin material reduction (SD = 0.499) had relatively low variability, indicating strong and consistent agreement among businesses. In contrast, drivers like customer demand (SD = 0.458) and green financing (SD = 0.376) exhibited higher variability.

5.2 Distinctive attributes of CE processes and outcomes of Ghana's plastic industry

The next set of questions sought to identify the specific processes and outcomes that characterise how businesses in Ghana's plastic industry engage with the CE. The objective was to go beyond general familiarity and business profiles, and instead examine the practical strategies adopted by firms. Responses revealed a diverse mix of CE practices, though their distribution indicates a clear emphasis on conventional and recycling-centric approaches.

5.2.1 Circular plastic economy business practices

According to Figure 5.4, the most frequently reported practice was the use of recycled material, which accounted for 60.8% of businesses. Similarly, recycling-only strategies (48.5%) and waste minimisation measures (47.4%) were also highly prevalent. Together, these three practices highlight a dominant focus on material recovery and waste reduction, reflecting relatively accessible strategies that align with existing production structures. Notably, engagement with the informal sector emerged as a distinctive feature of Ghana's plastic CE ecosystem. Reported by 41.5% of businesses, this practice reflects the critical role of grassroots actors in waste collection, segregation, and recovery processes.

By contrast, practices associated with more advanced or systemic models of circularity registered lower levels of adoption. For instance, product life extension (21.1%), material substitution (19.9%), and product-as-a-service models (18.7%), industrial symbiosis (18.1%), and consumer awareness initiatives (17.5%) remain underutilized, which could indicate limited inter-firm collaboration and a still-nascent focus on consumer behaviour change. Interestingly, only 9.4% of businesses indicated complete absence of circular practices

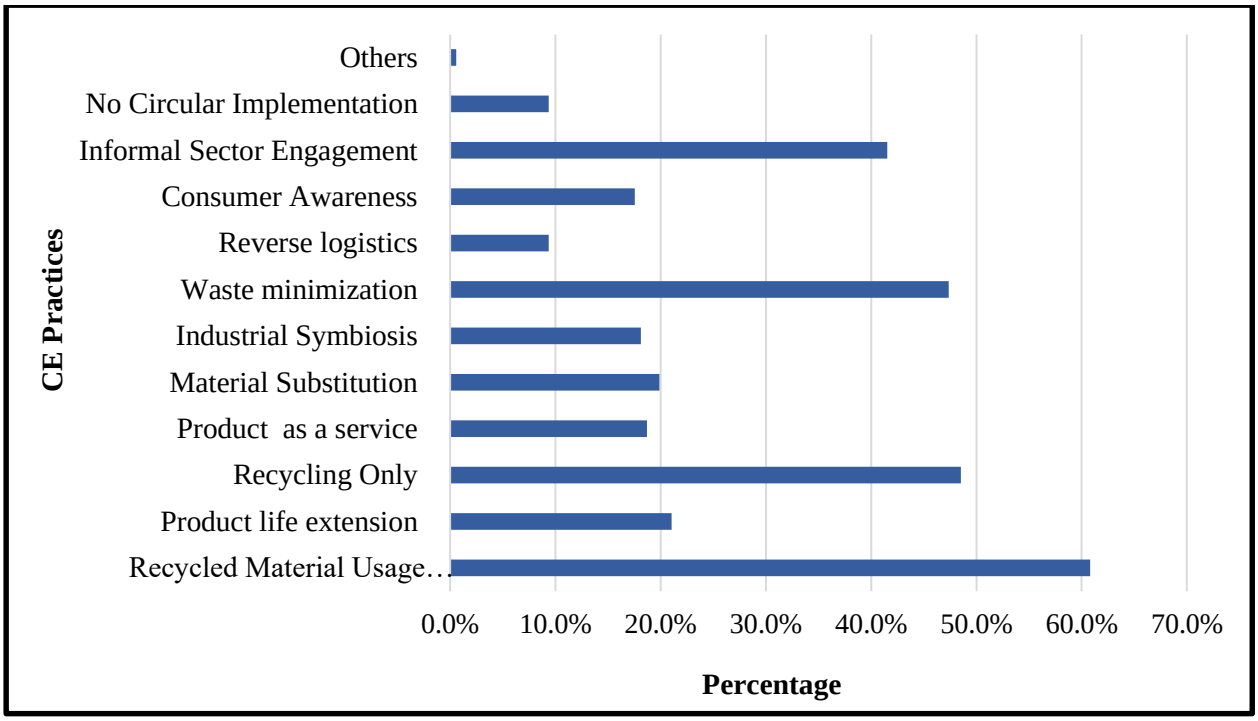


Figure 5.4 – Percentage distribution of CE practice types among businesses

5.2.2 Percentage of business with their energy source and management practices

Energy is a critical factor shaping the environmental footprint of businesses in Ghana's plastic industry. The survey findings indicate a high concentration of dependence on conventional sources of energy. As shown in Table 5.4, the national energy grid, comprising hydro and fossil fuel-based thermal power dominates as the primary source of energy. It was reported by 97.6% of respondents, accounting for 56.8% of all energy sources cited.

Table 5.4– Energy sources utilized by businesses

Energy Source	Count	% of Response	% of Respondent
National Energy Grid	166	56.8%	97.6%
Diesel Generators	71	24.3%	41.8%
Biomass	32	11.0%	18.8%
Solar	12	4.1%	7.1%
LPG	11	3.8%	6.5%

Diesel generators are also widely used among respondent, with 41.8% of businesses depending on them. They constitute 24.3% of total energy sources, reflecting their role as backup solutions. Renewable energy adoption remains relatively low. Biomass is used by 18.8% of businesses, while only 7.1% leverage solar power, and 6.5% rely on LPG. This underlines a significant gap, as renewable sources remain largely untapped despite their potential to enhance sustainability and reduce fossil fuel dependence. Despite these limitations in renewable energy integration, a notable finding is that a large majority of businesses, 89% of respondents reported adopting energy-saving measures in Table 5.5.

Table 5.5 - Proportion of businesses implementing energy-saving measures

Energy Management Action	**Frequency**	**Percent**
Yes	153	89.0
No	19	11.0

According to Figure 5.5, the survey suggest that businesses show a strong preference for technology-based energy measures that deliver quick and visible cost savings, with equipment efficiency upgrades leading and adopted by 78.3% of companies.

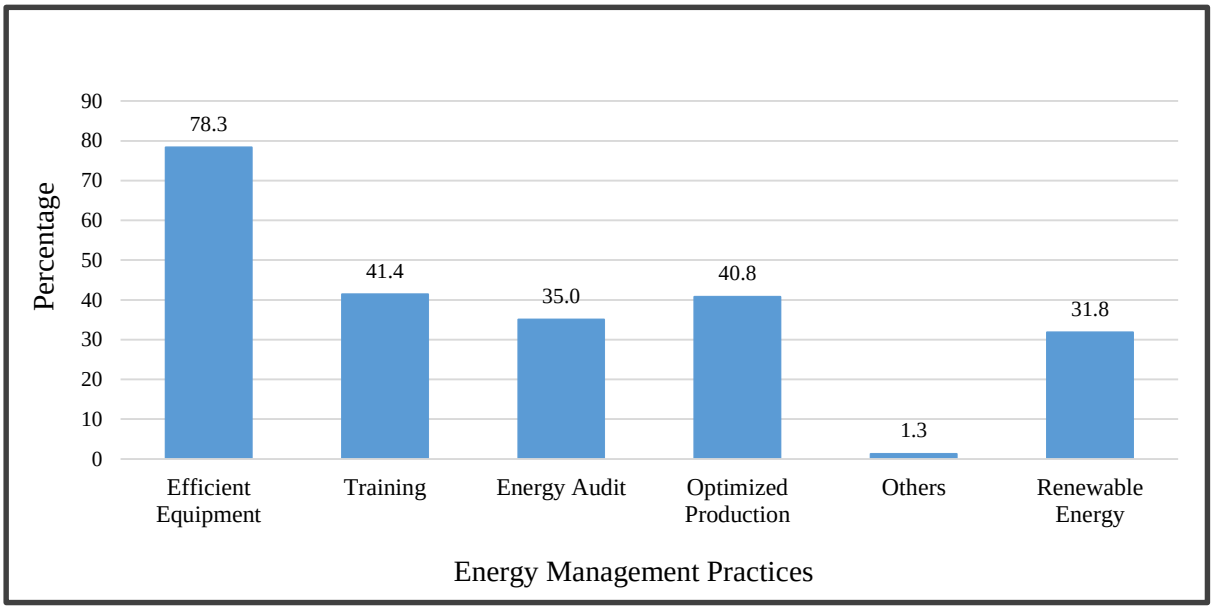


Figure 5.5– Percentage distribution of energy management measures by businesses

Training programs (41.4% adoption) representing the second highest measure. Production process optimisation accounts for 40.8% adopted measures by businesses. Energy audits (35%) remain underutilized, reflecting a reactive rather than proactive approach to system-wide energy planning. Once again renewable energy adoption and transition is found to be significantly lower (31.8%) and may serve as a supplementary source of energy. The minimal uptake of "other" strategies (1.3% of measures) shows limited experimentation beyond mainstream approaches. This is backed by the fact that respondents selected the "Other" option but did not specify additional details.

5.2.3 Percentage distribution of businesses by waste type and management practices

Understanding the waste profile of businesses in the plastic sector is central to evaluating their environmental performance and potential alignment with CE principles. As illustrated in Figure 5.6, the survey findings highlight that the dominant operational waste streams are residual plastic waste (76.5%), emissions (70.5%), and wastewater (69.9%). Together, these account for over 94% of all reported waste streams, underscoring their centrality as the most pressing environmental outputs of business operations in the sector. A smaller share of respondents (10%) reported "non-applicable," reflecting businesses whose operational processes do not generate significant waste, such as some scavengers and service-oriented firms.

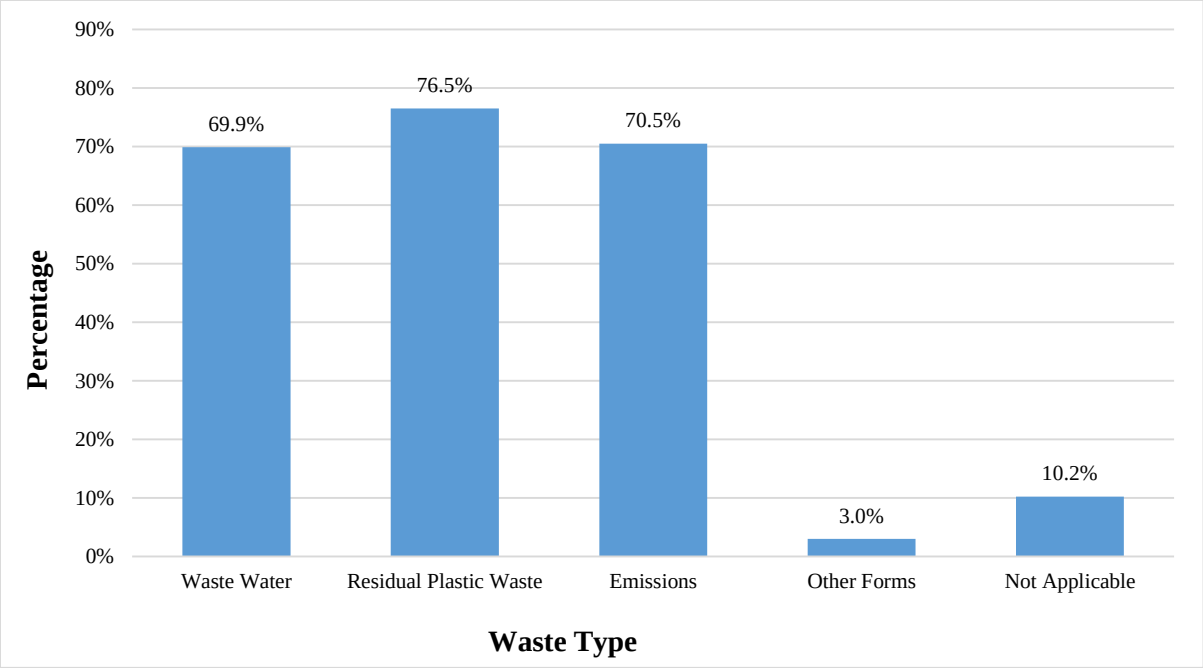


Figure 5.6 – Distribution of waste type generated at operations and production

To better understand how these wastes are managed, businesses were asked to identify the specific practices they employ. The most prominent practices are internal recycling (43.9%) and the use of licensed waste handlers (43.9%), both reflecting structured approaches to managing waste streams within and outside an organisation. These are followed closely by landfill disposal (43.3%) and incineration of non-recyclables (42.1%), which highlight the continued prevalence of linear waste pathways that remove materials from potential circular loops.

More circular-oriented practices such as production integration (38%), where waste is reused in internal processes and industrial symbiosis (35.1%), where waste streams are exchanged across firms, show moderate uptake but remain underutilized relative to the scale of waste challenges in the sector. Selling recyclables to external processors is the least common (28.7%), suggesting limited market linkages between mainstream plastic businesses and specialized recyclers. Rarely adopted "other" practices (1.2%) reflect minimal experimentation beyond the established set of strategies. Holistically, these practices presented in Table 5.6 reveal a blend of circular and traditional approaches to waste management per type.

Table 5.6– Percentage distribution of waste management practices by businesses

Waste Management Practices	**Count**	**% of Response**	**% of Respondents**
Internal Recycling	75	15.9%	43.9%
Sell to recyclers	49	10.4%	28.7%
Production integration	65	13.8%	38.0%
Use of Licensed Waste Handlers	75	15.9%	43.9%
Incineration of non-recyclable	72	15.3%	42.1%
Landfill	74	15.7%	43.3%
Industrial Symbiosis	60	12.7%	35.1%
Others	2	0.4%	1.2%

5.2.4 Crosstab of CE Practices by Business Type Category

The cross-tabulation of CE (CE) practices across different business models within the plastic industry reveals distinct patterns of adoption, with certain strategies proving more prevalent in specific categories (Table 5.7). Recycled Material Usage emerged as the most frequently reported practice, particularly within Plastic Manufacturing (24%) and Plastic Cycling (22.6%) businesses, while adoption was comparatively lower in Plastic Packaging (14.4%) businesses. Similarly, 'Recycling Only' showed a high uptake among 'Plastic Cycling' (23%) and 'Plastic Manufacturing' (22.2%), but was less common in Plastic Packaging (10%) and in other models. Waste Minimisation practices followed a similar trend, accounting for 20.9% in Plastic Manufacturing and 20.5% in Plastic Cycling businesses but dropping to 12.8% in Plastic Packaging businesses. Less dominant CE strategies, such as Product-as-a-Service (PaaS), material substitution, and industrial symbiosis, showed variation across business models. For instance, Product-as-a-Service represented 13.3% of responses among businesses implementing multiple models ("All Above"), suggesting that hybrid or integrated business approaches foster innovation in CE strategies. Likewise, Industrial Symbiosis was most frequently observed in the "All Above" category (10%).

Table 5.7 - Crosstab of CE practices by business type

CE Practices		**Business Category by Type**				
		Plastic Cycling	Plastic Manufacturing	Plastic Packaging	All Above	Others
Recycled Material Usage	Count	54	54	36	14	3
	percentage	22.6%	24.0%	14.4%	23.3%	17.6%
Product life extension	Count	14	11	19	5	1
	percentage	5.9%	4.9%	7.6%	8.3%	5.9%
Recycling Only	Count	55	50	25	5	4
	percentage	23.0%	22.2%	10.0%	8.3%	23.5%
Product as a service	Count	4	4	21	8	0
	percentage	1.7%	1.8%	8.4%	13.3%	0.0%
Material Substitution	Count	7	7	23	3	0

	percentage	2.9%	3.1%	9.2%	5.0%	0.0%
Industrial Symbiosis	Count	6	5	19	6	2
	percentage	2.5%	2.2%	7.6%	10.0%	11.8%
Waste minimisation	Count	49	47	32	4	5
	percentage	20.5%	20.9%	12.8%	6.7%	29.4%
Reverse logistics	Count	1	1	11	4	0
	percentage	0.4%	0.4%	4.4%	6.7%	0.0%
Consumer Awareness	Count	8	10	18	6	0
	percentage	3.3%	4.4%	7.2%	10.0%	0.0%
Informal Sector Engagement	Count	36	33	35	4	2
	percentage	15.1%	14.7%	14.0%	6.7%	11.8%
No Circular Implementation	Count	5	3	10	1	0
	percentage	2.1%	1.3%	4.0%	1.7%	0.0%
Others	Count	0	0	1	0	0
	percentage	0.0%	0.0%	0.4%	0.0%	0.0%

Informal Sector Engagement was relatively consistent across categories, ranging from 14.0% in Plastic Packaging to 15.1% in Plastic Cycling businesses, underscoring its role as a cross-cutting strategy in the Ghanaian plastics sector. By contrast, Reverse Logistics, Consumer Awareness, and No Circular Implementation appeared infrequently across the dataset, each contributing only marginally to total responses. Notably, businesses reporting no CE adoption were minimal across all categories (1.3–4.0%), potentially indicating widespread recognition of circular practices, even if implementation remains uneven.

5.2.5 Crosstab of CE practices by company size

The cross-tabulation of CE practices across different company sizes (Table 5.8) reveals distinct variations in adoption patterns, reflecting differences in operational capacity, resource availability, and business orientation. Recycled Material Usage emerged as the most dominant practice overall

(104 cases), with the highest proportional adoption among large-scale businesses (83.3%). Medium-to-large firms also showed strong engagement (54.2%), as did SMEs at 62.7%, and cottage industries at 63.2%, demonstrating widespread use of recycled materials across business scales.

Table 5.8 - Crosstab of CE practices by business size

CE Practices		**Business Category by Size**			
		Cottage industry	Medium to large Scale Business	Small and medium Enterprise	Large Scale Business
Recycled Material Usage	Count	12	45	32	15
	Percentage	63.2%	54.2%	62.7%	83.3%
Product life extension	Count	6	16	6	8
	Percentage	31.6%	19.3%	11.8%	44.4%
Recycling Only	Count	4	34	33	12
	Percentage	21.1%	41.0%	64.7%	66.7%
Product as a service	Count	7	17	4	4
	Percentage	36.8%	20.5%	7.8%	22.2%
Material Substitution	Count	4	22	4	4
	Percentage	21.1%	26.5%	7.8%	22.2%
Industrial Symbiosis	Count	5	19	2	5
	Percentage	26.3%	22.9%	3.9%	27.8%
Waste minimisation	Count	6	35	29	11
	Percentage	31.6%	42.2%	56.9%	61.1%
Reverse logistics	Count	2	11	1	2
	Percentage	10.5%	13.3%	2.0%	11.1%
Consumer Awareness	Count	4	19	4	3
	Percentage	21.1%	22.9%	7.8%	16.7%

Informal Sector Engagement	Count	1	42	21	7
	Percentage	5.3%	50.6%	41.2%	38.9%
No Circular Implementation	Count	0	10	5	1
	Percentage	0.0%	12.0%	9.8%	5.6%
Others	Count	1	0	0	0
	Percentage	5.3%	0.0%	0.0%	0.0%

Recycling Only also exhibited significant uptake (83 cases), particularly among large-scale firms (66.7%), SMEs (64.7%), and medium-to-large businesses (41.0%), underscoring the prevalence of post-consumer recycling as a core component of circularity. Product Life Extension practices were most common among large-scale businesses (44.4%) and cottage industries (31.6%), reflecting efforts to enhance product durability and reduce waste within these segments. More specialized models such as Product-as-a-Service were relatively less adopted, though cottage industries (36.8%) and medium-to-large firms (20.5%) showed some experimentation. Similarly, Material Substitution and Industrial Symbiosis displayed moderate but uneven adoption, led by medium-to-large businesses (26.5% and 22.9%, respectively) and supported by smaller contributions from cottage industries (21.1% and 26.3%).

Waste Minimisation was widespread across company sizes (81 cases), especially among SMEs (56.9%) and large-scale firms (61.1%), reflecting increased attention to efficiency and resource recovery. However, more complex operational models such as Reverse Logistics recorded low engagement, concentrated mainly among medium-to-large and large firms indicating limited adoption of advanced product recovery systems.

Consumer Awareness initiatives showed a balanced spread, with medium-to-large firms (22.9%) and cottage industries (21.1%) more actively engaging in public-facing sustainability communication. In contrast, Informal Sector Engagement was primarily driven by medium-to-large businesses (50.6%) and SMEs (41.2%), confirming the bridging role of mid-sized enterprises in connecting formal recycling systems with informal collection networks. Cottage industries showed minimal engagement (5.3%), likely constrained by organisational capacity. Finally, non-implementation of CE practices was relatively rare, with only 16 businesses (9.4% of the sample)

reporting no adoption. This indicates broad awareness and engagement with CE strategies across Ghana's plastic sector, even if adoption levels and complexity vary significantly by business size.

5.2.6 - Cross-tab of waste management practices by business model category

In further addressing research question 2, the analysis reveals major contrasts between linear and circular waste management approaches (See Table 5.9). Plastic product manufacturing businesses emerge as the most dependent on conventional waste handling, reporting the highest use of licensed waste handlers (64.5%) and incineration (61.3%). Similarly, landfill disposal was most prevalent among Plastic Manufacturers (62.9%) and Plastic Cycling businesses (55.6%).

Table 5.9- Waste management practices by business category by type

Waste Management Practices		**Business Category by Type**				
		Plastic Cycling	Plastic Manufacturing	Plastic Packaging	All Above	Other
Internal Recycling	Count	36	33	29	10	4
	Percentage	50.0%	53.2%	36.3%	58.8%	44.4%
Sell to recyclers	Count	19	17	32	2	2
	Percentage	26.4%	27.4%	40.0%	11.8%	22.2%
Production Integration	Count	21	16	40	7	2
	Percentage	29.2%	25.8%	50.0%	41.2%	22.2%
Use of Licensed Waste Handlers	Count	40	40	33	8	1
	Percentage	55.6%	64.5%	41.3%	47.1%	11.1%
Incineration of Non-recyclable	Count	41	38	32	7	1
	Percentage	56.9%	61.3%	40.0%	41.2%	11.1%
Landfill	Count	40	39	32	4	5
	Percentage	55.6%	62.9%	40.0%	23.5%	55.6%
	Count	18	15	45	4	0

Industrial Symbiosis	Percentage	25.0%	24.2%	56.3%	23.5%	0.0%
Others	Count	0	0	2	0	0
	Percentage	0.0%	0.0%	2.5%	0.0%	0.0%

By contrast, Plastic Packaging companies stand out as major players in CE adoption. They demonstrated the highest uptake of industrial symbiosis (56.3%) and production integration (50.0%), both of which represent advanced strategies for retaining value within material loops. This orientation is further reflected in their dominance of selling to recyclers (40.0%). The All Above firms, which combine multiple business categories, demonstrated the most balanced and progressive approach to waste management. They reported the lowest reliance on landfill (23.5%), alongside strong adoption of internal recycling (58.8%) and production integration (41.2%). Conversely, the 'other business' category showed minimal engagement with structured or formalized waste management. Their reported use of licensed waste handlers (11.1%) and incineration (11.1%) was the lowest of all groups, while industrial symbiosis was completely absent (0%).

5.2.7 - Crosstab of waste management practices by business size.

Results from Table 5.10, relation assessment reveal clear differentiation across business sizes in their waste management approaches within Ghana's plastic industry. Internal recycling appears to be the most widely adopted practice overall, particularly among large-scale businesses (83.3%) and cottage industries (42.1%). Small and medium enterprises also show considerable adoption (43.1%), reflecting a moderate level of in-house recycling capacity across business categories. Medium-to-large businesses demonstrate relatively higher engagement in production integration (47.6%) and use of licensed waste handlers (51.2%), suggesting stronger operational structures and compliance mechanisms. These businesses also record substantial participation in industrial symbiosis (45.2%), where waste or by-products are shared across firms, pointing to more formalized waste management systems.

Table 5.10- Waste management practices by business size

Waste Management Practice	Cottage Industry	Small and Medium Enterprises	Medium-Large Business	Large Business
Internal Recycling	8 (42.1%)	22 (43.1%)	30 (35.7%)	15 (83.3%)
Licensed Waste Handlers	4 (21.1%)	20 (39.2%)	43 (51.2%)	8 (44.4%)
Landfill Disposal	2 (10.5%)	27 (52.9%)	35 (41.7%)	10 (55.6%)
Incineration	7 (36.8%)	24 (47.1%)	35 (41.7%)	7 (38.9%)
Production Integration	6 (31.6%)	9 (17.6%)	40 (47.6%)	10 (55.6%)
Industrial Symbiosis	7 (36.8%)	9 (17.6%)	38 (45.2%)	7 (38.9%)
Sell to Recyclers	3 (15.8%)	13 (25.5%)	27 (32.1%)	7 (38.9%)
Other Methods	2 (10.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Among smaller enterprises, particularly SMEs and cottage industries, practices such as selling to recyclers (25.5% and 15.8%) and landfilling (52.9% and 10.5%) are more common. Cottage industries, while less equipped technologically, display a notable presence in internal recycling, implying practical adaptation of small-scale circular strategies. Large-scale businesses consistently record higher percentages across several practices, particularly internal recycling. However, landfilling (55.6%) remains prominent among this group, highlighting that even well-resourced firms still depend on conventional waste disposal methods. The “Other” category was minimal (10.5% among cottage industries) and unspecified by respondents, indicating that most waste management behaviours align with the listed practices.

5.2.8 Crosstab of energy reduction practices by business type

Energy management strategies (Table 5.11) show clear divisions across business models, with efficiency measures being widespread while advanced practices like renewable energy adoption remain limited. Efficient equipment is the near-universal foundation, with adoption exceeding 95% in Plastic Manufacturing and reaching 89.7% in Plastic Cycling, though it is less dominant in Plastic Packaging (71.8%) and integrated 'All Above' businesses (73.3%). A significant divergence emerges in more strategic areas. Renewable energy adoption remains modest, peaking at just 41-42% in Plastic Cycling, Manufacturing, and 'All Above' firms, and falling to 25.6% in Plastic Packaging. Optimized production practices show a similar pattern, being strongly embedded in process-oriented Plastic Manufacturing (68.9%) and Cycling (64.7%) but far less common in Packaging (29.5%) and 'All Above' (20.0%) models.

The distribution of energy audits is more balanced, with adoption rates clustering between 36-40% across four of the five business models. The most striking contrast is in training initiatives. Plastic Packaging firms (65.4%) are the clear outlier, investing heavily in workforce capacity—a rate quadruple that of Plastic Manufacturing (16.4%) and Cycling (16.2%). Across all strategies, the "Other Models" category reported no engagement, highlighting its distinct operational context.

Table 5.11: Energy management practices by business category by type

Energy Management Practices		**Business Category by Type**				
		Plastic Cycling	Plastic Manufacturing	Plastic Packaging	All Above	Other Models
Efficient Equipment	Count	61	58	56	11	2
	Percentage	89.7%	95.1%	71.8%	73.3%	100.0%
Renewable Energy	Count	28	25	20	6	0
	Percentage	41.2%	41.0%	25.6%	40.0%	0.0%
Optimized Production	Count	44	42	23	3	1
	Percentage	64.7%	68.9%	29.5%	20.0%	50.0%
Energy Audit	Count	25	24	29	6	0

	Percentage	36.8%	39.3%	37.2%	40.0%	0.0%
Training	Count	11	10	51	6	0
	Percentage	16.2%	16.4%	65.4%	40.0%	0.0%
Others	Count	1	0	1	0	0
	Percentage	1.5%	0.0%	1.3%	0.0%	0.0%

5.2.9 Crosstab of energy reduction practices by business size

The adoption of energy reduction practices varies significantly by business size, reflecting distinct levels of resource availability and operational formalisation (See Table 5.12). From the findings, Large-scale businesses demonstrate a highly formalized, process-oriented approach. Nearly all (92.3%) use energy-efficient equipment, supported by widespread adoption of production optimisation (69.2%) and energy audits (53.8%).

Meanwhile, Medium-to-large scale and cottage businesses exhibit a balanced strategy, combining technological and human-capacity investments. High adoption of efficient equipment (78.0%) is complemented by significant investment in staff training (53.7%) and energy audits (40.2%), suggesting a transitional phase towards full formalisation. In addition, Cottage Industries exhibit a distinctive profile, placing their strongest emphasis on training (56.3%) as their primary energy reduction strategy, compared to other measures such as optimized production, where their adoption was the lowest (12.5%).

Table 5.12: Energy management practices by business size

			Business Category by Size			
			Cottage industry	Medium to large Scale Business	Small and medium Enterprise	Large Scale Business
Energy Reduction Practices	Efficient Equipment	Count	12	64	35	12
		Percentage	75.0%	78.0%	76.1%	92.3%
	Renewable Energy	Count	3	23	19	5
		Percentage	18.8%	28.0%	41.3%	38.5%
	Optimized Production	Count	2	25	28	9
		Percentage	12.5%	30.5%	60.9%	69.2%
	Energy Audit	Count	4	33	11	7
		Percentage	25.0%	40.2%	23.9%	53.8%
	Training	Count	9	44	6	6
		Percentage	56.3%	53.7%	13.0%	46.2%
	Others	Count	0	1	1	0
		Percentage	0.0%	1.2%	2.2%	0.0%

5.2.10 Percentage of recycled material use *within each business type*

The use of recycled materials serves as a central marker of CE adoption, with integration levels varying significantly by business type (Table 5.13). Plastic manufacturers lead in adoption, with a vast majority (83.9%) incorporating 26–100% recycled content. A negligible share (1.6%) relies solely on virgin plastic, indicating a strong industry shift. Conversely, plastic packaging

businesses lag considerably. A majority (60.0%) use only minimal recycled content (1–25%), with a mere 7.5% achieving high usage levels (51–100%).

Table 5.13: Percentage of recycled material adoption by business category

			Business Model Category by Type			
			Plastic Manufacturing	Plastic Packaging	All Above	Other Models
% Recycled Material	0% (We use only virgin plastic)	Count	1	2	0	0
		Percentage	1.6%	2.5%	0.0%	0.0%
	1-25%	Count	9	48	3	1
		Percentage	14.5%	60.0%	17.6%	11.1%
	26-50%	Count	32	23	10	0
		Percentage	51.6%	28.8%	58.8%	0.0%
	51-75%	Count	14	2	2	0
		Percentage	22.6%	2.5%	11.8%	0.0%
	76-100%	Count	6	4	2	0
		Percentage	9.7%	5.0%	11.8%	0.0%
	No Response	Count	0	1	0	0
		Percentage	0.0%	1.3%	0.0%	0.0%
	Not Applicable	Count	0	0	0	8
		Percentage	0.0%	0.0%	0.0%	88.9%

Conversely, plastic packaging businesses lag considerably. A majority (60.0%) use only minimal recycled content (1–25%), with a mere 7.5% achieving high usage levels (51–100%). This suggests significant sector-specific barriers to integrating recycled inputs. Diversified businesses mirror the strong performance of manufacturers, with 82.4% reporting 26–100% recycled content usage. Their integrated position across the value chain appears to facilitate

material circularity. The category of "Other" businesses, which includes recyclers and non-producers, largely found the question not-applicable (88.9%), consistent with their role outside core material production.

5.2.11 Virgin material usage across business categories by type

As demonstrated in Table 5.14, the pronounced variation in virgin material dependence across business categories underscores significant impediments to circular economy transition.

Table 5.14: Percentage of virgin material adoption by business type

			Business Category by Type			
			Plastic Manufacturing	Plastic Packaging	All Above	Other Models
% of virgin material use	0-25%	Count	14	38	1	1
		Percentage	22.6%	47.5%	5.9%	11.1%
	26-50%	Count	11	33	12	0
		Percentage	17.7%	41.3%	70.6%	0.0%
	51-75%	Count	28	7	3	0
		Percentage	45.2%	8.8%	17.6%	0.0%
	76-100%	Count	7	1	1	0
		Percentage	11.3%	1.3%	5.9%	0.0%
	No Response	Count	2	1	0	0
		Percentage	3.2%	1.3%	0.0%	0.0%
	Not Applicable	Count	0	0	0	8
		Percentage	0.0%	0.0%	0.0%	88.9%

This is most pronounced among plastic manufacturers, where a combined 56.5% use virgin materials for more than half of their inputs (51-75%: 45.2%; 76-100%: 11. 3%).This indicates that a majority of manufacturers remain heavily dependent on virgin feedstock. Conversely, plastic packaging businesses show a stronger inclination toward circularity. A vast majority (88.8%) use virgin materials for half or less of their inputs, with nearly half (47.5%) in the lowest usage tier (0-

25%). This suggests packaging firms are more actively incorporating recycled content, possibly driven by brand or regulatory pressures. Meanwhile, diversified businesses present a unique profile, with a pronounced concentration (70.6%) in the 26-50% virgin material range. This balanced usage reflects their integrated position across multiple value chain stages. For businesses outside direct plastic production, 88.9% indicated that the question was not applicable, this percentage is less the exception granted to companies that recycle plastic because of their line of work. A small minority (11.1%) reported using virgin materials at levels of 0–25%.

5.2.12 Social sustainability initiatives across business sizes

This section examines the strategic adoption of social sustainability initiatives within Ghana's plastic industry, as detailed in Table 5.15. The results reveal a mixed pattern of adoption across business sizes, indicating that the depth and focus of social sustainability efforts are closely tied to organisational capacity. Fair wages emerged as the most consistently implemented measure, reported by over 83% of businesses in all size categories, from cottage industries (94.7%) to large-scale firms (83.3%). In stark contrast, gender equality initiatives remain underdeveloped. While over half of medium-to-large firms (52.4%) reported such measures, adoption drops significantly among large-scale firms (33.3%), and plummets in SMEs (12.0%) and cottage industries (5.3%).

A clear hierarchy is also evident in capacity building and partnership development. Medium-to-large firms lead strongly in both capacity-building (59.5%) and partnerships (73.8%), followed by SMEs (34.0% and 54.0%, respectively) and large-scale firms (44.4% and 55.6%). Cottage industries report minimal engagement, underscoring their limited human resource structures and external collaboration networks. Health and safety measures again reflect the advantage of larger organisations, with more than half of medium-to-large firms (54.8%) and nearly half of large-scale firms (44.4%) having implemented formal initiatives. Engagement is far lower among SMEs (12.0%), while the moderate rate in cottage industries (31.6%) likely reflects informal, risk-driven practices rather than structured policies.

Table 5.15: Percentage distribution of social measures implemented by businesses by size.

			Business Category by Size			
			Cottage industry	Medium to large Scale Business	Small and medium Enterprise	Large Scale Business
Social Measures	Fair Wages	Count	18	72	44	15
		Percentage	94.7%	85.7%	88.0%	83.3%
	Gender Equality	Count	1	44	6	6
		Percentage	5.3%	52.4%	12.0%	33.3%
	Capacity Building	Count	4	50	17	8
		Percentage	21.1%	59.5%	34.0%	44.4%
	Partnership	Count	5	62	27	10
		Percentage	26.3%	73.8%	54.0%	55.6%
	Health and Safety	Count	6	46	6	8
		Percentage	31.6%	54.8%	12.0%	44.4%
	Human Rights	Count	3	37	12	8
		Percentage	15.8%	44.0%	24.0%	44.4%
	Community Development Initiatives	Count	3	47	18	6
		Percentage	15.8%	56.0%	36.0%	33.3%
	Sustainability Practices by Employee	Count	3	45	12	12
		Percentage	15.8%	53.6%	24.0%	66.7%
	Incentives	Count	4	46	30	7
		Percentage	21.1%	54.8%	60.0%	38.9%

Finally, employee-driven initiatives show dynamic variation. Large-scale (66.7%) and medium-to-large firms (53.6%) most commonly encourage staff-led sustainability actions. However, for formal incentive schemes, SMEs report the highest adoption (60.0%), surpassing large-scale firms

(38.9%). This suggests SMEs may rely more heavily on tangible rewards to motivate sustainable behaviour.

5.2.14 Policy systems and CE transitions

This section examines respondents' perceptions of government policy and regulatory support mechanisms influencing the transition toward Circular Economy (CE) practices within Ghana's plastic industry. In this context, respondents' views on "policy effectiveness" are interpreted broadly as perceptions regarding the capacity of existing CE-related governance measures, strategic interventions, and regulatory support systems to facilitate circularity objectives when adequately supported by institutional implementation and legal frameworks. The analysis reveals a clear hierarchy of preferred intervention measures considered necessary for advancing CE practices across the sector. Figure 5.7 illustrates the hierarchy of policy preferences identified by businesses.

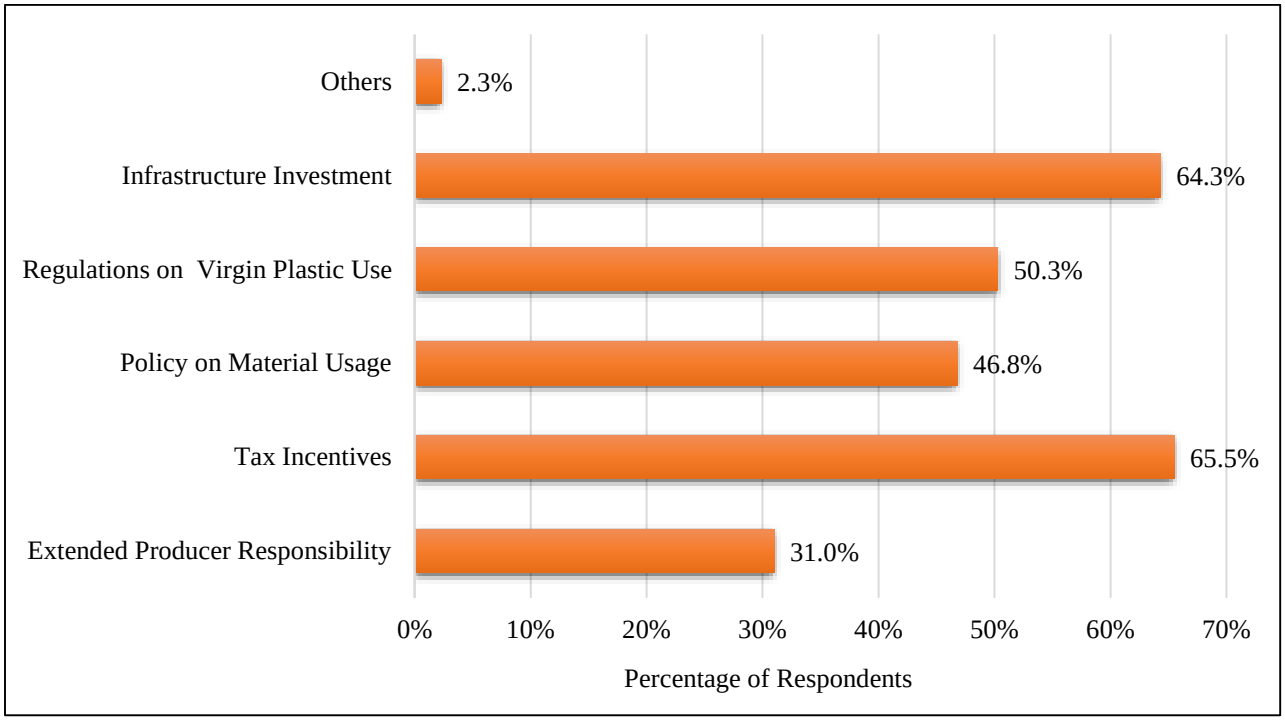


Figure 5.7 Hierarchy of policy preference by businesses

Quantitative results indicate that tax incentives (65.5%) and infrastructure investment (64.3%) emerged as the most critical enablers, followed by regulations on virgin plastic use (50.3%). A substantial proportion of respondents (46.8%) also recognized the need for policy frameworks on

recycled material usage, reflecting an industry with interest for structured guidelines on sustainable sourcing and production. In contrast, awareness or prioritisation of Extended Producer Responsibility (EPR), a cornerstone policy in many circular economies was notably low, cited by only 31.0% of businesses. This suggests a significant gap in awareness or readiness for the shared accountability model that EPR requires. Finally, the minimal response to the *"Other (please specify)"* category (2.3%) may indicate that the survey's predefined list comprehensively captured the likely key policy priorities within the industry as no direct addition was made. However, complementing these findings, responses to a separate open-ended question underscored the same priorities but provided in-depth context. Participants proposed:

- *"There should be a policy by government to bind all companies using plastics for packaging, be it bottles or bags, to recycle 70% of the plastics they send into the market."*
- *"The government should build companies internally that will produce the raw virgin materials for plastic manufacturing companies rather than relying on plastic imports from other countries."*
- *"There should be sensitisation programs and support to local recyclers to operate efficiently."*
- *"Enhanced policy implementation and monitoring mechanisms"*

These responses suggest that businesses associate effective CE transitions not only with strategic policy direction, but also with the presence of supportive regulatory structures, implementation capacity, institutional coordination, infrastructure development, and awareness-building initiatives. However, respondents appear to perceive fiscal incentives, infrastructure investment, and operational governance mechanisms as central to improving the practical attainability of circular economy objectives within Ghana's plastics sector.

5.2.14 Perceived effectiveness of government policy measures and support for deposit refund schemes (DRS)

As shown in figure 5.8, the data indicates a mixed view on the effectiveness of current government-led CE policy and measures. Only 11.6% of businesses considered existing measures to be effective, while nearly half (47.7%) rated them as ineffective. A further 40.7% adopted a neutral stance (Maybe), suggesting widespread uncertainty or limited awareness of specific policy impacts

or mixed experiences regarding implementation effectiveness within the sector. Within the context of this study, these findings should not be interpreted strictly as legal evaluations of enforceability, but rather as stakeholder perceptions regarding whether existing CE-oriented governance approaches, institutional arrangements, and policy directions possess sufficient capacity to achieve intended circularity objectives when adequately supported through implementation and regulatory mechanisms.

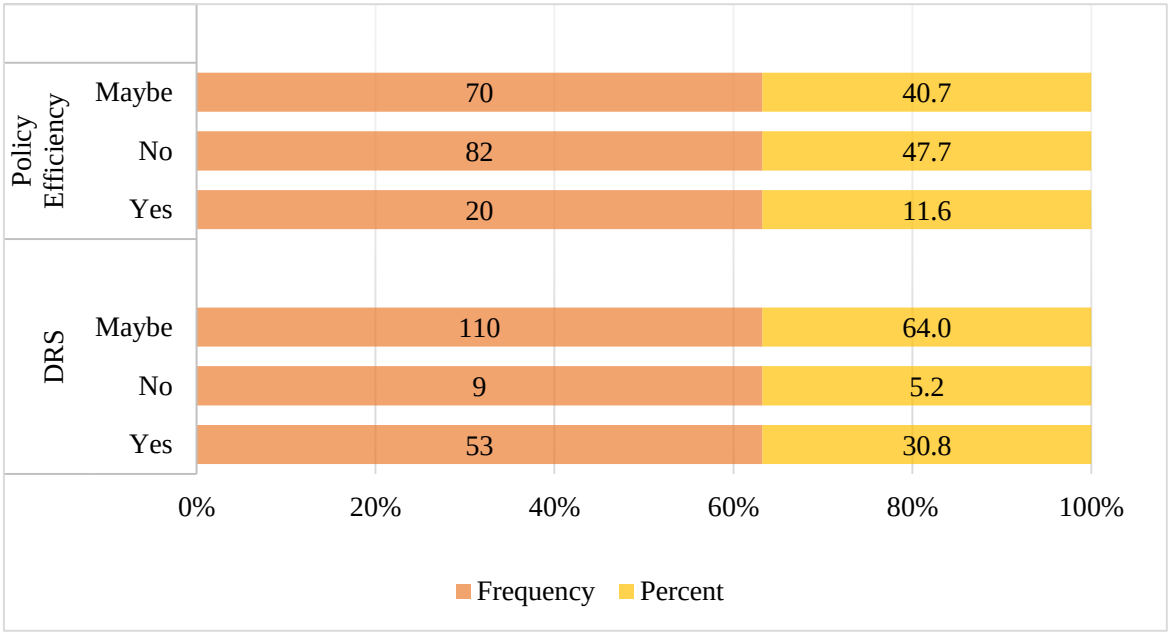


Figure 5.8: Perceived effectiveness ratings and support for of government policies.

Consequently, the perceived ineffectiveness identified by respondents may reflect concerns relating to implementation capacity, institutional coordination, operational enforcement systems, infrastructure deficits, or the practical feasibility of translating policy intentions into measurable circular outcomes. This perception also appears to influence attitudes toward emerging governance instruments such as Deposit Refund Schemes (DRS). When asked about supporting a Deposit Refund Scheme (DRS), responses were similarly cautious. While a majority (64.0%) selected "Maybe," 30.8% clearly supported it, and only 5.2% strongly disagreed. The cautious response pattern suggests that businesses may recognise the potential relevance of DRS systems while remaining uncertain about implementation practicality, operational costs, institutional preparedness, or regulatory administration within Ghana's plastic sector.

To complement the graphical presentation, descriptive statistics were computed to summarize the central tendency and variability of responses on policy effectiveness and support for the Deposit Refund Scheme (DRS). The average policy effectiveness score (M = 2.29, SD = 0.66) shows that responses cluster around the middle of the scale. Similarly, the mean score for support of the Deposit Refund Scheme (DRS) (M = 2.33, SD = 0.92) also falls within the mid-range, suggesting that opinions were not strongly polarized toward either agreement or disagreement. The slightly higher standard deviation for DRS support shows a wider spread of responses, indicating more variation in how businesses viewed this proposed mechanism.

5.2.15 Cross tabulation of policy preference by business size and type category

The Cross-tabulation analysis demonstrated on Table 5.16 reveals that policy preferences within Ghana's plastic sector are sharply divided by business size and operational scale. For instance, infrastructure investment was the predominant priority, with support increasing with firm size: from 42.1% (cottage) to 83.3% (large-scale). Similarly, tax incentives were a major focus for formalized businesses, reported by 82.0% of SMEs and 77.8% of large-scale firms, but of limited interest to cottage industries (31.6%), likely due to their informal structures. Regulatory measures also showed size-dependent trends. Regulations on virgin plastic use were backed by over half of all but the smallest firms, peaking at 66.7% among large-scale businesses. Policy on percentage of recycled material usage found significant support (44-56%) from SMEs upward but decreased with cottage industry. In a notable contrast, Extended Producer Responsibility (EPR) was the top priority for cottage industries (57.9%) but attained significantly less support from SMEs (16.0%) and only a third of larger firms. This inverse pattern highlights EPR's unique status as a concern primarily for the smallest operators. The minimal selection (2.3%) of "other" policies confirms the survey effectively captured the key policy domains.

Table 5.16 -Cross-tabs of policy preference by business category by size

			Business Category by Size			
			Cottage industry	Medium to large Scale Business	Small and medium Enterprise	Large Scale Business
Policy Focus Area by businesses	Extended Producer Responsibility	Count	11	28	8	6
		Percentage	57.9%	33.3%	16.0%	33.3%
	Tax Incentives	Count	6	51	41	14
		Percentage	31.6%	60.7%	82.0%	77.8%
	Policy on Recycled Material Usage	Count	3	45	22	10
		Percentage	15.8%	53.6%	44.0%	55.6%
	Regulations on Virgin Plastic Use	Count	5	43	26	12
		Percentage	26.3%	51.2%	52.0%	66.7%
	Infrastructure Investment	Count	8	53	34	15
		Percentage	42.1%	63.1%	68.0%	83.3%
	Others	Count	0	4	0	0
		Percentage	0.0%	4.8%	0.0%	0.0%

However, complementing these findings, responses to a separate open-ended question underscored the same priorities but provided richer context. Participants proposed: (1) binding government regulations requiring companies to recycle 70% of plastics introduced to the market (2) establishment of domestic production facilities for virgin materials (3) enhanced policy implementation and monitoring mechanisms and (4) awareness campaigns and capacity-building for recyclers and citizens. Collectively, these findings indicate that businesses perceive CE transitions as dependent not only on strategic policy direction, but also on institutional

effectiveness, implementation systems, infrastructure capacity, and regulatory coordination mechanisms.

Examining preferences by business model or type, reveals how a firm's specific position in the value chain shapes its view of necessary government intervention. Findings presented on Table 5.17, on the relationship between business models and policy preferences reveals that tax incentives and infrastructure investment are the most consistently prioritized measures. Support for tax incentives was most pronounced among plastic cycling (86.1%) and manufacturing (87.1%) firms, indicating that production-focused businesses are highly responsive to fiscal policy.

Table 5.17 - Cross-tabs of policy preference by business type category

Policy Focus Area By Businesses		**Business Model Category**				
		Plastic Cycling	Plastic Manufacturing	Plastic Packaging	All Above	Other Models
Extended Producer Responsibility	Count	10	9	31	12	2
	Percentage	13.9%	14.5%	38.8%	70.6%	25.0%
Tax Incentives	Count	62	54	46	7	5
	Percentage	86.1%	87.1%	57.5%	41.2%	62.5%
Policy on Recycled Material Usage	Count	33	30	39	6	4
	Percentage	45.8%	48.4%	48.8%	35.3%	50.0%
Regulations on Virgin Plastic Use	Count	39	41	41	9	5
	Percentage	54.2%	66.1%	51.3%	52.9%	62.5%
Infrastructure Investment	Count	58	52	47	8	4
	Percentage	80.6%	83.9%	58.8%	47.1%	50.0%
Others	Count	1	0	3	0	1
	Percentage	1.4%	0.0%	3.8%	0.0%	12.5%

Similarly, infrastructure investment was a top priority for these same groups (manufacturing: 83.9%; cycling: 80.6%), underscoring their reliance on robust collection, sorting, and reprocessing

systems. Notably, companies operating across multiple models ("All Above") demonstrated a distinct profile, with 70.6% emphasizing Extended Producer Responsibility (EPR). This suggests a broader awareness of shared accountability inherent to managing a diversified value chain. In contrast, packaging-specific businesses showed more diversified preferences, with higher interest in regulations on virgin plastic use (51.3%) and recycled material usage policies (48.8%). This points to a strategy reliant on downstream regulations and material standards to enable sustainable packaging solutions. The "Other Models" category showed modest overall policy engagement, with a primary focus on regulations (62.5%) and infrastructure (50.0%), likely reflecting the niche or specific constraints of these firms.

Qualitative results - interviews

5.3 Results on critiques of CE implementation in Ghana's plastic sector

This section of the results demonstrates how Ghanaian businesses understand, contest, and expand upon global criticisms of circularity. It also identifies possible context-specific issues influenced by the socioeconomic, political and institutional realities of the country. In response to the research question, "What are the primary critiques surrounding the CE as applied to the plastic industry in Ghana?" the following findings were compiled from surveys and interviews of sampled businesses and industry experts.

5.3.1 Overview of qualitative coding and thematic analysis process

The study adopted a hybrid thematic analysis approach. This constituted a combined deductive and inductive analysis approach (Figure 5.9). Deductively, the researcher drew on Corvellec et al., (2022) systematic review, which broadly classified criticisms of the CE as (a) theoretical, (b) practical, and (c) ideological. According to the authors, these critiques taken together imply that CE is more of a contested, ambiguous framework and less of a radical solution.

The following were highlighted; the definitional vagueness, oversimplification and disregard for established knowledge (e.g., laws of thermodynamics) that proponents and practitioners of circular models assume to offer were linked to theoretical criticisms. More attention was directed to CE implementation obstacles, measurement metrics, and possibility of corporate greenwashing in practical criticisms.

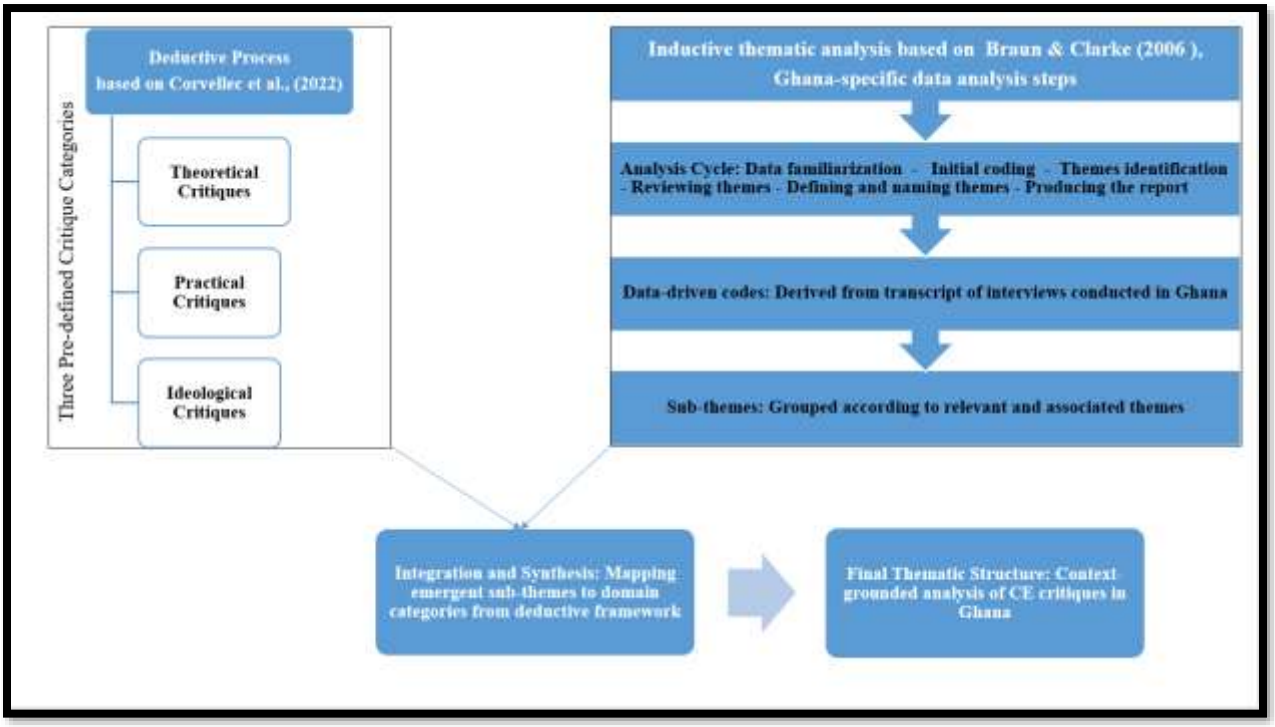


Figure 5.9: Hybrid thematic analysis flow diagram

Source : Adapted from Corvellec et al. (2022) and Braun and Clarke (2006) by the Author.

In terms of ideology, the criticisms draw attention to how deceptive the idea could be, expressing concern about the concept in relation to transformative vs reformist systems, and bringing up additional difficulties pertaining to political economy, justice in terms of just transition and equality. Basically, these three categories provide the broad structure for this study's analysis of respondent's data and addressing the study's research question.

In addition to the deductive approach, an inductive approach was employed to allow new, Ghana-specific issues to emerge directly from the data. This was accomplished using a methodical approach to interview data processing that adhered to the recommendation of Braun and Clarke (2006). The process consists of six steps: (1) becoming acquainted with the data; (2) creating preliminary codes; (3) looking for themes; (4) evaluating themes; (5) identifying and labelling themes; and (6) creating the report. Sub-themes representing the final results were categorized under the broad critique themes of theory, practice, and ideology that were established through the deductive process. For this study, the process unfolded as follows:

1. Familiarisation: All interview transcripts were read and re-read to develop an in depth apprehension of the content.

2. Initial coding: The approach used was flexible to ensure that the coding process reflected the meaning of participants' responses. Hence, the coding process employed a basic unit of analysis, primarily based on a meaningful segment of text from the interviews. Segments were identified based on semantic content and could range in length from a single or short phrase to many sentences. Each segment represented a single coherent thought, critique, or experience. For example:

    - Key phrases expressing critical views (e.g., *"virgin plastic is relatively cheaper"*)
    - Complete sentences articulating arguments (e.g., *"the solution should be to reduce production"*)
    - Longer quotations illustrating systemic issues.

3. Code generation: Initial codes were generated inductively from the data rather than being pre-determined. For example, phrases like *"there's no waste segregation" and "everything is put in the dustbin"* were coded under "Lack of Source Segregation."

4. Theme development: Codes were collated and grouped into potential themes based on conceptual similarity. This involved:

    - Identifying patterns across multiple participants.
    - Grouping related codes into sub-themes (e.g., combining various infrastructure-related codes).
    - Organizing sub-themes under broader thematic categories (theoretical, practical and ideological).

5. Theme refinement and validation: The preliminary set of themes developed during coding was refined through repeated comparison with the original transcripts to confirm that each theme authentically represented participants' views and experiences. A sub-theme was considered robust and reported only if it was supported by evidence from multiple participants (See Table 5.19), ensuring it represented a pattern within the dataset rather than an isolated opinion. With

some themes being cited by over 7 different interviewees, demonstrating the recurring nature of these sub - themes across the sector.

Based on the quantitative and qualitative data gathered, several practices and characteristics emerge that demonstrate criticism of the CE (CE) within the plastic sector of Ghana. These findings are summarized in the descriptive narrative that follows, which also offers evidence-based indicators that correspond to the three primary theme areas (See Table 5.18).

Table 5.18: Prevalence of CE critique themes in interview data compiled by author

Main Theme	Sub-Theme	Number of Participants Citing
Theoretical Critiques	Conceptual Immaturity and Knowledge Gaps	7
	The Narrow Framing of CE	7
Practical Critiques	Economic Paradox and Market Failure	8
	Technical, Infrastructure and Operational Limitations	10
	Policy and Financial Constraints	10
	Economic Viability and Profitability Challenges	5
Ideological Critiques	Cultural Resistance, Perceptions, and Value Priorities	10
	Under-Addressed Social Dimensions and Marginalisation of Informal Workers	8

Section A: Interview narrative (qualitative analysis)

The semi-structured interviews with 17 experts, advocates, plastic recycling, manufacturers, and packaging businesses, and informal waste collectors were designed to ascertain in-depth understanding on the real-world application of CE (CE) principles in Ghana's plastic sector. Questions covered the conceptual understanding of CE business models and operations, identified key barriers, assessed policy effectiveness, evaluation of environmental and social operation outcomes in terms of impact and explored socio-economic and cultural dimensions of implementing a circular plastic economy. As elaborated earlier, in Section 5.3.1, the findings are discussed based on the broad deductive themes of theoretical, practical and ideological critiques.

5.3.2 Theoretical critiques:

The theoretical critiques emerged as a prevalent concern, with discussed themes being identified by multiple participants across different interviewed groups. Focusing on conceptual ambiguity, misrepresentation, feasibility and lack of systemic coherence in CE understanding in Ghana.

5.3.2.1 Conceptual immaturity and knowledge gaps

Several respondents emphasized that CE is still a poorly understood concept in Ghana, often conflated with general sustainability. As one circularity advocate from the Non-Profit sector explained, *"The CE as a whole, it's something that is still very much in its conception stage"* (Participant 6, Circularity Practitioner). The participant further clarified that many organisations misrepresent sustainability projects as CE initiatives, stating that, *"Non-profits don't actually do CE; they do sustainability implementation, and they cloud it as a CE" (Participant 6,* Circularity Practitioner*).* The participant also highlighted a gap between theory and practice, noting that *"the issue here is the theory has no problem, the implementation is where the problem comes in." (Participant 6,* Circularity Practitioner*).*

Similarly, others highlighted a disconnection between the academic or theoretical understanding of CE and its practical recognition in Ghana's business context. A circular business developer observed that many enterprises are unknowingly engaged in circular activities, remarking, *"there are certain businesses that are actually operating within the CE, but if you don't pay attention, you may not even realize it" (Participant 17, Circularity Consultant).* With popular businesses

like the plastic rental services being referenced by the participant for its poor acknowledgement as a circular plastic model.

Supporting this view, a social entrepreneur explained that the lack of conceptual clarity extends even to institutions expected to lead CE implementation: *"Not a lot of people understand the circularity, CE, and the models, even people who are working for institutions that are supposed to supervise and manage the sector…for some people, it's just a business they're running" (Participant 1 social entrepreneur).*

Conceptual inconsistencies in CE thinking were also evident. A regulatory officer emphasized this notion on the term "maladaptation," arguing that some interventions solve one problem while creating others elsewhere: *"We're trying to solve one problem, but in a vast majority of those instances, we're instead creating other problems at different ends... Instead of using, for example, plastic, we just switch to paper. The problem with paper is that even to recycle it, you need a lot more water… and you also need to cut down trees. We are cutting down way more trees than we are planting. So even that is not sustainable." (Participant 7, Regulator).*

Further emphasizing the lack of holistic and systematic thinking in circularity practices, a sustainability brand consultant noted, "*If you are treating plastic, you are using fossil fuel instead of solar, it kind of defeats the purpose. If you are burning a lot of this waste to increase your carbon footprint, it kind of defeats the purpose... I'm seeing people going into circular, but it's not holistic. It's not a whole, It's partly." (Participant 10, Sustainability Consultant).* These perspectives reveal a critical gap between the theoretical ideals of circularity and their systemic environmental realities. Underscoring that without deeper understanding, CE initiatives risk becoming fragmented and counterproductive.

5.3.2.2 The Narrow framing of CE

When questioned about the most common ways businesses in the sector adapt and implement circular plastic models, many respondents including collectors, segregators, and aggregators equated CE practices mainly with recycling and waste segregation, indicating a conceptually narrow understanding. For example, Participant 2, a social entrepreneur in the waste collection

and segregation sector, explained that their organisation's CE activities were focused on end-of-life processes: *"We do collection; we collect, sort, and link them up to a recycling company."*

A waste management consultant supporting plastic product manufacturers reiterated this point, noting that: *"If you look at it, the model that the system is used to, and where the emphasis has always been, is recycling, recycling, recycling"*. However, the participant added, *"But just imagine the scenario where we also focus on the 'reduce' model." (Participant 4, Consultant).* Similarly, a plastic manufacturer confirmed the dominance of recycling-focused systems, stating, *"Currently, it's end-of-life." (Participant 9, Manufacturer)*. A PET bottle collector also echoed this view: *"I think we are more into recycling." (Participant 5, Plastic Waste Collector).*

Participant 16 (Environmental Consultant), further emphasized this imbalance, remarking that: *"People usually focus too much on the recycling aspect."* The participant went on to advocate for a more diverse approach, explaining, *"We want to focus on what it would mean for recycling not to be prioritized, but to see how we are reusing things and avoiding waste from being generated in the first place."*

Unlike some product manufacturers, collectors, segregators, and aggregators who had a narrow viewpoint of CE and its implemented practices in Ghana's plastic sector, circularity experts had additional view point. Circularity Experts (Participants 4, 13, and 17) although did acknowledge the presence of the more comprehensive 3R (reduce, reuse, and recycle) methods to circularity, also could identify different models in their explanations beyond recycling.

For example, a consultant working with electronic and plastic waste systems observed: *"Recycling, I think, for the Ghanaian perspective, is the commonest because most of the products are exported. But now I see a lot of people also switching to alternative materials… I would not say it's only limited to recycling; other approaches are also happening now" (Participant 13, Waste Consultant and Aggregator).* In support of this, Participant 17 (Circularity Consultant) mentioned the Product as a Service model, who further highlights a significant gap between the known spectrum of circular business models and those actually implemented in Ghana: *"I don't know anybody doing this in Ghana, like a refill system... as a business model, I'm not sure if anybody is doing that."*

Assuming that the theoretical potential is vast, but only a few basic models are implemented in the country. These responses reveal that the CE is commonly perceived through a narrow recycling lens. While a few experts recognize broader models, the dominant understanding across the sector remains confined to end-of-life waste management, rather than upstream innovation or resource prevention. A regulator remarked: *"All of these things are... downstream measures... the waste problem... is an upstream problem because we're producing way more plastics than our waste management systems can manage. So... the solution should be... not to increase the size of your waste management architecture, but to reduce your production" (*Participant 7, Regulator).

5.3.3 Practical critiques

Practical barriers constituted the most frequently cited category of critiques, with infrastructure limitations alone mentioned by 12+ participants interviewed. The economic and operational challenges described below represent systemic barriers that multiple stakeholders encounter.

5.3.3.1 The Economic paradox of 'free' waste and market failure.

Respondents highlighted the paradoxical economics of waste undermining circularity. Although waste is perceived as a free and abundant resource, the processes of collection, sorting, and recycling often make it costlier than using virgin materials, creating a paradox at the core of the CE. As one collector explained: *"People who insist on using virgin plastic will look at the cost of production. Obviously, people who look at picking plastic from the environment… would definitely incur higher costs" (Participant 11, Recycler).* This reverses the theoretical economic advantage of circularity, making circular business models such as recycling less financially viable. This sentiment was agreed by others, who observed that *"The virgin plastic is relatively cheaper… while people (business owners) and businesses are for profit. So anything to cut down costs and make profit, they'll go for it" (Participant 13, Waste Consultant and Aggregator).*

This paradox extends into a broader market failure, where recycled products remain commercially uncompetitive due to higher production costs and low consumer purchasing power. A recycler explained this dilemma: *"having a production that is relatively higher compared to the income of the people... you produce the stuff, people don't buy it... companies and industries that are into... sustainability, don't really live long" (Participant 11).* The profitability of recycling is further

undermined by the inconsistent quality of "free" waste collected from the environment. When plastics are heavily contaminated, they translate into direct financial losses, creating instability. A PET bottle collector described this risk: *"It's a two-way game. You sometimes gain; you sometimes lose... Sometimes you receive materials that are very dirty beyond use... You've paid for it... You end up losing" (Participant 5).*

Furthermore, the recycling market itself was described as volatile, with unpredictable price fluctuations that hinder long-term initiative and planning. A regulator highlighted this challenge: *"There's market volatility… you're selling one ton of plastic for a 1000 cedis (79 Euros) … The next day, it drops to 500 **ce**dis (49euro). How far can you lose out on big money before your business runs to the ground?" (Participant 7, Regulator).* Compounding these issues, linear export models, selling raw, unprocessed waste abroad were identified as more immediately profitable than investing in domestic recycling or value-addition. As one social entrepreneur stated*, "The biggest and most profitable business model in the plastic value chain is the export of waste... the cost of innovation makes it difficult for adoption…that becomes a big challenge." (Participant 1).*

5.3.3.2 Technical, infrastructure and operational limitations

Technical challenges were identified as an issue when implementing CE practices in the plastic sector. With recycling being echoed as a major model, technical challenges with recycled feedstock, such as segregation, infrastructure, contamination, colour mixing, and low durability was observed. A recycler emphasized the problem at the household level as a start: *"In our environment, we don't have waste segregation, even in our homes... everything is put in the dustbin... There's no waste segregation" (Participant 11, Recycler).* This lack of source segregation was widely viewed as a fundamental weakness that undermines recycling efficiency as a model across the value chain. A policy actor and circularity consultant explained: *"The number one biggest challenge... it's difficult to recycle plastic that's contaminated. The fact that we don't have legal frameworks for mandatory separation of waste at source is... the number one challenge" (Participant 7, Circularity Consultant).*

A product manufacturer further explained how this challenge influences the production process, necessitating the continuous s use of virgin materials discussed earlier to maintain product standards: *"The percentage of the best plastic will determine how much virgin material we should*

add to it… it depends on the age and how the plastic has been exposed" (Participant 9, Plastic Manufacturer). These quality issues were compounded by fragmented systems and limited coordination among value chain actors. As Participant 14 observed: *"The chain starts from the consumer's ability to segregate. So because we are not segregating, that's why the waste pickers come in... If at the end of the day, I'm going to segregate my waste, and you come for it and lump everything together, what's the point?" (Participant 14, Environmental and Social Impact Expert).*

Respondents described the inefficiencies of the circular models implemented in the plastic sector and defined it as being resource-intensive and environmentally problematic, contradicting the ideal of circularity. For instance, pollutants were reported as by-products of local recycling processes. *"There's a lot of pollution from most of the processes. There's smoke pollution, there's dust and fumes pollution, there's microplastic pollution" (Participant 1, Social Entrepreneur).* Likewise, basic processes of collection, sorting and washing were said to generate additional waste, such as bottle labels and residual contaminants; *"The waste we generate has to do with the rubbers[1] that are like the labels... we normally cut them off and throw them away" (Participant 2, Plastic Waste Collector).* Additionally, washing contaminated plastic waste was described as highly water-intensive, as mentioned by Participant 12, a regulatory actor *"when it comes to the use of waste plastics…. you use water to clean waste",* creating significant volumes of untreated wastewater: *"When you are dealing with plastics, there's a lot of wastewater... if we don't have strong systems in place, you have companies discharging their water directly into the gutters" (Participant 14, Environmental and Social Impact Expert).*

5.3.3.3 Policy and financial constraints

Weak governance coordination and limited financial support emerged as fundamental barriers to scaling Circular Economy (CE) practices within Ghana's plastic sector. In this study, references to "policy constraints" are interpreted broadly to include strategic policy directions, governance arrangements, implementation mechanisms, and supporting regulatory structures influencing CE transitions. Interview responses suggest that Ghana's CE governance framework remains at an emerging stage, contributing to uncertainty and the absence of a clearly operationalised transition

[1] In this context, "rubbers" is a common Ghanaian term referring to thin plastic film or label materials attached to plastic bottles and packaging.

pathway for businesses. As one regulator explained, *"Government is coming up with a CE road map... Eventually, there'll be a policy on that, out of the road map" (Participant 12, Regulator).*

Respondents consistently highlighted gaps not only in policy formulation, but more significantly in implementation, dissemination, institutional coordination, and operational enforcement systems. Several participants argued that while multiple initiatives, standards, and governance interventions exist, including the National Plastic Action Partnership (NPAP) and emerging food-grade RPET standards, their practical influence within the sector remains limited. An environment and social impact expert pointed out; *"Sometimes you create the standards, you create the policies, and then when it's done, it's there for the publicity"* emphasizing how *"voluntary*" the policies are in terms of application while questioning broader awareness of the policies; "*I am aware, but I don't know how many people are even aware of this... even though it's a very significant game changer" (Participant 14, Environmental and Social Impact Expert)* in reference to the emerging policies and standard in the country's plastic sector. This sentiment was echoed by a recycler who bluntly assessed that *"regulation is poor. It's not being implemented" (Participant 2, Plastic Recycler).*

Rather than reflecting a purely legal critique of policy enforceability, these responses indicate stakeholder concerns regarding the practical capacity of existing governance systems to translate CE ambitions into measurable operational outcomes. Participants appeared to associate weak effectiveness with limited implementation structures, low dissemination and awareness, inadequate monitoring systems, fragmented institutional responsibilities, and insufficient incentives to encourage transitions away from linear production systems. Figure 5.10 presents the major disconnects identified by participants between policy creation, dissemination, and implementation. These stages appear interconnected within a self-reinforcing governance cycle. Policy creation was frequently described as a predominantly top-down process with limited engagement from key industry actors and implementers. Consequently, CE goals such as circularity often remain aspirational rather than operational. Respondents further noted that the absence of strong implementation mechanisms, regulatory clarity, institutional coordination, and stakeholder support contributes to weak adoption across the sector. In many instances, businesses perceived CE-related initiatives as largely voluntary, reducing both pressure and incentives for companies to alter established linear operational models.

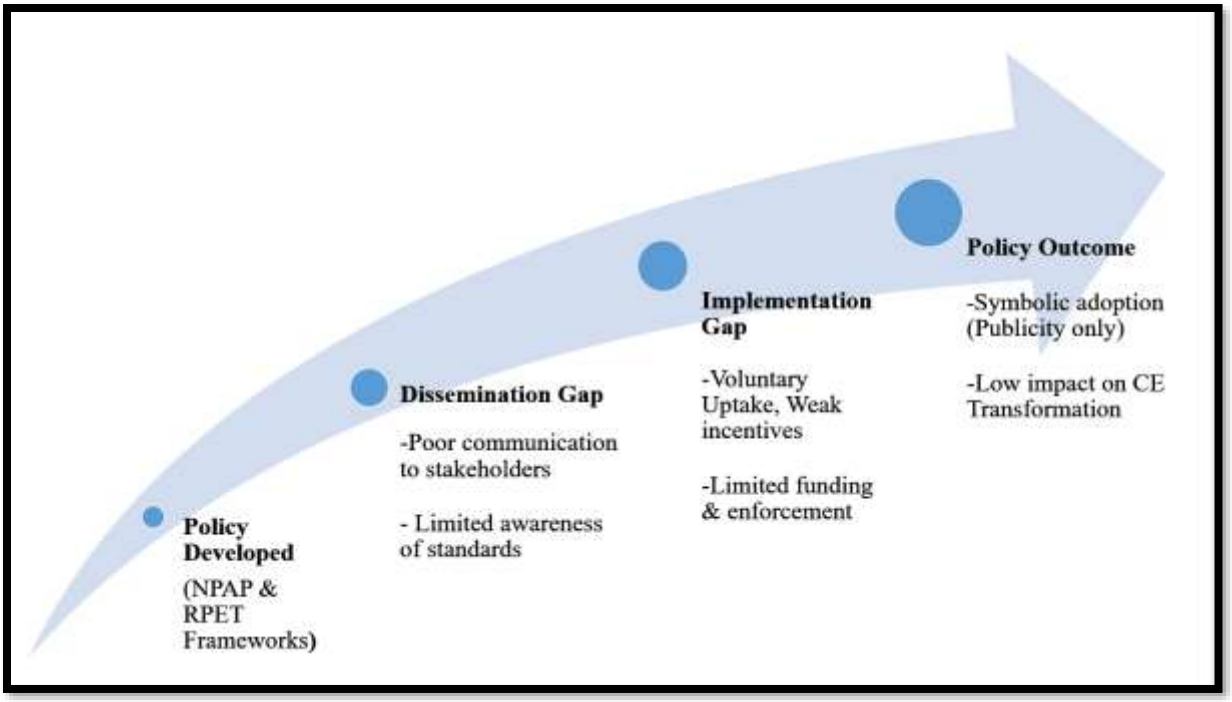


Figure 5.10: Policy disconnections between creation, dissemination, and implementation- adapted from interview feedback by author.

Participants further indicated that weak policy dissemination contributes to limited awareness, stakeholder buy-in, and implementation readiness. This, combined with weak monitoring systems, inadequate institutional capacity, and unclear regulatory responsibilities, was perceived to undermine implementation effectiveness. Consequently, unsuccessful implementation outcomes may be interpreted by policymakers as stakeholder resistance or lack of interest rather than reflecting deeper governance, coordination, or capacity-related limitations. Collectively, these disconnects help explain why CE initiatives within Ghana's plastics sector are frequently perceived as promising at the strategic level but insufficiently operationalised in practice.

Beyond weak institutional coordination, financial constraints were also highlighted as a major limitation. Several respondents pointed to the absence of dedicated funding mechanisms and fiscal incentives for circular business models. *"There should be some tax incentives for some of these companies." (Participant 12, Regulatory Actor).* Others criticized how existing plastic levies and environmental taxes are managed, arguing that they fail to support innovation within the sector *"There's a lot of support for traditional waste collection and dumping, but not a lot of support for innovations." (Participant 1, Social Entrepreneur).*

The slow allocation of public resources and limited prioritisation of CE initiatives within government budgeting processes were similarly perceived as symptoms of broader structural and institutional challenges. According to one participant, "The government is slow in a way... there's never been any conscious effort in allocating the needed resources... prioritisation" (Participant 15, Waste Management Consultant). This critique extended further to concerns regarding Ghana's dependence on externally funded projects and donor-driven implementation structures. As Participant 15 further explained, "Most of the policies... are always supported by an international organisation. It raises the question, if the international organisation is not there, then what happens?... the project will start and finish." This observation suggests that the sustainability of many CE initiatives may remain vulnerable to fluctuations in external financial and institutional support, potentially limiting long-term continuity and sector-wide transformation.

5.3.4 Ideological critiques

Although ideological critiques were less direct, more value-based and complex than the practical or theoretical ones, they repeatedly emerged in participants' interview responses. Reflecting shared concerns about fairness and equity, policy, and cultural values within the circular plastic business model implementation in Ghana. These findings indicate the deep-rooted beliefs, social norms, and consumer values that collectively undermine sustainable circular behaviour.

5.3.4.1 Cultural resistance, perceptions, and value priorities

Several participants emphasized the deep cultural barriers for the adoption of circularity. For many, plastics are not just a convenience but have become socially embedded symbols of respect, privacy, and daily necessity. And can be interpreted as impolite or impractical when refused. Participants described situations where consumers insist on receiving multiple plastic bags for everything they buy, even when unnecessary. On the other hand, businesses are known to force this plastic on consumers even when refused. Both parties see plastic packaging as a sign of good service, respect from the business, provides a sense of privacy and protection for personal items or food, reinforcing its cultural desirability. These expectations create a strong social demand for plastics that goes beyond functional need. As explained by a waste collector and recycler: *"Plastic has come to stay... we are in a society where we find respect to our way of life, and people always ask for plastic without even feeling a challenge attached to it." (Participant 11, Recycler).*

Beyond cultural significance, participants described a wider tendency to shift responsibility for environmental care to others. Many citizens, they observed, believe that waste management is the governments or private collectors' duty. As summarized by a recycler: *"Some people argue that I don't have that responsibility of taking care of my environment, because people are being paid to do that*" *(Participant 11, Recycler).* Additionally, these attitudes were linked to a broader culture of civic detachment, where individual environmental action is rare and social responsibility is outsourced. One respondent reflected*: "The main challenge is we, the individuals... are we ready to subject to change? If we are not willing to change, nothing can be solved" (Participant 4, Waste Management Consultant).*

A recurring ideological barrier is the stigma against waste and recycled goods. Participants reported that consumers often view such goods as inferior or unhygienic. Participant 9, a product manufacturer explained: *"The lay people… assume that recycled products are not strong. But when we prove to them, then they change their perception."* Similarly, Participant 14 observed: *"In Ghana, most people do not value the recycled products… They prefer the virgin… I told someone you can now use recycled PETs for bottled water, and he said, I'm not going to buy it... It's poisonous, it's unhygienic."* Other participants described this as a "mental blockade", a cultural mindset that views waste as something to discard, not reintegrate into the economy *"There's a mental blockade... when we make products from waste, it's difficult for people to accept them no matter how durable they are because of that mindset" (Participant 1, Social Entrepreneur).*

In contrast to the above, a regulatory actor seemed convinced that the product material did not matter, depicting the dominance of economic motivations over sustainability values. For most consumers, purchasing decisions are driven by price rather than environmental impact. Participant 12 explained: *"For consumers, they don't have any problem… They just look for what they want and buy it."* This market-driven behaviour easily reinforces linear consumption and reflects a deeper ideological hierarchy, where affordability outweighs environmental or social responsibility.

5.3.4.5 Under-addressed social dimensions and marginalisation of informal workers

While CE discourse in Ghana frequently celebrates job creation, it largely overlooks broader social dimensions such as gender equality, occupational safety, and the inclusion of informal workers. Respondents emphasized that despite the visibility of the waste value chain, few concrete protections exist for the people sustaining it, particularly women and children working in hazardous informal conditions. *"Sixty percent of the people who work in the waste sector are women… They are earning below the minimum wage… working under very dangerous conditions without protective gear" (Participant 1, Social Entrepreneur).* Other participants reinforced the riskiness of informal work, describing widespread exposure to physical and health risks, child involvement, and a lack of social recognition. *"The sector relies heavily on informal waste pickers. Most women are involved… They are involved in risky collection without PPEs. Children are also involved" (Participant 16, Environmental Consultant).*

This feedback reveals that even as the CE agenda promotes environmental sustainability, systemic neglect of labour rights and equity, and economic benefits do exist. Participant 7, a policy actor and circularity consultant criticized the lack of structural integration and fairness in compensation: *"The wages of waste pickers and informal sector actors... it's insulting... There is not enough compensation for them. There are no proper working conditions... Labour laws don't even recognize them as legitimate actors... If we have an Extended Producer Responsibility (EPR) scheme that doesn't channel money directly from producers to waste pickers, then we're making a big problem" (Participant 7, Environmental Consultant).* At the same time, respondents displayed ideological blind spots toward social sustainability, emphasizing job creation while overlooking issues like fair wages, child labour, or worker safety when asked about social issues when implementing circularity practices: *"The social impact is probably creating jobs... It is creating jobs, giving people opportunity... I don't know about the others [issues]" (Participant 12, Regulator).*

Section B: interview narrative (qualitative and quantitative analysis)

5.3.5 Integration of interview findings and survey results (mixed-methods interpretation)

This section provides an integrated examination of the quantitative and qualitative findings, combining survey data insights and interview evidence. The goal is to provide a critical comparison that highlights areas of convergence and divergence between the two data sets, thus deepening our understanding of how reported practices, perceptions, and challenges align or conflict with participants' lived experiences within Ghana's circular plastic economy implementation. The same thematic framework is maintained for coherence.

5.3.5.1 Conceptual immaturity and knowledge gaps

Survey findings reveal a pronounced unevenness in the familiarity with CE principles among businesses in Ghana's plastic sector. As shown in Figure 5.2, deep understanding is limited; only 8.7% of businesses reported being very familiar with CE concepts, while the majority were only slightly (37.2%) or moderately (36.6%) familiar. A significant 17.4% admitted to being not at all familiar, underscoring that CE remains a nascent concept where applied knowledge is confined to a narrow segment of actors.

The qualitative interviews reinforced this finding, revealing that many organisations engage with CE rhetorically rather than substantively. One circularity practitioner explained:

- *"A lot of people don't understand it, but they pretend that they understand it, including the big organisations" (Participant 6, Circularity Practitioner).*

Similarly, a social impact entrepreneur further explained that for many actors, involvement in CE activities is mainly transactional rather than value- or sustainability-driven:

- *"It's not everybody who understands circularity and sustainability... They're not necessarily interested in the sustainability and the circular economic component of it" (Participant 1, Social Entrepreneur).*

5.3.5.2 The narrow framing of CE (recycling-centric models)

Figure 5.4 of the survey established a clear dominance of downstream, end-of-life strategies within the sector's interpretation of circularity. The use of recycled material (60.8%) and recycling-only approaches (48.5%) were the most frequently reported practices, significantly outpacing the adoption of more advanced strategies like product life extension (21.1%) and industrial symbiosis (18.1%). This recycling-centric model, as explored in sub-section 5.3.2.2, reflects a sector that largely frames circularity as a waste management issue rather than a holistic systemic transformation. Qualitative findings from the interview reinforced this narrow conceptualisation. A sustainability consultant argued that an overemphasis on recycling detracts from more impactful solutions, stating:

- *"People usually focus too much on the recycling aspect… but the solution should be to reduce production" (Participant 10, Sustainability Consultant).*

The effectiveness of this recycling-dependent model is critically undermined by the widespread failure of waste segregation at source. A social entrepreneur explained,

- *"We realize that most of the waste segregation and recovery programs that exist already don't work. Mostly the waste ends up getting contaminated and then the value of it is being reduced" (Participant, Social Entrepreneur).*

The resulting poor quality of collected plastic waste creates a technical and economic dependency on virgin materials. Recycled plastics often fail to meet production standards, forcing manufacturers to blend them with virgin resin. As elaborated by participant 1, (entrepreneur):

- *"Virgin plastic allows you to do a lot of things… but waste plastics come in their own colours… Companies still have standards they have to meet" (Participant 1, Social Entrepreneur).*

Even where segregation is attempted by households or businesses, the effort is often nullified by a linear collection system that commingles waste streams. This systemic failure disincentivizes participation and severs the connection between individual action and circular outcomes. A consultant reflected:

- *"if I am practicing waste segregation, at the end, where does it go?... there is no direct linkage" (Participant 4, Waste Management Consultant).*

A policy actor confirmed this disconnection, stating:

- *"I will separate my waste at source. When that truck comes, they put all the waste back together, defeating the purpose" (Participant 7, policy Actor and Environmental Consultant).*

Furthermore, the formal waste management infrastructure itself was described as dysfunctional and exploitative, eroding the trust and cooperation necessary for a functioning circular system. Participant 4 highlighted that workers are

- *"Not paid appropriately, and it's even below the national daily wage... and even with that, it's not done properly" (Participant 4, Waste Management Consultant).*

5.3.5.3 Policy and financing constraints

The reported challenges with existing policies reinforce scholarly critiques that CE (CE) frameworks often remain more aspirational than operational (Jones and Comfort, 2017). Quantitative findings underscore significant systemic gaps, with 89.0% of businesses citing unclear and unenforceable policies as a primary barrier, followed by ineffective partnerships (57.3%), failure to integrate the informal sector (51.2%), and a lack of incentives for CE practitioners (50.0%) as major policy issues.

Qualitative evidence from the interview further reveals the nascent and fragmented nature of Ghana's CE policy system. Interviewees highlighted a severe implementation. One practitioner described this gap:

- *"There's a lot of paperwork and nothing to back the paperwork.... I think the devil is in the detail" (Participant 6, Circularity Practitioner).*

A recurring theme among interviewees was the policy–funding paradox, where existing fiscal instruments fail to channel resources toward circular initiatives.

- *“We have a couple of levies and taxes on plastic waste… But the Legislative instruments... does not allow the money to be directly used to tackle the problems… the money goes into the consolidated fund” (Participant 1, Social Entrepreneur).*

The same participant emphasized the absence of targeted support mechanisms, noting:

- “Our policies are not really favourable… There is nothing that the government is putting in place to promote those of us trying to solve sustainable issues.” *(Participant 1, Social Entrepreneur).*

Furthermore, a fundamental failure in participatory governance persists, particularly the exclusion of critical stakeholders like informal waste pickers from policy formulation. A policy actor emphasized this point while making reference to Ghana's first National Plastics Management Policy, noting that considering:

- *"The number of waste pickers... not a single one of them was consulted before this policy" (Participant 7 Policy Actor and Environmental Consultant).*

5.3.5.4 Technical, infrastructure and operational limitations

The most frequently cited practical barrier is the near-total absence of the basic infrastructure required to support circular system. As summarized by a practitioner,

- *"Lack of infrastructure will be number one... I just don't think there's one... We don't have proper waste management infrastructure... that works, anything from collecting, from segregation, or sorting, turning it around, and the entire supply chain" (Participant 6, Circularity Practitioner).*

This absence is compounded by a critical shortage of recycling facilities, which severely limits accessibility and scalability. A waste management consultant emphasized:

- *“We don't have enough recycling facilities… if every community had facilities within a few kilometres, CE would be easier” (Participant 4, Waste Management Consultant).*

A specific manifestation of this problem is the inefficiency of the "last mile" of collection. The lack of formal buyback centres and clearly demarcated collection routes makes aggregation economically unviable. As one environmental and social impact expert explained,

- *"One physical challenge is the lack of buyback centres... It's like there's no clear demarcation of these collection routes"* leading to a situation where *"you can't carry a whole truck and say that you are just moving within the communities to be picking plastics... you get 20 kilograms. It doesn't make any business sense" (Participant 14, Environmental and Social Impact Expert).*

Consequently, the system relies on a fragmented and informal network, where

- *"boys or the women... go around to collect... and then they send it to the recycling companies" (Participant 12, Regulator),* a process that is inherently unscalable and inefficient.

Furthermore, there is a stark disparity in infrastructure between urban and rural regions, with collection in the north being particularly challenging due to dirtier materials and higher transportation costs to processing plants in the south. As a collector from the north stated, *"Up north, the education is not that much... Usually, you get them in a very dirty condition... Transporting the bottles... is also quite a challenge" (Participant 5, PET Collector).*

The high cost of transporting low-value, bulky plastic waste emerged as a universal operational hurdle. Participants highlighted:

- *"the cost of transportation of the waste plastics, may be a bit high" (Participant 12, Regulator*), a problem exacerbated because the material *"creates a lot of space" (Participant 2, Informal Waste Collector).*

A profound yet simple inefficiency compounding this issue is the failure to process materials at the source. As one consultant pointed out,

- "*The transportation of these plastics is expensive... If these bottles were just crushed... it takes a much smaller space... That's the solution to the transportation problems" (Participant 17, Circular Business Developer).*

The operational model of Ghana's plastic sector is characterized by a significant energy dependence that undermines the environmental rationale for circularity. As presented in Table 5.4, quantitative data showed evidence of near-universal reliance on the national grid (97.6%) and a substantial dependence on diesel generators (41.8%), while the adoption of renewable energy remains minimal (solar at 7.1%). This reliance on fossil fuel-based energy creates a critical contradiction, as the energy-intensive processes of recycling are powered by sources that contribute to the very environmental problems CE aims to mitigate.
A policy actor and environmental consultant pointed out this contradiction succinctly:

- *"We are using a lot of dirty energy... we're using energy that is coming from fossil fuels to be able to recycle plastics... we are instead creating a problem for another part of the value chain" (Participant 7, Policy and Environmental Consultant)*.

Interestingly, even companies making efforts to integrate renewables remain locked into a linear energy pathway, forced to rely on the grid and diesel backups for consistent operation. As one manufacturer described,

- *"We are in a mixture. We are currently using solar... and we are using the main grid... We do also use the generators... diesel generator" (Participant 9, Plastic Manufacturer).*

This linear energy pathway extends beyond stationary processes to collection logistics. The fleet of vehicles used for waste collection is almost entirely dependent on fossil fuels, presenting another layer of contradiction. A plastic waste collector described:

- *"We actually use tricycles... it's mostly fuel"* whiles acknowledging the superiority of Electric Vehicles (EVs) which are *"very cheap to even operate,"* but citing the primary barrier: *"we don't have the financial capacity" (Participant 2, Informal Waste Collector).*

5.3.5. 5 Economic viability and profitability challenges

The adoption of CE (CE) models in Ghana's plastic sector is critically constrained by persistent economic viability and profitability barriers. While survey results indicated that cost reduction is a primary motivator (see Table 5.4), access to the necessary green financing remains severely limited, cited by only 16.9% of businesses. This financial gap exacerbates high operational costs and challenges in achieving profitability under circular models.

Interview data described circular businesses as financially precarious. A circular business developer explained the fundamental dilemma:

- *"Going circular is actually more expensive. It may have long-term cost savings. But in a country where access to capital is hard, long-term cost savings means nothing to most businesses. They would choose the cheaper option in the short term. Always" (Participant 17, Circular Business Developer).*

This sentiment was reinforced by an environmental consultant who stated:

- *"You cannot do plastic recycling as your business model and make profits… you are running at a loss, or you are not paying your workers a living wage" (Participant 16, Environmental Consultant).*

A significant component of this financial burden is the high cost of technology. As noted by an aggregator:

- "*Technology is a challenge because of the high cost of the equipment.... they are not made in Ghana…. they are very expensive" (Participant 13, Waste Consultant and Aggregator).* This can lead to operational inefficiency, with the same participant admitting *"We've been stockpiling materials for two years because we didn't have equipment to process them."*

The high cost of capital further truncates business ambitions, forcing many manufacturers to *"just do the first stage" rather than producing high-value finished goods (Participant 9, Plastic Manufacturer).*

Furthermore, the demand for circular products is a significant constraint, but its perception is uneven across the sector. While 66.7% of medium-to-large businesses identified it as a barrier, it was less prevalent among SMEs (20.5%), large-scale businesses (16.7%), and cottage industries (21.1%), suggesting a fragmented market pull. The most formidable competitive challenge, however, comes from the international market. local circular innovators cannot compete with the low prices of imported products particularly from China. A consultant illustrated this strong reality:

- *"The Chinese man is ready to give it to me at 10 or 20 pesewes per bag. The same amount if you want to do a collaboration here... It will cost you more... we are competing with an international market" (Participant 15, Waste Management Consultant).*

5.3.5.6 Under-addressed social dimensions and marginalisation of informal workers

The quantitative results (Table 5.14) show that most businesses reported fair wage practices across all sizes, 94.7% of cottage industries, 90.7% of SMEs, 85.7% of medium-to-large enterprises, 83.3% of large-scale firms, and 71.4% of social enterprises. However, gender equality initiatives, health and safety measures were reported far less consistently, suggesting that social sustainability is not evenly integrated within business operations.

The qualitative interviews provide deeper insight into these gaps. While businesses claim to uphold fair wage practices, participants described a different reality within the informal sector, which underpins much of Ghana's circular plastic economy. Several respondents emphasized that waste pickers and informal workers, particularly women, remain undervalued, unprotected, and socially stigmatized. As explained:

- *"The wages of waste pickers and informal sector actors... it's insulting... There is not enough compensation for them. There are no proper working conditions... Labour laws don't even recognize them as legitimate actors" (Participant 7, Policy Actor and Environmental Consultant).*

Beyond pay, interviewees highlighted a growing social stigma and lack of respect for informal waste workers.

- *"Some people even feel that women are mad that they are collecting bottles." (Participant 13, Waste Consultant and Aggregator)*
- *"There's a lot of discrimination when it comes to their work, especially with the waste pickers... people not respecting their work." (Participant 14, Environmental and Social Impact Expert)*

Others explained that the recycling economic model cannot now support reasonable salaries because recyclers struggle with profitability, making it difficult to provide improved working conditions and wages for informal pickers.

- *"It's never a possibility for these waste collectors to be paid a living wage... we cannot even blame the recyclers, because they are not even making profits in the first place." (Participant 16, Aggregator)*

5.3.5.7 Cultural resistance, perceptions, and value priorities

The quantitative data show that motivations such as building brand reputation (29.5%) and accessing green finance (16.9%) were among the lowest reported drivers of CE (CE) engagement. However, the qualitative interviews reveal a deeper ideological scepticism, a widespread perception that many circular initiatives are performative rather than transformative. Several participants described CE adoption as superficial, pursued more for visibility or funding than for genuine environmental commitment.

- *"I actually don't think that there's any belief in it realistically... nobody sees the viability in it, not even the sustainability organisations." (Participant 6, Circularity Practitioner)*

Others criticized what they saw as symbolic participation, where actors promote CE to enhance their public image or fulfil donor expectations.

- *"They would sell you a dream, but that's not what it is." (Participant 6, Circularity Practitioner)*

This sentiment was captured pointedly in one participant's rhetorical reflection:

"Are you playing for the win, or you're just playing to choke something you can put in your impact report and get everybody clapping for you?" *(Participant 6, Circularity Practitioner)*

At the policy level, similar frustrations were expressed regarding government and donor actions, often described as "box-ticking" exercises lacking genuine commitment or continuity.

- *"Many times, many agencies in Sub-Saharan Africa do things so they can tick the box... 'We have funding for this. We've done it. Check.' The level of intentionality that goes on is not robust" (Participant 7, Policy Actor and Environmental Consultant).*

This perception of performativity extends to policy design, where emphasis is placed on fines and levies rather than structural change or research investment.

- *"Our policies are all designed to get money from polluters... It's more like you are punishing wrongdoers by just asking them for money. It's not ending plastic pollution. It's not investing in research. We don't have policies for that." (Participant 16, Environmental Consultant)*

To offer a logical comprehension of the factors influencing the adoption of CE in Ghana's plastic sector, the subsequent part presents a summary of the integrated analysis.

5.4 Summary of results

Descriptive and thematic analyses were conducted to assess CE (CE) implementation within Ghana's plastic sector. Quantitative data were analysed using IBM SPSS Statistics 31 through descriptive statistics, frequencies, and cross-tabulations to examine awareness levels, adoption practices, and policy challenges. Inferential analyses explored relationships between business size, CE familiarity, and implementation patterns, while qualitative interviews provided contextual depth.

The results show that the sector is dominated by medium-to-large and small-to-medium enterprises, with circular activities largely centred on recycling and waste minimisation. Adoption of broader CE models such as material substitution and product life extension remains limited. Social and environmental practices such as fair wages, capacity building, and partnerships are

evident but inconsistently applied across business categories. Policy-related findings highlight strong business preference for tax incentives, infrastructure investment, and clearer regulatory frameworks, though confidence in current policy effectiveness remains modest.

The results indicate that while CE awareness is growing, implementation remains fragmented and predominantly recycling-based. Weak policy enforcement, financial constraints, and inadequate infrastructure continue to limit progress. The evidence points to a disconnect between CE implementation principles for sustainable development and business-level practice. The implications are discussed further in Chapter 6.

Chapter 6 Discussion

6.0 Introduction

The study, organised around four research questions in chapter one, critically examines the implementation attributes, criticisms, and policy dynamics of CE and circular business models within Ghana's plastic sector with a focus on the implications on sustainable development as determined by the quantitative and qualitative data accumulated. In this chapter, the discussion situates Ghana's realities within broader scholarly debates in the literature review (chapter 2) on CE implementation, models and criticism. Highlighting the areas of convergence and divergence between the concept principles and operational reality.

The sector study reveals a country where awareness of the CE is growing, yet implementation remains fragmented and nascent. The findings depict a system where the intent to transition to circularity often surpasses the capacity to implement it effectively and responsibly. Hence this chapter synthesizes and interprets the key findings of the study, integrating both quantitative and qualitative insights to present a coherent analysis on the research questions: (1) criticisms associated with the implementation and practices of circularity, (2) distinctive attributes evident in the outcomes and processes and (3) how have government legislative initiatives contributed to a sustainable transition toward circularity in Ghana. Finally, it reflects on the implications of these findings for theory, policy, and practice while concluding with key situational recommendations.

6.1 The attributes and implementation of Ghana's circular plastic industry

Prior systematic reviews examining the processes and outcomes of CE models do no portray a narrative marked by recurring criticisms and structural weaknesses. The CE implementation as a driver of sustainable development has been characterized in literature as conceptually vague, practically infeasible, environmentally uncertain, socially weak, and ideologically aligned with the very growth-oriented economic model it seeks to reform (Corvellec et al., 2022; Valenzuela and Böhm, 2017; Corvellec and Stål, 2019; Mah, 2021; Vonk, 2018; Hobson, 2019; Kirchherr et al., 2018). Findings from this study similarly reveal a complex landscape where the appropriation of CE and circular business models in Ghana's plastic sector is both nascent, heavily constrained with a notable gap between CE aspirations and on-the-ground realities. The demographic profile of Ghana's plastic sector reveals a landscape largely composed of young enterprises (88.4% operating for 1–10 years), reflecting a dynamic and evolving business environment. While medium-to-large

firms constitute the largest single category (48.8%), the combined share of small-to-medium and medium-to-large enterprises (78.5%) indicates that the sector is characterized by small-to-medium-scale operations rather than large-scale industrialisation. The context of relatively young and mid-sized firms is crucial for understanding the sector's approach to the CE.

A primary barrier to a transformative CE transition is the pronounced conceptual weakness. The data indicates a significant knowledge gap, with only 8.7% of businesses being "very familiar" with CE principles and a notable 17.4% "not familiar" (Figure 5.2). This conceptual limitation has a direct and visible impact on business decisions, systems, and practices. The survey data demonstrates that the circular plastic economy in Ghana is predominantly understood and practiced as a recycling and waste management system. The most adopted practices are "use of recycled material" (60.8%), "recycling only" (48.5%), and "waste minimisation" (47.4%). In contrast, upstream, systemic models like "product-as-a-service" (18.7%), "material substitution" (19.9%), and "product life extension" (21.1%) saw minimal uptake. This reflects a pragmatic but fundamentally limited engagement with CE, reducing it to an end-of-pipe solution which can be tied to limited knowledge of CE principles and implementation scope by so called “circular business owners”. This recycling-centric perspective aligns with global patterns observed in the literature, where circular business models are often "recycling-centric" and "oriented towards end-of-life solutions," as seen in India and the Netherlands (Lit et al., 2024; Retamal et al., 2021). It also confirms earlier findings on Ghana by Bungert (2022) and Kessman (2019), who noted that efforts focus on the "Obsolescence phase" and "final waste collection" rather than comprehensive value chain circularity.

Existing literature presents a diverse portfolio of holistic circular business model (CBM) classification, namely: cycling, extending, intensifying, and dematerializing (Geissdoerfer et al., 2020). However, the Ghanaian results demonstrate an overwhelming dominance of a single typology - "Cycling." - this stands in major contrast to the literature's emphasis on a "holistic approach" that considers "every facet of a business" (Bjornbet et al., 2021). The very low adoption of "extending," "intensifying," and "dematerializing" strategies indicates a sector that has adopted the most basic form of circularity, failing to engage with the full spectrum of other CBMs. This major focus of cycling aligns with the literature's warning about the practical transferability and applicability of CBMs being questionable (Smol et al., 2024). In Ghana, implementation is not

holistic but fragmented. The results validate that businesses face immense difficulties in employing strategies necessary for circularity implementation (Chhimwal et al., 2022). The CBM framework requires "significant changes to value chain and production design" (Oghazi and Mostaghel, 2018). However, Ghanaian businesses, constrained by cost and infrastructure, are largely making incremental changes at the end-of-life stage rather than transforming their core value creation processes. This is a classic case of a "fragmented approach" that Rashid et al. (2013) and Schulte (2013) argue is "insufficient for achieving true circularity." Although this cycling-focused perspective is a pragmatic response to the visible problem of plastic waste, it fundamentally misunderstands CE as a systemic transformation. It echoes the literature's critique that an over-reliance on technological fixes like recycling in any of it forms can "divert attention from root causes such as overconsumption" (Mah, 2021). The result is a system that is less about creating and preserving value for a socio-ecological transformation (Calisto Friant et al., 2021; Lit et al., 2024) and more about managing waste, thereby missing the transformative potential of a true CE.

While literature makes a strong argument for the business case for circularity to improve economic viability (Murray et al., 2017; GEF, 2018), the Ghanaian results, however, expose a weak economic reality that undermines this principle. Findings from the qualitative data assert that circular practices like recycling are often more expensive than linear alternatives. Though 63.9% of respondents cited “cost reduction” as their main CE motivation, circularity processes within recycling systems remains more expensive than linear processes (direct virgin plastic usage) due to high collection, sorting, and cleaning costs combined with the low market price of secondary materials product erode profitability and constrain scalability. These findings give support to the critiques of CE's 'unclear implementability' at the organisational level where high capital costs and uncertain profits are known barriers (de Jesus and Menonca, 2018; Corvellec et al., 2022). Furthermore, the limited role of green financing, a CE driver opted by only 16.9% of businesses surveyed indicates critical barrier. Thus, despite the growing visibility of sustainable business focused financing schemes, the low uptake raises the question about actual access, eligibility and the financial sector readiness to support circular transitions. According to earlier research, CE models provide workable methods for incorporating sustainable financing, which ultimately enhances company performance (Taera et al., 2025; Geissdoerfer et al., 2017). Innovative financing techniques like blended finance are crucial for finding a balance and avoiding budgetary

constraints because implementing the CE framework in underdeveloped countries like Ghana requires large financial commitments (Andersen et al., 2019).

The high upfront cost of technology and the difficulty in accessing capital force businesses into a short-term, survivalist business mindset. As one developer stated, "in a country where access to capital is hard, long-term cost savings mean nothing to most businesses". This creates a vicious cycle: without investment, businesses cannot achieve the economies of scale and technological efficiency that would make circular models truly cost-competitive with the linear economy. This finding critically challenges the assumed economic drivers of CE and sustainability while confirming literature's caution that increased circularity does not inherently guarantee sustainability (Vendries et al., 2020) especially where enabling conditions such as finance, infrastructure, and supportive regulation are weak or absent. The high operational costs, volatile market for recycled and recyclable products, and competition with cheap imported linear products create an environment where circularity is not only expensive but also creates a profound dilemma for businesses, as summarised *"companies and industries that are into sustainability don't really live long"*. However, international case studies demonstrate that this market failure can be counteracted through strategic interventions. For instance, as stated in chapter 2, Trioplast Industries AB in Sweden successfully markets products with a high fraction of recycled content by leveraging a strong brand commitment to sustainability and aligning with national and international policy goals (e.g. stringent EPR, recycling target), that internalize environmental cost and create a market for circular products (Khan, 2020). Their success is partly dependent on a consumer base and regulatory environment that values and rewards circularity. Findings from the study validates the literature's assertion that business models are essential to assess the viability of technical solutions (Lit et al., 2024). Additionally, the economic model for recycling in Ghana is not viable without a significant intervention, explaining why more radical CBMs remain the least common as seen in the case of India (Retamal et al., 2021).

Circular Business Models are presented as holistic systems that reconfigure value creation to close, slow, and narrow resource loops (Bocken et al., 2016; Geissdoerfer et al., 2020). Ghana's systems however, illustrates a partial and fragmented adaptation of these principles. A major tenet of the concept of circular business models is the aim of generating economic, environmental, *and* social value, moving beyond traditional profit motives (Bocken et al., 2016; Stubbs and Cocklin, 2008).

Beyond the narrow framing and cycling focused nature of circular business models within Ghana's plastic industry discussed in section 6.1, the idea of creating triple bottom line value proposition (creation, capture, and delivery) is a major concern for industry players. The analysis in this study shows a skewed value proposition heavily directed towards economic drivers and a struggle with value capture. The economic value is uncertain for most, as the "economic paradox" makes recycling unprofitable. The environmental value is contradicted by the linear energy system (97.6% grid reliance) and the generation of significant waste streams (wastewater, emissions), undermining the environmental rationale. Most critically, the social value dimension is severely under-addressed. These conflicts in alignment indicates an implementation failure for what can be termed as an "authentic circular business model". The models in Ghana is far from creating a balanced triple bottom line. Instead, it is creating a scenario where economic viability is challenged, environmental benefits are questionable due to high energy and pollution footprints (Vendries et al., 2020), and social equity is neglected. This directly connects to the literature's critique of "circular-washing," where companies may adopt the language of circularity without enacting the deep, systemic changes that deliver genuine social and environmental value (Stål and Corvellec, 2018; and Mah, 2021). The treatment of informal workers is an example of this, highlighting a disconnect from the CBM principle of viewing "society as a crucial stakeholder."

Despite the results indicating limited know-how of participants when it comes to CE awareness, lack of technical skills seems not to be the major barrier for business as compared to deep rooted systematic failures as emphasised by (Liu and Bai, 2013). The "policy and financial constraints," "technical and infrastructure limitations," and "cultural resistance" identified in the qualitative data are classic institutional and cultural barriers. The lack of "institutional support" (Lit et al., 2024) is evident in the perceived ineffectiveness of government policy (only 11.6% see it as effective). The "cultural resistance" to recycled products and the stigma against waste pickers represent social and cultural complications that further hinders business operations. These are consistent with the findings of Lit et al. (2024), which show that in an unsupportive ecosystem, CBM success characteristics such a "well-defined circular value proposition" and "robust networking capabilities" are unachievable. For instance, a business cannot develop a "product-as-a-service" model (an intensifying/dematerializing CBM) without a reverse logistics infrastructure and a cultural shift towards accepting reused products. The findings confirm that the challenges are systemic, requiring coordinated action across policy, infrastructure, and culture. This explains why

CBM innovation in Ghana is largely limited to internal "transformation" towards recycling rather than more radical "circular start-ups" or "diversification" into new models (Geissdoerfer et al., 2018).

From a theoretical lens, Ghana's plastic sector depicts a sector engaged in Circular Business Model adaptation, rather than innovation. The sector has latched onto the most accessible "cycling" typology but has been unable to implement the holistic, systemic, and multi-value-driven models that the literature posits as essential for a true circular transition. Bridging this gap requires integrated interventions policy coherence, financial incentives, infrastructure, and social inclusion that enable a shift from a fragmented "cycling" system to a whole circular ecosystem.

6.2 Analysis of how business type and size shape circularity in Ghana

As part of uncovering the contextual factors that shape how different businesses in terms of size and model to understand and implement circularity, several cross tabulations were analysed. The results verify that the journey towards circularity in not uniform. it is profoundly influenced by a company's place in the value chain (business type) and its resource capacity (business size). For instance; plastic cycling and manufacturing are the champions of traditional recycling. They show the highest adoption of "Recycled Material Usage" (22.6%, 24.0%) and "Recycling Only" (23.0%, 22.2%). Indicating this is part of their core business. However, these same business categories show low engagement in innovative CE models such as Product-as-a-Service (1.8–1.7%) or industrial symbiosis (2–2.5%), indicating a narrow operational interpretation and focus on recycling rather than resource efficiency or redesign.

Meanwhile, Plastic Packaging companies while less focused on recycling, show a surprising lead in more advanced strategies like "Industrial Symbiosis" (7.6%), "Material Substitution" (9.2%) and "Product-as-a-Service" (8.4%). This suggests their business model, which deals with containing and protecting goods is steering towards the rethinking of material flows and service-based models. Thus an openness to innovation in areas where design, reuse and consumer interaction play a larger role. However, businesses combining multiple models are the most interesting, showing the highest adoption of product-as-a-service, industrial symbiosis and consumer awareness practices. Their diversified operations across the value chain seem to foster a broader, more innovative close loop view of circularity, allowing them to experiment with

business models that are out of reach for specialized firms. Engagement with the informal sector (14–15%) appears consistent across business categories, highlighting its importance as a cross-cutting feature of Ghana's plastic economy. However, the limited uptake of reverse logistics and consumer awareness points to a missing link between production, consumption, and recovery, which remains a significant barrier to circularity.

Large, to Small businesses showed dominance in the material recovery models with large business in the lead in "Recycled Material Usage" (83.3%) and "Recycling Only" (66.7%). Their scale gives them the purchasing power and consistent demand to integrate recycling into their operations reliably. However, although limited in scale, cottage industries show a unique profile, with the highest adoption of "product-as-a-service" (36.8%). This is a rational adaptation: with limited capital for machines, offering services (e.g., repair, refill, rental) is a low-capital way to engage in circularity. This finding challenges the notion that advanced models are only for large firms and highlights context-specific innovation. The findings further show that the broader CE exists but is currently fragmented and driven by specific operational logics rather than a shared, holistic vision in Ghana.

The relationship on virgin and recycled material usage by businesses reveal key different economic realities and barriers across business types. Plastic manufacturers are the most dependent on virgin materials (56.5% use over half virgin feedstock). Considering the high-quality standards for their products that contaminated recycled feedstock cannot meet, locking them into linear supply chains. Compared to plastic packaging companies with the vast majority using virgin materials for half or less of their inputs. This could be driven by brand pressure for sustainable packaging by consumers, lower performance thresholds especially for non-consumables, and emerging regulations around Extended Producer Responsibility (EPR) making brands financially accountable for the final phase of their packaging material, allowing them to incorporate more recycled practices.

This dichotomy highlights a structural circumstance where manufacturers, though technically capable of recycling with the study result showing an 83.9% lead in recycled input usage, are economically locked into virgin materials due to price competitiveness, limited supply of high-grade plastic recyclables and regulatory compliance especially recycled plastic for food contacts. Diversified businesses show a balanced profile, with 70.6% in the 26-50% virgin material range.

Their integrated model gives them more control over their material flows, making them potentially the most successful at balancing circular and linear inputs.

The analysis of waste management practices by both business type and organisational size (Tables 5.10 and 5.11) provides a clear picture of a sector in transition, with different business types or size leading linear practices and circular innovation.

Plastic Manufacturers remain highly aligned with linear waste disposal pathways, showing the highest reliance on landfilling (62.9%), incineration (61.3%) and licensed waste handlers (64.5%). This pattern underscores a compliance-driven approach focused on safe disposal rather than material recovery. From a theoretical standpoint, this supports Corvellec et al. (2022) and Cullen (2017), who argue that industrial CE practices like manufacturing often replicate linear logics under a "circular" guise, optimizing waste end-points instead of redesigning production systems.

In contrast, plastic packaging exhibit stronger integration of circular practices demonstrating the highest uptake of Industrial Symbiosis (56.3%), Production Integration (50.0%) and selling recyclables to external processors (40%). These practices reflect a growing orientation toward material retention and value preservation, driven by market pressures, consumer expectations, and the reputational importance of packaging sustainability. This supports previous research indicating that downstream corporations, such as consumer-facing industries are more likely to adopt visible circular business models in response to increased public scrutiny since they can control product flows, shape or obstruct the flow of raw and secondary materials, and encourage sustainable design (van Langen et al., 2023).

Findings shows that diversified "All Above" businesses, which operate across multiple value chain stages show the most progressive approach, with the lowest reliance on Landfill (23.5%) and high rates of Internal Recycling (58.8%). Because these firms operate across multiple functions within the value chain, they are better positioned to close material loops internally and facilitate cross-functional reuse. This operational flexibility reflects the principles of industrial symbiosis and resource efficiency enabling these firms to treat waste as a beneficial internal input rather than an external hardship.

When viewed through the lens of organisational size, another pattern of differentiation emerges. Large-scale firms exhibit the most structured waste management frameworks with high in internal

recycling (83.3%), production integration (55.6%), and licensed waste handler use (44.4%). This indicates institutional maturity, regulatory visibility, and access to waste treatment technologies. However, the continued high rate of landfill disposal (55.6%) reveals an unresolved dependency on linear infrastructure even for technological advanced firms due to systematic barriers to full circularity.

Medium-to-large firms stand out as bridging actors between compliance and innovation. Their elevated engagement in industrial symbiosis (45.2%) and production integration (47.6%) suggests greater inter-firm collaboration and experimentation attributes consistent with meso-level circularity, where sectoral clusters and partnerships drive innovation diffusion (Sarja et al., 2025). Small and medium enterprises (SMEs) and cottage industries exhibit grassroots circularity, characterized by adaptive reuse, in-house recycling, and selling waste to recyclers. While technologically limited, these systems sustain material flows and reduce waste through adaptive reuse and informal recycling networks grounded in necessity, and informal ingenuity rather than formal policy frameworks. These outcomes are consistent with Calisto Friant et al. (2020), who caution that dominant CE discourse often exclude indigenous and Global South perspectives, despite their alignment with regenerative and ecocentric principles. Additionally, their continued marginalisation within national CE policies and financing mechanisms illustrates how Westernized, technocentric interpretations of circularity risk overlooking and even displacing existing regenerative practices in the Global South.

Across both businesses type and size, selling waste to recyclers remains surprisingly low, despite being one of the most direct circular pathways: This could be due to a systematic reason, such as: recycled material prices in Ghana are volatile and frequently lower than the cost of collection, transportation, and sorting. Manufacturers usually state that fresh plastic is less expensive and more consistent, lowering demand for recycled material. With low demand, selling garbage becomes financially unappealing. Second, manufacturers and large businesses create mixed or contaminated waste streams that necessitate costly pre-processing. Without a guaranteed customer, businesses prefer disposal methods (landfill, incineration, licensed handlers) that ensure regulatory compliance and operational efficiency. Additionally, (SMEs) and cottage industries may not have access to recognized recyclers or operate in locations without regular collection services. Medium-to-large and large businesses are better positioned to sell recyclables, which explains their slightly

higher but still modest engagement. As a result of fundamental market failures, contamination difficulties, and the lack of streamlined recycling supply chains, selling to recyclers remains a limited circular channel. This reinforces the economic paradox where recycling is promoted, yet the market conditions make it unattractive.

6.3 Ghana's plastic sector as a reflection of global CE critiques (theoretical, practical, and ideological)

The Ghanaian experience exemplifies several global critiques of the CE concept, its conceptual ambiguity, social blind spots, and neglect of physical and systemic limits. The findings provide robust evidence for the three-pronged critique of CE, Theoretical, Practical, and Ideological—as adapted from Corvellec et al. (2022) in chapter 2.

Table 6.1: Alignment of Ghana-Specific Findings with Global CE Critiques-Compiled by author

Critique Category	Global Critiques (Literature)	Ghana's Plastic Sector	Convergence / Divergence
Theoretical: Definitional Vagueness and Conceptual Confusion	CE suffers from over 100 definitions; often conflated with sustainability or waste management (Kirchherr et al., 2017; Reike et al., 2018).	CE and its models mostly understood within the R-Strategies dominant by recycling while also linked it to waste recovery. limited awareness of systemic strategies.	Convergent – replicates global conceptual confusion and lack of shared understanding
Theoretical: Biophysical Realities	Full circularity is impossible due to thermodynamics; downcycling, energy limits and material loss are inevitable (Cullen, 2017; Skene, 2018).	Recyclers noted declining quality of plastics after multiple cycles, limiting market value. Concerns about "maladaptation" and "dirty energy," showing awareness of this contradiction.	Convergent with localized illustration where material degradation creates a fundamental technical and economic constraint.
Practical: Policy Vagueness and Symbolism	CE policies often aspirational, lacking enforcement or clear targets (Flynn and Hacking, 2019; Lazarevic	Policies exist but lack enforcement, coordination, and consultation. Described as "a lot of paperwork and nothing to back it"	Convergent – Empirical findings strongly align with the "policy rhetoric vs. practice" critique

Critique Category	Global Critiques (Literature)	Ghana's Plastic Sector	Convergence / Divergence
	and Valve, 2017: Kovacic et al., 2020).	and policies that "exist for publicity"	
Practical: Infrastructure and Technological Barriers	Limited facilities, scalability issues (Linder and Williander, 2017).	Severe infrastructure and logistical gaps; poor segregation and transport inefficiencies.	Convergent but amplified in scale.
Practical: Economic Constraints	High costs, weak markets for secondary materials, low margins, and lack of market incentives (Linder and Williander, 2017: Zink and Geyer, 2017).	Recycled materials costlier than virgin; weak demand, price volatility.	Strong convergence. Empirical evidence substantiates economic infeasibility critique
Ideological: Cultural and Consumer Behaviour	CE assumes rational "green consumers," ignoring habits, identity, and resistance (Hobson, 2019).	Plastic use embedded in social norms of respect and convenience; resistance to recycled products.	Convergent but contextually rooted. Cultural embeddedness confirms behavioral and social resistance critique.
Ideological: Techno-depoliticisation, Social Exclusion and Inequality	CE often presented as a technical fix, neglects labour, justice dimensions and inclusion (Hobson and Lynch, 2016: Pla-Julian and Guevara, 2019:	Focus remains on recycling technology, Informal workers face exploitation, gender inequality, and stigma, despite their key role in plastic recovery.	Convergent; Supports depoliticisation critique; lack of social justice lens in CE application.

Critique Category	Global Critiques (Literature)	Ghana's Plastic Sector	Convergence / Divergence
	Valenzuela and Böhm, 2017).		
Ideological: Performative Engagement and Corporate led Narratives	CE risks greenwashing and donor dependency and compliance (Corvellec and Stål, 2019).	Participants view CE engagement as performative, "playing for impact reports" or "tick-box" actions with limited impact.	Convergent: Strong empirical confirmation of performative CE behavior.
Localized Adaptation	CE in Global South reframed as developmental opportunity (Calisto Friant et al., 2020).	CE used for livelihood and environmental cleanliness, not industrial reform.	Divergent – introduces new localized interpretation.

As discussed in chapter 2, the literature establishes that CE is a "contested and evolving concept" (Kirchherr et al., 2017a) with a "fragmented conceptual foundation" (Velenturf and Purnell, 2021). This ambiguity allows for a reductionist interpretation, often collapsing the CE into the "3R" framework and, even more narrowly focused on recycling over other strategies (Reike et al., 2018; Korsunova et al., 2022). The results demonstrate that CE is mostly operationalized and understood as waste management and "circular" is functionally synonymous with recycling in Ghana, which aligns with this conceptual reduction in practice. The high adoption of "use of recycled material" and "recycling-only" strategies, contrasted with the minimal uptake of upstream approaches like "refuse" or "rethink," demonstrates a sector that has absorbed the most accessible, yet least transformative, interpretation of CE. This aligns with Korsunova et al.'s (2022) critique that in developing economies, a narrow focus on recycling often conceals the diversity of more impactful R-strategies.

This finding validates the literature's concern about the "lack of standardisation and consistency in CE conceptualisation" (Agyei et al., 2023). The "conceptual immaturity" identified in the qualitative interviews is a major problem of CE concepts inherent flexibility and not a uniquely Ghanaian problem. The exemplified CE system in Ghana has been captured by the "reformist" interpretation of CE that focuses on managing waste flows within the existing linear system, rather than a "transformative" one that challenges regular system and practices (Schröder et al., 2019). This demonstrates how definitional ambiguity at the global level translates into fragmented and limited action on the ground.

The operational data from the plastic sector study provides concrete evidence of these physical and systemic limits. The recycling process itself generates significant new waste streams: wastewater from cleaning (69.9%), emissions from processing (70.5%), and residual plastic waste (76.5%). Converging with literature that suggest that a truly closed loops is impossible (Corvellec et al., 2022). Furthermore, the system's near-total reliance on the fossil-fuel-based national grid (97.6%) creates a profound contradiction, thus the energy required to close the material loop is itself sourced from a linear, polluting system. This evidence directly challenges the ideal of a "zero waste" cyclical process (Ellen MacArthur Foundation, 2015). Instead of a clean and closed loop, the Ghanaian model is a resource-intensive, polluting system that simply creates different forms of pollution and waste. This validates the critiques of scholars like Giampietro and Funtowicz (2020), who argue that CE neglects both ecological complexity and the unavoidable loss of energy (entropy) inherent in industrial processes.

Meanwhile, it is interesting to note that the findings also extend the theoretical debate by providing certain localised context as to how CE is interpreted in Global South. Ghanaian practitioners often frame CE not as a radical transformation of production-consumption systems, but a systematic response to waste accumulation and unemployment. This localised viewing of CE in the plastic sector as a livelihood opportunity contrast with the environmental logic dominance found in the Western CE discourse. It highlights the need to incorporate socio-economic imperatives into CE theory, ensuring that circularity is not merely technologically centred but socially grounded.

Practical critiques were the most frequently cited, centred on a crippling infrastructure deficit. The qualitative data is unequivocal: "Lack of infrastructure will be number one". The absence of source segregation, recycling facilities, and efficient collection systems (e.g., buyback centres) makes the

entire circular value chain inefficient and expensive. The "last mile" problem, where collecting scattered, low-value plastic is economically unviable, is a primary bottleneck. Ghana's CE efforts are failing at the most fundamental stage of waste segregation. Although 41.5% of businesses collaborate with the informal waste sector, this effort is undermined by poor infrastructure and weak system linkages. Participant described the system as one that constantly discourages consumer participation. For example, consumers have limited awareness of where their segregated waste ends.

The dilemma is aggravated by inefficient collection techniques, in which consumers separate waste but then get mix back together when it is collected by waste collection actors. Such a defective system renders individual effort ineffective, weakening the very social base necessary for circular change. Furthermore, contaminated plastics collected increase manufacturing risk and operational financial costs, which has an impact not just on consumer engagement but also on circular businesses. The involvement of waste collection businesses is crucial in re-establishing confidence and efficiency in waste segregation and collection for value development. They must progress from simply transporting waste to becoming facilitators of a circular feedback loop.

Beyond definitions, technical and economic barriers, deep-seated ideological and cultural factors impede plastic CE progress. A significant finding is the stigma against recycled products, perceived as "unhygienic" and "inferior". This "mental blockade" limits the market for circular products and shapes customer demand. Increasing consumer awareness and interest in circular offerings from ownership to users is crucial for circular firms, as this has been identified as a significant consumer-level obstacle to the adoption of circularity (Hobson and Lynch, 2016: Lazarevic and Valve, 2017). Furthermore, a culture of shifting responsibility where citizens view waste management as solely the government's duty erodes the collective action needed for a functioning CE. Additionally, a fundamental ideological critique identified is the perception of performative adoption. The qualitative data suggests that for some businesses, CE is a branding or fundraising tool rather than a core belief, for instance a "box-ticking" exercise. This suggest a scepticism that threatens the long-term, genuine commitment required for a systemic transition.

A central ideological critique of CE is its systematic underrepresentation of social equity. The literature contends that themes like equity, and inclusion, are covered in only "1–2% of the literature" (Geissdoerfer et al., 2017; Kirchherr et al., 2017), creating a significant gap between CE

rhetoric and the principles of sustainable development (Velenturf and Purnell, 2021). The results from Ghana's plastic sector further reveals this social concern. While the survey results showed that most businesses provide "fair wages" and that "inclusivity" is recognized as a motivator for circularity by 44.6% of businesses, both qualitative and quantitative data reveal a different reality for Ghana's informal sector, which is the engine of the recycling model. The descriptions of informal workers, particularly women, earning lower wages, working in "dangerous conditions without protective gear," and facing social stigma, are a powerful indictment of a CE model that prioritizes material loops over people. This directly reflects the ethical concerns raised about informal labour in developing countries (Luthra, 2019; Zapata Campos and Zapata, 2013).

This substantial contrast between reported practices and lived experiences underscores the phenomenon of "circular-washing." It reveals a system where the economic value of waste is extracted without a fair distribution of the benefits or protections for those doing the work. This is a clear failure to integrate the principles of a "Just Circularities" (McCauley, 2025). The results demonstrate that without explicit, deliberate efforts to include and protect informal workers ensuring "distributional, procedural, and restorative justice", the CE transition in Ghana risks reinforcing existing social inequalities.

The findings from the Ghanaian plastic sector reveal several practices that, when examined, demonstrate critiques that have been raised against the CE in practice, in theory, and at the level of ideology. The empirical findings largely converge with global CE critiques, while divergence is mainly contextual as Ghana amplifies issues such as informality, supply-chain fragility, and livelihood priorities. These critiques emerge in the way businesses approach circularity, the balance between linear and circular practices, and the joining of social and economic dimensions alongside environmental goals. The Ghanaian case demonstrates that, without institutional adaptation commitment and inclusive design, CE risks remaining symbolic and narrowly technical.

6.4 Policy practice dynamics in Ghana's circular plastic economy

The results indicate a significant disconnect between Ghana's ambitious policy frameworks, as outlined in Section 2.5, and the on-the-ground realities perceived by businesses. Although businesses find tax incentives and infrastructure investment as necessary policy directives for Ghana's circular plastic economy, only 11.6% view existing government measures as effective

with nearly half (47.7%) rating them as ineffective. Importantly, these perceptions should not be interpreted strictly as legal assessments of enforceability, but rather as stakeholder (respondents) evaluations of the extent to which existing policy directions, governance arrangements, implementation systems, and regulatory support structures are capable of facilitating meaningful circularity outcomes within the sector. Qualitative findings reinforce this interpretation, with participants characterising current CE initiatives as largely symbolic, and constrained by weak implementation systems. Respondents described existing initiatives as functioning primarily for "publicity" purposes, while others highlighted major dissemination, coordination, and implementation gaps. These perception of ineffectiveness stems from the "fragmented institutional landscape" and "non-binding mandates" critiqued in the literature**.**

The policy disconnection model developed from the interview findings (Figure 5.10) further illustrates these governance challenges. Participants consistently suggested that government measures and initiatives are symbolic due to inadequate stakeholder engagement, limited awareness, weak institutional coordination, and insufficient implementation capacity. This perspective directly supports the literature's synthesis that there are "significant gaps between policy formulation and implementation" and that policies "remain largely aspirational, with limited tangible outcomes. The widespread view that current government measures are ineffective (47.7%, Figure 5.7) and the cautious, non-committal support for new instruments like a Deposit Refund Scheme (64.0% "Maybe") point towards a broader issue of limited stakeholder confidence in institutional implementation systems. Businesses are unlikely to make substantial long-term investments in circular infrastructure, redesign processes, or alternative material systems in the absence of predictable governance arrangements, operational clarity, financial support mechanisms, and institutional consistency. The call from interviewees for "binding" regulations, enhanced monitoring, capacity building and more structured regulatory support underscores the need for a governance approach that combines strategic direction with practical implementation capability.

Insights from the cross-tabulations of policy preferences, suggests that an approach to policy that is universally applicable (one-size-fits-all) may not be the best of Ghana's plastic sector. The needs of a large manufacturer are fundamentally different from those of a cottage industry. As exemplified in the results, large-scale firms and SMEs overwhelmingly prefer Tax Incentives

(77.8%, 82.0%) and Infrastructure Investment (83.3%, 56.7%). These formal businesses seek financial advantages and better systems to limit risk and scale their operations. In contrast, Cottage Industries have a completely different priority: As seen in Table 5.15, 57.9% prioritize Extended Producer Responsibility (EPR). This may suggest that for small operators, EPR is seen as a potential mechanism for inclusion, compensation, and participation compared to larger business that may perceive EPR as a cost burden highlighting the challenges of implementing polluter-pays principles. Meanwhile the low interest of cottage businesses in tax breaks (31.6%) reflects their informal status and minimal tax liability.

Analysis based on business models shows that Plastic Cycling and Manufacturing firms strongly favour Tax Incentives (86.1%, 87.1%), since their profitability is directly tied to operational costs. Meanwhile business engage in diversified portfolios show the highest preference for EPR (70.6%), understanding the need for shared accountability. The data indicates that the literature's recommendation for "adequate funding and incentives" (MESTI, 2019; and GEF, 2019), is context-dependent rather than uniform across all firms. Policies that focus solely on tax breaks for formal industry will exacerbate the marginalisation of the informal sector, which is the main pillar of collection. The strong advocacy for EPR among the smallest players highlights a demand for a Just Transition as discussed in chapter two, a concept underexplored in Ghana's current policy mix. It shows that the informal sector, rather than seen as an issue that has to be resolved, is an important stakeholder that seeks fair compensation and inclusion, aligning with the literature's call for "inclusive" policies for a sustainable transition.

While the business model and size influence policy interest and actions of businesses, a major finding associated with this study is the reformist policy trap Schröder et al., (2019): and Reike et al., (2018) critiqued in previous studies. According to the authors CE policies are overly focused on "end-of-pipe waste management" rather than "designing waste out of the system" among other radical shifts. The data shows that, the policy preferences and practices revealed are significantly downstream oriented with little evidence of strong policy interest and support for upstream interventions like bans on specific plastics, standards for eco-design, or subsidies for reusable packaging systems. The most common CE practice is recycling as the most preferred policy instruments are those that support recycling (infrastructure, tax breaks for using recycled content). This bias towards downstream initiatives creates a directional risk where Ghana's CE may become

permanently "stuck" in a recycling loop. The policies, as perceived and demanded by the sector, are reinforcing the existing "recycling-centric" model rather than incentivizing a shift towards the more comprehensive R-strategies (like refuse, rethink, redesign) outlined in the literature. This reflects a "reformist" approach that tweaks the existing system rather than a "transformative" one that challenges the status quo of plastic production and consumption.

6.5 A Just Transition Lens on Ghana's Circular Plastic Economy

For any circular economy transition to be just, it must simultaneously incorporate safeguards that ensure all stakeholders at risk are recognised, able to participate, and positioned to benefit from the transition, regardless of their geographical location or their role within the value chain (Gözet et al., 2026). To operationalise this, the just transition framework distinguishes three core dimensions of justice: distributional (how benefits and burdens are shared), procedural (whether decision-making is inclusive and transparent), and recognition (whether diverse knowledge systems, identities and contributions are acknowledged) (Gözet et al., 2026). Applying this lens to the empirical findings of the present study reveals that Ghana's circular plastic economy is currently far from just. To start with in terms of distributional justice, the benefits of circularity (e.g., access to recycling technology, formal financing, and stable markets) can be said to be concentrated among large-scale businesses and a handful of well-capitalised businesses. Conversely, the burdens of irregular income, hazardous working conditions, and lack of social protection fall disproportionately on informal waste collectors, who provide the backbone of material recovery (41.5% of surveyed businesses engage them). With only 16.9% of businesses having access to green financing, none of that reaches informal workers. Additionally, the high reliance on diesel generators (41.8%) and grid electricity (97.6%) also distributes environmental harm (air pollution, carbon emissions) to local communities, with little compensation or mitigation. When the results are considered based on procedural justice, the findings show that only 11.6% of businesses rate current government policies as effective, and nearly half (47.7%) consider them ineffective. This perception is not merely about technical shortcomings; it reflects a lack of meaningful stakeholder engagement. Informal workers, small-scale recyclers, and community representatives are largely excluded from policy design and monitoring. Top-down, donor-driven initiatives have failed to generate legitimacy. Without inclusive decision-making, policies remain disconnected from the realities of those who manage waste on the ground. Informal

waste collectors are central to Ghana's plastic circularity, yet they are legally invisible, and stigmatised. Their knowledge of material flows, sorting, and market prices is rarely acknowledged in policy or business strategies. Women waste pickers face double marginalisation; they perform the most precarious tasks but are often excluded from cooperatives, training programmes ad decisions that affects their livelihood. This failure of recognition not only violates basic rights but also undermines the effectiveness of circular interventions, because policies ignore the very actors who make collection and recycling work.

To this end, Ghana's current CE transition is techno-centric and efficiency-focused, but it does not yet meet the criteria of a just transition. Without deliberate attention to distribution, participation, and recognition, circularity risks perpetuating existing inequalities or creating new forms of social and environmental injustice in Ghana. The following section therefore translates these justice gaps into concrete recommendations in Chapter 7 for integrating informal workers, building on international experiences documented in the literature.

6.6 Socio-Economic Challenges of Integrating Informal Workers into Ghana's Circular Plastic Economy.

The findings indicate that informal actors remain central to material recovery within Ghana's plastic sector, with 41.5% of surveyed businesses reporting engagement with informal waste collectors. However, interviews revealed that this participation is largely precarious, unregulated, and weakly protected despite its importance to the functioning of circular activities such as collection, sorting, and recycling. While the informal sector contributes significantly to plastic recovery, the broader socio-economic implications of integrating these workers into formal CE systems remain insufficiently addressed within policy and practice. Drawing on the PREVENT Waste Alliance (PWA) (2023) framework and interview findings, the study identifies several interconnected challenges relating to legal recognition, economic vulnerability, occupational safety, and the complexities of formalisation.

One major challenge concerns legal and institutional exclusion. Informal waste collectors in Ghana often operate without formal recognition, employment contracts, social security protection, or clear labour rights, exposing them to exploitation, unsafe working conditions, and inconsistent income opportunities. The absence of binding regulatory mechanisms means that businesses

engaging informal collectors are rarely obligated to provide fair wages, protective equipment, or long-term employment guarantees. Developed policy instruments such as Extended Producer Responsibility (EPR) schemes also tend to prioritise formal collection structures, unintentionally marginalising informal actors who currently sustain a substantial proportion of material recovery activities. Economically, informal workers remain highly dependent on unstable market prices for recyclables, possess limited bargaining power within value chains, and generally lack access to credit facilities, savings mechanisms, or insurance systems. These vulnerabilities are further reinforced by the broader lack of financial support mechanisms for circular activities identified throughout this study.

The study also highlights severe occupational and social risks associated with informal plastic recovery. Interview findings and previous literature indicate that waste handlers are frequently exposed to contaminated plastics, hazardous materials, sharp objects, and physically demanding working conditions without adequate protective equipment or healthcare access. Women and children within informal waste systems remain particularly vulnerable to exploitation, social stigma, and gender-based risks. Although formalisation is frequently presented as a solution capable of improving income stability, legal protection, and social inclusion, literature suggest that formalisation itself presents important trade-offs (PWA, 2023). Rigid registration requirements, taxation, fixed working arrangements, or compliance obligations may unintentionally exclude vulnerable groups who depend on the flexibility of informal work for survival. Consequently, the findings suggest that a uniform approach to formalisation may be ineffective. Instead, inclusive CE transitions in Ghana require adaptive models that recognise the economic realities of informal workers while gradually improving labour protections, access to social services, participation in EPR systems, and fair compensation mechanisms within the circular plastic value chain

6.7 Other Stakeholders in a Just Plastic Transition: Consumers and Society

While informal waste workers are the most directly affected stakeholder group, a truly just circular transition also requires attention to consumers and society at large. From a distributional justice perspective, circular economy measures such as deposit-refund schemes, recycled content mandates, or product-as-a-service models can affect affordability and access. Low-income consumers may be disproportionately burdened if circular products (e.g., durable goods, packaging with recycled content) are priced higher than conventional alternatives, or if take-back systems are

located far from underserved communities (Gözet et al., 2026). Procedural justice demands that consumers have access to transparent, understandable information about product circularity (e.g., through standardised labels, digital product passports) and meaningful feedback mechanisms to influence product design and waste management systems (Gözet et al., 2026).) Recognitional justice requires acknowledging that consumption patterns are shaped by cultural norms, infrastructure, and economic constraints; blaming individual consumers without providing accessible circular options is neither fair nor effective.

At the societal level, a just transition calls for public investments in circular economy education, skills development, and local innovation that benefits all communities, not only industrial hubs (Gözet et al., 2026). It also requires that the burdens of plastic pollution and recycling (e.g., emissions from diesel-powered collection) are not externalised to vulnerable neighbourhoods or future generations. In practice, Ghana's plastic transition should therefore include consumer awareness campaigns that are inclusive and accessible, ensure that circular products remain affordable (e.g., through tax exemptions on recycled materials), and create multi-stakeholder platforms where civil society, consumer groups, and environmental advocates can co-design policies, thereby embedding justice across the entire value chain.

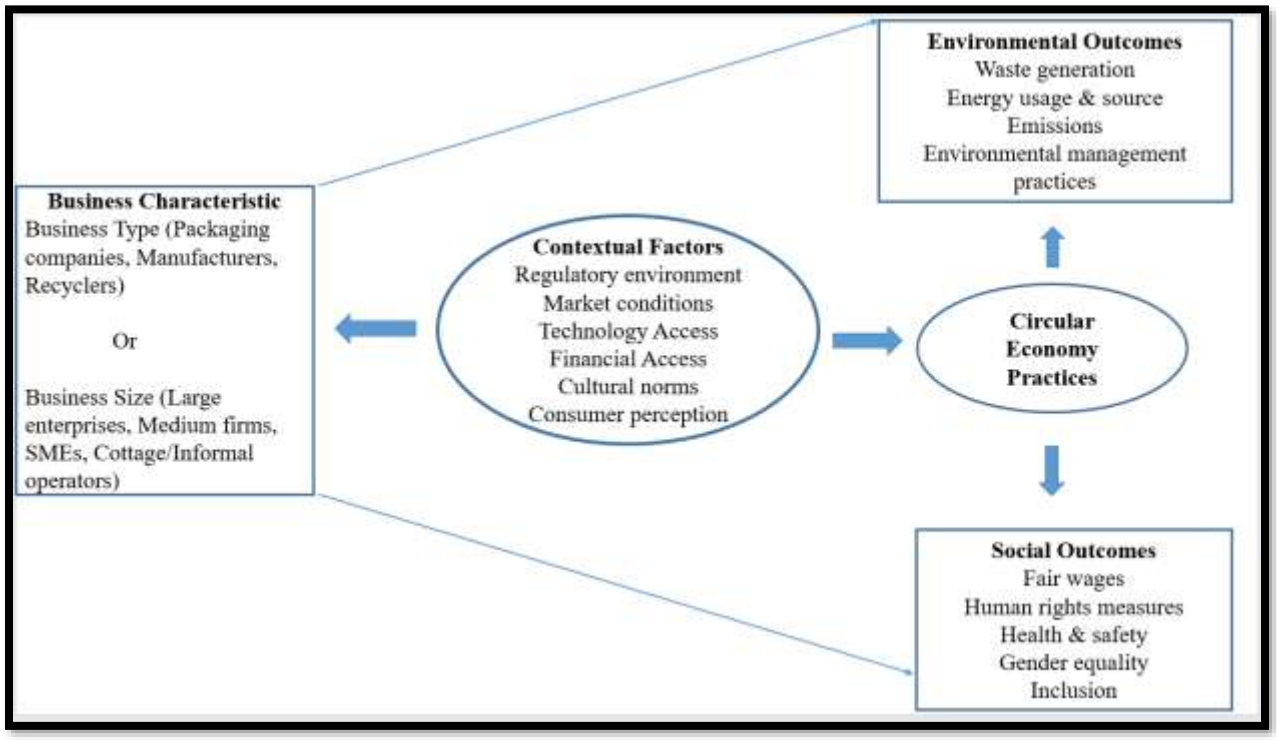
6.8 Synthesizing the Ghanaian CE paradox

To synthesize these insights, an emergent conceptual framework is proposed (See Figure 7.1). The framework positions business characteristics, specifically business type and business size as the primary as the primary independent variables influencing CE (CE) practices within Ghana's plastics industry. These business characteristics, although they influence environmental and social outcomes, do not operate in isolation, as the relationship is not linear or uniform. They are moderated by contextual factors, including regulatory strength and enforcement, market dynamics between virgin and recycled plastics, access to technology and infrastructure, availability of green financing, and prevailing cultural and consumer norms. These factors systematically constrain and enable firms' ability to adopt and scale CE practices.

CE practices act as an intervening mechanism through which business characteristics translate into measurable outcomes. The framework distinguishes between two categories of dependent variables:

- Environmental outcomes, including waste generation, energy usage and sources, emissions, and environmental management practices; and
- Social outcomes, such as fair wages, human rights measures, occupational health and safety, gender equality, and social inclusion

Figure 7.1: An Emergent Conceptual Framework of CE Transitions in Ghana's Plastic Sector



Source: Author Design

The framework therefore highlights that CE outcomes are not determined solely by firm-level decisions but emerge from the interaction between firm characteristics and systemic conditions. This interaction explains the Ghanaian CE paradox observed in the study, where circularity is widely promoted in policy discourse but unevenly realized in practice due to persistent structural and contextual constraints. This paradox is sustained by a self-reinforcing constraint cycle, in which the economic unviability of circular practices limits investment in supportive systems, while the absence of these systems further undermines the scalability and effectiveness of CE adoption.

6.9 Conclusion

This chapter has interpreted the integrated findings, revealing that while CE principles are gaining recognition in Ghana's plastic sector, their implementation remains profoundly constrained by conceptual, structural, and ideological limitations. Although policy emerged as an important enabling condition, the findings further revealed that circular practices are equally shaped by market incentives, organisational strategies, technological limitations, stakeholder networks, and grassroots survival systems, particularly within the informal sector. The sector is currently defined by a recycling-centric approach, a reliance on an exploited informal workforce, a dependence on linear energy, and a crisis of confidence in governance. The discussion showed that Ghana's circular transition remains heavily recycling-centred, downstream-oriented, and dependent on informal recovery systems operating within broader linear economic structures. Consequently, the sector reflects a circular economy in rhetoric more than a fully transformative circular system in practice. The findings therefore support broader critiques within CE literature regarding weak implementation, reformist transitions, and the persistence of linear production logics beneath circular narratives. Ultimately, achieving a socially inclusive and economically viable CE transition in Ghana will require integrated governance approaches capable of aligning policy frameworks with financial systems, infrastructure development, technological innovation, market incentives, and social justice considerations. The following chapter presents the study's final conclusions, contributions, and recommendations for advancing a more transformative circular transition within Ghana's plastic sector.

Chapter 7 Conclusion

7.1 Introduction

Fundamental to the CE is the elimination of waste and management of resources both before, during and after any production process, making certain that materials are used for as long as feasible. In theory, this model can help economies grow while minimising waste, save resources, and lowering environmental and social negative impacts. However, even though the CE has strong potential to split economic development from resource usage and pollution, its practical implementation remains challenging. These challenges raise important questions about how effectively the CE can serve as a medium to sustainable development in real-world contexts especially from a developing economy perspective where several determining factors are constrained.

In the case of Ghana, where contamination by plastic remains an existential environmental menace owing to rising production and widespread use at both industrial and household levels, these concerns are even more pronounced. This study, through a mixed method approach assesses the implementation, critiques, and distinctive attributes of CE and CBM within Ghana's plastic sector. The study further examined how current practices align with or diverge from existing literature critiques, while understanding its local context. This concluding chapter summarizes the discussions most relevant findings relating to the research questions collectively.

7.1.1 Summary of research findings

The CE and circular business model discourse in Ghana's plastic sector has inspired meaningful action but remains narrowly focused, and far from systematic value creation and social justice. Limiting its transformation toward a fully circular sector in practice. Through qualitative and quantitative analysis, the integrated findings show a sector in actively engaged with circularity but is restricted within a reformist system rather than a transformational one.

From a theoretical standpoint, circular business models promise value creation beyond waste recovery, yet Ghana's current reality is a pragmatic response to a waste crisis rather than a holistic transformation. The findings confirm widespread conceptual misunderstanding. CE is easily mistaken with sustainability or end of life waste recovery, and very few actors articulated a comprehensive understanding of upstream circular strategies such as design innovation, reuse, or

product life extension. Ghana's CE implementation is constrained by weak infrastructure, high operational costs, dependence on fossil-based energy, process waste generation, and inadequate policy enforcement. Survey data identified unclear policies, poor partnerships, and lack of incentives as key constraints. Interviews reinforced these findings by emphasizing the absence of buyback centres, inadequate segregation systems, and costly logistics. Even where awareness exists, weak financial and technological capacities constrain businesses from turning circular intent into competitive advantage. These operational inefficiencies, compounded by financial limitations, renders CE in the plastic sector to be economically risky.

Meanwhile, the CE remains underdeveloped in addressing fairness, inclusion, and cultural embeddedness within Ghana plastic sector. Quantitative results indicated high formal compliance with fair wages, yet interviews revealed widespread social inequities within the informal labour force that sustains much of the plastic recovery system. Female waste pickers, in particular, face low wages, unsafe working conditions, and social stigma. Additionally, public resistance to behavioural change, rooted in cultural attachments to plastic as a symbol of convenience, respect, and hygiene further hinders circularity adoption at both organisational and individual level.

The convergence between global critiques and Ghana's empirical realities demonstrates that many challenges in operationalizing CE are systemic and universal, rather than context-specific. Conceptual ambiguity, infrastructural deficits, and economic barriers persist across settings. However, the Ghanaian case contributes novel insights by emphasizing the intersection of circularity, informality, and social justice as fundamental. This study demonstrates that Ghana's circular systems in developing economy context heavily rely on informal workers, whose labour sustains the majority of plastic recovery activities but who remain marginalized. In contrast to dominant CE narratives that emphasize technological efficiency and business innovation, this positions livelihoods, job creations, equity as core pillars to circularity transition in Ghana and not merely technology and innovative models.

Taken together, these findings reveal a noticeable gap between what is promoted in CE discourse and what is practiced on the ground. The Ghanaian plastic sector study thus confirms global critiques of CE to have broad boundaries, ambiguous theoretical basis, and structural constraints in its application (Corvellec et al., 2022), while also exposing context-specific challenges shaped

by, weak institutional and social systems and informality. Across this finding, five noticeable broad pattern emerge, thus:

1. Circularity is fragmented, as the sector exhibits multiple, uncoordinated approaches to CE, with businesses implementing isolated practices rather than integrated, system-wide circular models.

2. Business size strongly shapes CE depth, influencing access to capital, technology, and formalized practices.

3. Recycling dominates the CE landscape, overriding more transformative models such as dematerialisation, product-as-a-service, or repair systems.

4. Economic viability is the central barrier, driven by high capital costs, cheap virgin plastic, and limited financing.

5. Environmental sustainability in Ghana’s plastic sector is only being addressed in limited ways, mainly through managing waste and improving efficiency within fossil-fuel-based systems. while social sustainability remains largely overlooked and inconsistently integrated.

7.2 Implications for policy and practice

7.2.1 Policy recommendation

The country's transition is impeded not only by a lack of understanding, but also by ineffective institutional enforcement, fragmented value-chain responsibilities, and significant infrastructural and financial deficits. Previous publications by Kwansa (2021) on "Ghana's Efforts and Plastic Waste Management Strategies," among others, have underlined the importance of establishing robust and enforceable CE regulations. This study emphasizes a shift further from strict policy enforcement to a policy system that is differentiated, targeted, and operationally adapted to the individual roles and capacities of various business type and sizes in the plastic industry.

Given the varied adoption patterns identified in the study, policy cannot treat the sector as uniform. Hence a one size fit all system may remain ineffective. For instance, packaging companies although a major source of single-use waste and identified as lagging in the area of recycled content usage would require mandatory recycled content standards and a robust EPR Extended Producer Responsibility Scheme with clearly defined recovery targets and transparent compliance mechanism. This could equally be extended to manufacturers despite their current use of secondary material use would create a reliable market and drive demand.

Additionally, plastic manufacturers who use moderate-to-high levels of recycled inputs would benefit more from tax incentives tied to incremental increases in recycled material usage, as well as research and development support to address physical limitations such as contamination and declining polymer quality. Across all business types within this sector, strict enforcement of mandatory waste segregation at source with graduated penalties to curtail non-compliance is necessary. This measure could equally be extended to the consumer level to aid the transition in terms of quality control of plastic materials recovered.

This measure responds directly to evidence from the study showing persistent mixing of segregated waste and the absence of clear accountability mechanisms within existing waste management structures. Further policy actions may include standardise national guidelines for quality and traceability of recycled materials and transparent reporting systems for businesses to reduce perceptions that CE policies are symbolic rather than substantive.

By providing mixed financial options, concessional loans, grants, and credit guarantees tailored to firm size and risk level, a CE Financing Facility might significantly change the landscape given the restricted availability of affordable financing. In addition, technology access initiatives like regional technology-transfer centres and equipment leasing programs will lower the barrier to cutting-edge circularity technologies and enable SMEs to adopt to new trends that are now unaffordable. Strengthening contextual enablers such as supporting buy-back centres and reliable sorting and collection system and decentralised processing facilities is essential for enabling firms to meet quality requirements for recycled feedstock. This would require policy prioritisation for infrastructure investment that expands collection and reprocessing capacity beyond the urban centre.

International experience demonstrates that formalising informal waste workers is both feasible and beneficial when policies are designed inclusively. For Ghana, the following policy implications emerges from those experiences. First, the government should legally recognise informal waste collectors by issuing identification cards, registering them in a national database. Second, when implementing Extended Producer Responsibility (EPR) schemes, a dedicated mechanism must be created to pay informal collectors a service fee (not below minimum wage) for the materials they supply. Third, support for waste picker cooperatives is essential to enable collective bargaining, access to training, and provision of basic infrastructure (e.g., sorting sheds, carts, PPE). Fourth, social protection – including health insurance, accidents should be extended to registered informal workers, funded through a portion of EPR fees or environmental taxes. Fifth, multi-stakeholder platforms must be established where informal worker representatives have a seat in policy design, monitoring, and grievance redressal. Sixth, formalisation programmes should be designed flexibly (offering part-time options and childcare support) while enforcing bans on child labour and providing alternative income support to affected families. Finally, as circular business models expand, workers in existing linear systems risk displacement. To promote social justice, economic growth, and environmental goals, Ghana's CE policy frameworks must embed retraining programmes and alternative livelihood pathways for affected workers.

The strengthening of energy policy is necessary to resolve the fundamental contradiction of using linear, fossil-based energy to power circular processes. Government should create incentives, such as grants or tax credits, for recycling and manufacturing facilities to adopt renewable energy sources. Support for solar financing programs specifically tailored to industrial users would help overcome high upfront costs. CE policy must be deliberately aligned with national energy transition strategies to ensure that the pursuit of material circularity does not inadvertently perpetuate carbon-intensive systems, thereby safeguarding the environmental integrity of the circular model.

The findings and literature suggest that individual behavioural change alone is insufficient to achieve systemic circular economy (CE) outcomes. Rather than viewing top-down policy interventions and business-led consumer education as mutually exclusive, they should be understood as mutually reinforcing when properly sequenced and aligned. Consumer demand for circular products, waste separation practices, and public participation remain important

components of CE implementation; however, such actions are heavily shaped by broader structural conditions, including infrastructure availability, affordability, market accessibility, regulatory frameworks, and institutional coordination. Expecting individuals or businesses to independently drive circular transitions without supportive systemic conditions places disproportionate responsibility on actors operating within constrained environments. A just transition therefore requires a balanced portfolio: policy sets the rules and provides infrastructure; businesses innovate and communicate; and consumers respond within an enabling system not as the main drivers. In this regard, the study conceptualises policy not as a replacement for market or social action, but as an enabling mechanism that shapes the conditions under which circular practices become feasible, accessible, and economically attractive. Businesses may contribute through innovation, consumer education, and product redesign, yet their capacity to stimulate demand for circular products often depends on wider governance systems, including incentives, standards, public awareness programmes, and waste management infrastructure. Circular transitions should thus be understood as shared socio-technical processes requiring interaction between top-down institutional support and bottom-up behavioural adaptation, rather than as responsibilities borne solely by individual consumers or private firms.

7.2.2 Practical recommendations for businesses

According to Rasimus (2020), it is important that firms understand why they are shifting away from linear systems in order to attain the maximum rewards of circular systems in the plastic industry. This study shows that cost savings are a main driver of CE, although important but not holistically to sustain the transition. Hence, in order to improve this option, and further achieve other environmental and social goals linked to CE and circular plastic business models, business in the industry must partner with financial institutions to develop customised financing products that address the unique risk profiles and longer payback periods associated with circular investments. A properly structured financing system unlocks investment needed for scale, efficiency, and innovation.

Due to the sector's fragmentation, strategic alliances will become more important for gaining a competitive edge. Businesses should aggressively encourage cooperation between plastic producers, packaging firms, official recyclers, and unofficial networks of collectors. Targeted

collaborations have the potential to strengthen material flows, enhance the consistency and quality of recycled feedstock, and generate shared value. These collaborations can go beyond the system's current isolated and ineffective operations to building and industrial symbiosis network that allows business to exchange resource, reduce waste and benefit from shared differences.

It is important for the actors to note that long-term sustainability depends on innovative CE models that go beyond downstream recycling. Businesses should be urged to investigate and make investments in upstream circular models, such as, modular design, product development for improved durability, reparability and recyclability, packaging reuse and refill systems, products as services and encourage the sharing and leasing of plastic products. By addressing waste generation at its source, these actions put companies at forefront of a truly revolutionary CE which can often provide larger economic and environmental benefits than end-of-pipe recycling alone.

The persistent stigma surrounding recycled plastic, combined with the lack of feedback and information flow within waste collection systems, shows the need for continuous consumer engagement to support a sustainable material recovery system and product market. Targeted awareness campaigns that clearly explain product quality, safety, and traceability backed by standards for recycled plastic and feedback channels can help build consumer trust. This trust is essential for creating demand, strengthening the market for recycled products, and improving the overall flow of materials in the CE.

7.4 Limitations of the study

There are several drawbacks to this study. The first was that some businesses did not respond right away, and the researcher had to go through bureaucratic procedures to acquire the attention of some of the interviewees and businesses who were designated for the study. Leading to a delay in data acquisition. The researcher was unable to conduct any operational life cycle assessments or participatory observations of business activities to enable inferences to their responses due to time and distance.

Additionally, the geographical focus on Greater Accra may not fully represent regional variations within Ghana although it serves as a major industrial hub. With a focus on cross-tabulations, the

study offers a single snapshot of CE practices at one point in time and cannot show how business behaviours, policies or practice change over time, limiting the ability to track any form of changes or impacts. Meanwhile, because much of the data is self-reported, especially on sensitive issues like wages, waste practices, or compliance, participants may respond in ways that make them look more responsible or sustainable than they actually are. Increasing the tendency of social desirability bias which may or can affect the accuracy of the findings.

Finally, while the mixed-methods approach provides depth, the qualitative sample size may limit generalisability. Nonetheless, the research offers a solid empirical basis for comprehending CE dynamics in the Ghanaian plastic sector and offers a conceptual framework that can guide future analysis.

7.4 Recommendations for future research

In order to overcome these constraints, future research should use longitudinal designs, broaden its geographic scope, and integrate surveys and observational techniques. In order to evaluate the framework's generalisability, comparative studies that apply it to various Ghanaian industries may be encouraged by the emergent framework and study findings. Possible cross-national analysis using similar developing economies to distinguish between universal and context-specific elements. Additional research might concentrate on a single company to determine performance in relation to the outcome of the circular business model, such as resource productivity, emission reduction, and material flow analysis to identify leakage sites in the plastic value chain.

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Appendices

Appendix I: Strategic actions for Ghana's national plastic management policy

Focus Area	Strategic Actions	Key Activities
Behavioural Change	Create a National Strategy for Education and Public Engagement	1. Develop and execute a nationwide communication plan using all major media channels. 2. Partner with and enhance existing national cleanliness initiatives. 3. Formulate actionable plans at national, regional, and local levels to scale up sanitation projects. 4. Mandate businesses to include public outreach in their annual plastic waste management plans. 5. Promote the initial separation of valuable plastics to improve collection efficiency and public participation.
	Integrate Waste Management into School Systems	1. Review and update the national educational curriculum to include the 4Rs (Reduce, Reuse, Recycle, Recover) and the impacts of plastic pollution. 2. Develop training resources for teachers on the updated curriculum. 3. Launch practical, school-based programs for managing plastic waste. 4. Build the necessary infrastructure to support the entire plastic management process.
	Encourage the Use of Alternatives to Plastic	1. Provide support to manufacturers of non-plastic products. 2. Fund awareness campaigns for reusable items. 3. Improve access to clean drinking water to reduce reliance on bottled water. 4. Fund research into developing new alternative materials.
	Set Clear Targets for Collection and Recycling	1. Conduct a study to gather baseline data on plastic waste. 2. Define clear national and local targets for collecting, recovering, recycling, and remanufacturing plastics. 3. Create a detailed system to monitor progress and report on these targets.

Focus Area	Strategic Actions	Key Activities
Strategic Planning and Collaboration	Develop Multi-Level Action Plans	1. Incorporate plastic waste management into the national development planning process for all sectors and local governments. 2. Require annual action plans to be submitted to a central oversight body. 3. Monitor the execution of these plans and publish an annual review. 4. Train local government staff on how to create and implement these action plans.
	Strengthen Collection and Recycling Capacity	1. Assist private companies in setting up and running recycling businesses. 2. Collaborate with businesses to create innovative and sustainable models. 3. Foster Public-Private Partnerships (PPPs) to increase efficiency and reduce costs. 4. Reward top performers in waste management with green procurement preferences, tax breaks on recycling equipment, and certification under EPR schemes.
	Create Plans for Industries and Institutions	1. Mandate industries and large institutions to submit their own annual waste management plans. 2. Review individual plans to align them for greater national efficiency. 3. Oversee the implementation of these plans and require regular reporting. 4. Train private sector leaders in developing effective action plans.
	Boost Local Research and Development	1. Fund local universities and research centres to identify best practices and technologies, including through international partnerships. 2. Create pathways and incentives to put research findings into practice. 3. Dedicate a portion of a national plastics fund specifically to research and development.

Focus Area	Strategic Actions	Key Activities
	Launch a Digital Marketplace for Plastic Waste	1. Build an open-access online platform to facilitate trading and improve operations. 2. Develop a mapping tool to help planners locate waste resources and processing facilities. 3. Educate stakeholders on how to use the new platform.
Funding and Finance	Design and Execute a Fundraising Strategy	1. Formulate a comprehensive strategy to mobilize financial resources. 2. Track the progress of this fundraising strategy. 3. Engage with both domestic and international donors to fill identified funding gaps.
	Create a Certification System and Registry	1. Set and publish standards for certifying operators along the plastic value chain. 2. Maintain a public database of all certified collectors and recyclers to ensure regulatory compliance. 3. Conduct regular checks to enforce these standards.
	Implement an Extended Producer Responsibility (EPR) Scheme	1. Design a full EPR system, building on any existing recycling funds. 2. Develop the legal framework needed for private sector participation in EPR. 3. Analyse the costs and benefits of different EPR models. 4. Help the private sector establish collection and take-back centres.
	Activate the Environmental Tax System	1. Clarify in law how the collected environmental tax funds will be distributed. 2. Ensure the fund's disbursement is transparent and accountable. 3. Monitor plastic importers and manufacturers for tax compliance. 4. Publish annual reports on the tax system's operation.

Focus Area	Strategic Actions	Key Activities
Governance and Accountability	Adopt Green Public Procurement Rules	1. Work with procurement authorities to establish guidelines for government purchases of eco-friendly products. 2. Monitor adherence to these green procurement rules. 3. Issue regular reports on implementation. 4. Give preference in procurement to local recyclers and companies using recycled materials, especially those participating in EPR.
	Set Up a Central Coordination Secretariat	1. Establish a dedicated secretariat to coordinate the overall policy implementation. 2. Support the operational needs of this secretariat. 3. Create a platform for different stakeholders to coordinate. 4. Assist the secretariat in developing its annual work plans.
	Strengthen the Regulatory Framework	1. Empower existing regulators to enforce this policy effectively. 2. Ensure policies are inclusive and consider gender and vulnerable groups. 3. Periodically review related policies and laws for consistency. 4. Organize training and knowledge-sharing for regulatory staff.
	Develop a Plan to Phase Out Hazardous Plastics	1. Categorize all plastic products based on national safety standards. 2. Form an expert committee from academia, government, and industry to assess the hazards of different plastics and advise the government. 3. Regularly analyse the health and economic costs of hazardous plastics. 4. Study the potential risks of biodegradable plastic additives, especially regarding chemical migration into food.

Focus Area	Strategic Actions	Key Activities
		5. Create a step-by-step plan to improve recycling standards and eliminate the most hazardous plastics.

Source: Ministry of Environment, Science, Technology and Innovation (MESTI) (2020)

Appendix II – Questionnaire

A Critical Analysis of the Critiques Surrounding the Sustainability of Circular Economy: An Authenticity Assessment of CE Practices in the Plastic Industry in Ghana.

Dear Participant,

This questionnaire is part of an ongoing Dissertation at the University of Malta, Institute for Climate Change and Sustainable Development.

The aim of my study is to explore the criticisms, attributes, and impacts of circular plastic models implemented in Ghana's plastic industry by addressing the overarching question: What are the primary critiques, distinctive attributes, and outcomes of circular economy initiatives in Ghana's plastic industry, and how do these factors influence the opportunities and challenges faced by businesses, as well as the role of government legislative initiatives in driving a sustainable transition toward circularity?.

This is an invitation to participate in this study, while acknowledging that participation in this questionnaire is entirely voluntary. As participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation to access, rectify and where applicable, ask for the data concerning you to be erased. All data collected will be stored in an anonymised form on completion of the study and publication of results. All data collected from this research, will be treated confidentially and will be used solely for the purpose of this study. Only the researcher and supervisors endorsing this letter will have access to this data.

By completing the questionnaire,
you are providing consent to participate in the study.

Thank you for your time and consideration.

Should you have any questions or concerns, you
may contact myself or my supervisors on the details provided below.

Researcher: faisal.mohammed-zakari.24@um.edu.mt

* Indicates required question

1. **Do you confirm that you have given your informed consent to participate in this study?** *

Mark only one oval.

- ◯ Yes
- ◯ No

2. **Are you aware that your data will be pseudonymised, i.e., your identity will not be noted on transcripts but instead, a code will be assigned. The codes that link your data to your identity will be stored securely and separately from the data.** *

Mark only one oval.

- ◯ Yes
- ◯ No

General Business Information

3. **Which of the following best describes your existing business models?** (Select all that apply) *

Tick all that apply.

- ☐ Plastic Cycling (Reuse, Recycle, Upcycling, Repair, Downcycling, etc.)
- ☐ Plastic Product Manufacturer
- ☐ Plastic packaging
- ☐ All the above
- ☐ Other: _____

4. If other, please specify

_____

5. **Which of the following best describes your business?** *

Mark only one oval.

- ◯ Cottage industry
- ◯ Medium to large Scale Business
- ◯ Small and medium Enterprise
- ◯ Large Scale Business
- ◯ Social Enterprise

6. **How many years has your company been in operation?** *

Mark only one oval.

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ More than 10 years

7. **How many employees does your company have?** *

Mark only one oval.

- ◯ 1-10
- ◯ 11-50
- ◯ 51-200
- ◯ More than 200

Circular Economy Business Models in Operation

8. **How familiar are you with the concepts of circular economy and circular plastic economy?** *

Mark only one oval.

- ◯ Not at all familiar
- ◯ Slightly familiar
- ◯ Moderately familiar
- ◯ Very familiar

9. **What is your primary driver (s) for implementing a plastic circular economy business model? (**Select all that apply) *

Tick all that apply.

- ☐ To reduce production costs through material efficiency
- ☐ To comply with environmental regulations and policies
- ☐ To meet customer demand for eco-friendly products
- ☐ To enhance brand reputation and corporate social responsibility
- ☐ To access green financing or investor interest
- ☐ To reduce dependency on virgin plastic/raw materials
- ☐ To address community/environmental concerns around plastic pollution
- ☐ To gain competitive advantage in the plastic industry
- ☐ To innovate and improve product design and lifecycle
- ☐ To build partnerships and collaborate in circular value chains
- ☐ To support inclusive employment, including the informal waste sector
- ☐ Other (please specify): _____

10. **Which circular economy business models or practices does your company currently implement?** *

(Select all that apply)

Tick all that apply.

- [ ] Use of recycled materials in production
- [ ] Product life extension (e.g., design for durability, repair, or upgradability)
- [ ] Recycling or reprocessing of used products/materials
- [ ] Product-as-a-service (e.g., leasing instead of selling)
- [ ] Material substitution with renewable or biodegradable alternatives
- [ ] Industrial symbiosis (sharing resources or by-products with other companies)
- [ ] Waste minimization in manufacturing processes
- [ ] Take-back schemes or reverse logistics
- [ ] Consumer education or engagement initiatives
- [ ] Employment or inclusion of informal sector workers in the value chain
- [ ] No circular practices currently implemented
- [ ] Other (please specify): _____

11. **What percentage of your raw materials come from recycled plastics? (Manufacturers & Packages only)**

Mark only one oval.

- ◯ 0% (We use only virgin plastic)
- ◯ 1-25%
- ◯ 26-50%
- ◯ 51-75%
- ◯ 76-100%

12. **What is the biggest challenge your company faces in adopting circular economy models?** (Select all the apply)

Tick all that apply.

- [ ] High cost of recycling technology
- [ ] Inconsistent supply of recyclable plastics
- [ ] Lack of government incentives
- [ ] Low market demand for recycled products
- [ ] Consumer preference for virgin plastics
- [ ] Other

13. If other, please specify

_____

Use of Virgin Plastics, Energy Consumption & Waste Generation

14. **What percentage of your production relies on virgin plastic? (Manufacturers & Packages only)**

Mark only one oval.

- ◯ 0-25%
- ◯ 26-50%
- ◯ 51-75%
- ◯ 76-100%

15. **What are the main sources of energy used in your operations?** (Select all that apply) *

Tick all that apply.

- [ ] Electricity from national grid
- [ ] Diesel generators
- [ ] Biomass (e.g., wood, agricultural waste)
- [ ] Solar energy
- [ ] LPG (Liquefied Petroleum Gas)
- [ ] Hydropower
- [ ] ☐ Other (please specify): _____

16. If other, please specify

_____

17. **Has your company taken steps to reduce energy consumption?** *

Tick all that apply.

- [ ] Yes
- [ ] No

18. **If yes, please specify the actions taken:** *

Tick all that apply.

- [ ] Installed energy-efficient equipment
- [ ] Switched to renewable energy sources
- [ ] Optimized production processes
- [ ] Implemented energy monitoring systems
- [ ] Employee training and awareness programs
- [ ] Other (please specify): _____

19. What are the major operational and production waste related to your circular plastic model *

Tick all that apply.

- [ ] Waste Water
- [ ] Residual plastic waste
- [ ] Emissions
- [ ] Other (please specify): _____
- [ ] Not Applicable

20. **How does your company manage operational and production waste?** (Select all that apply) *

Tick all that apply.

- [ ] We recycle waste internally
- [ ] We sell or supply waste to external recyclers
- [ ] We reuse materials within the production process
- [ ] We dispose of waste through licensed waste handlers
- [ ] We incinerate non-recyclable waste
- [ ] We landfill residual waste
- [ ] We partner with other companies for industrial symbiosis
- [ ] Other (please specify): _____

21. If others, please elaborate

_____

_____

_____

_____

_____

Business Challenges & Economic Viability

22. **What is the primary source of funding for your circular economy initiatives?** *

Tick all that apply.

- [ ] Company Revenue
- [ ] Government grants/subsidies
- [ ] Loans from banks/financial institutions
- [ ] Foreign or local investors
- [ ] Others

23. **How profitable is your circular economy business model?** *

Mark only one oval.

- ◯ Highly profitable
- ◯ Moderately profitable
- ◯ Break-even
- ◯ Not profitable

24. **What factors limit the profitability of your circular economy model?** (Select all that apply) *

Tick all that apply.

- [ ] High operational costs
- [ ] Low demand for recycled products
- [ ] Government regulations
- [ ] Competition from virgin plastic producers
- [ ] Others

25. If others, please elaborate

_____

_____

_____

_____

26. **If any, what factors can positively influence the profitability of your circular economy model? Please explain briefly**

Social Sustainability & Integration

*

27. **Does your company work with informal waste collectors?** (Select all that apply)

Tick all that apply.

- [ ] Yes, we buy plastic waste from them
- [ ] Yes, we provide training and financial support
- [ ] No, we source waste through formal channels
- [ ] Others

28. **What percentage of your workforce is from the informal waste sector?** *

Mark only one oval.

- ◯ 0%
- ◯ 1-25%
- ◯ 26-50%
- ◯ 51-75%
- ◯ 76-100%

29. **How does your company contribute to social sustainability within your circularity model?** *
(Select all that apply)

Tick all that apply.

- [ ] Creating fair employment opportunities (decent wages, job security)
- [ ] Supporting gender equality and inclusive hiring practices
- [ ] Providing training and capacity building for employees and informal workers
- [ ] Partnering with community-based or informal waste collectors
- [ ] Ensuring health and safety standards across all operations
- [ ] Promoting ethical labor practices and human rights
- [ ] Supporting community development initiatives (e.g., education, healthcare)
- [ ] Encouraging employee participation in sustainability initiatives
- [ ] Offering incentives or profit-sharing with lower-tier workers
- [ ] Other (please specify): _____

Policy & Regulatory Environment

30. **What government policies would improve circular economy practices in your sector?** (Select all that apply)

Tick all that apply.

- [ ] Extended Producer Responsibility (EPR) schemes
- [ ] Tax incentives for using recycled materials
- [ ] Policy on the amount of recycled plastics to be use
- [ ] Stricter regulations on virgin plastic use
- [ ] More investment in recycling infrastructure and Circular technologies
- [ ] Others

31. If others, please elaborate

_____

_____

_____

_____

_____

32. **Are current government policies efficient enough in the circular plastic business economy transition?** *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

33. **What do you think are the main reasons for the limited influence of government policy on the adoption of circular plastic business models in Ghana?** (Select all that apply) *

Tick all that apply.

- ☐ Lack of clear and enforceable regulations
- ☐ Inconsistent or poorly implemented policies
- ☐ Limited financial or tax incentives for circular businesses
- ☐ Weak coordination among regulatory agencies
- ☐ Lack of awareness or prioritization of circular economy by policymakers
- ☐ Low stakeholder engagement in policy design
- ☐ Inadequate support for informal waste sector integration
- ☐ Political interference or shifting priorities
- ☐ Limited collaboration between government and private sector
- ☐ Other (please specify): _____

34. **Would you support a Deposit Refund Scheme (DRS) for plastic bottles and packaging?** *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

35. if any, what policy recommendations do you have for improving the circular economy models in Ghana's plastic sector?

Appendix III – Interview questions

Section A: Semi-structured interviews for recycling, manufacturing, plastic packaging businesses.

Sub-section 1: Business Model and Operations

1. How would you describe your company's involvement in the plastic value chain (Recycling, Manufacturing, or plastic packaging)?
2. What specific CE strategies does your company implement (if any)? (E.g., recycling, reuse, waste reduction, product redesign, alternative materials)
3. What plastic materials do you work with, and how do you source them?
4. How do you ensure the sustainability of your supply chain?

Sub-section 2: Process Evaluation

5. What technologies or systems do you use in your CE model?
6. How does your company handle plastic waste, and what steps do you take to recover and reintegrate plastic into production?
7. What proportion of your raw materials is from recycled plastics versus virgin materials?
8. In account of the use of virgin materials, what are the main reasons for using virgin plastic materials in your production process?
9. What waste streams are generated at different stages of your CE model, and how do you manage them?
10. How do you manage energy consumption within your operations, and have you implemented any renewable energy sources?
11. What challenges have you encountered in implementing your model(s) or initiatives?
12. What role do partnerships (with recyclers, waste managers, etc.) play in enabling circular processes within the industry?

Sub-section 3: Outcome Evaluation and Impact

1. What measurable outcomes have you observed from implementing CE models? (E.g., reduction in plastic waste, cost savings, new revenue streams)
2. How do your initiatives impact environmental sustainability?
3. Have you experienced any unintended negative consequences or risks (e.g., operational inefficiencies, financial constraints)?
4. How does your business model contribute to job creation and social inclusion?
5. Do you engage informal waste collectors, cooperatives, or marginalized groups in your value chain? If so, how?
6. What kind of social benefits (e.g., improved working conditions, fair wages, and skills development) are integrated into your CE strategy?
7. How do customers, suppliers, or other stakeholders respond to your CE practices?
8. What are the major barriers preventing full circularity in your industry?
9. Do the implemented circular plastic models create new business opportunities (e.g., partnerships) for your business?

Section B: Semi-structured interviews for experts, non-profits, and advocacy groups

1. What are businesses' main sustainability challenges when implementing CE practices in Ghana's plastic sector?
2. To what extent do circular plastic economy models in Ghana effectively reduce plastic pollution, and what gaps still exist?
3. What are the most common ways businesses in this sector are adopting CE models?
4. What main barriers (e.g., cost of recycling technology, material flow, consumer awareness) hinder the scalability of CE initiatives in the plastic industry?

5. How does the reliance on informal waste collectors impact the sustainability and efficiency of the CE in Ghana?

6. If any, what would you say are the key environmental and social criticisms of plastic circularity implementation in Ghana? (e.g., energy-intensive processes, microplastic pollution, down-cycling limitations)

7. How does the use of virgin plastics continue to compete with recycled materials, and what factors drive businesses to favor one over the other?

8. Are there significant social or labor-related concerns (e.g., poor wages, child labour, and unsafe working conditions) linked to CE practices in the plastic sector?

9. How effective are existing government policies, regulations, and incentives in promoting a truly CE in Ghana?

10. What role does consumer behavior play in the success or failure of CE models, and how can awareness and participation be improved?

11. How do consumer attitudes towards recycled plastics affect market demand and sustainability efforts?

12. What aspects of the current CE framework seem most challenging or problematic for the Ghanaian plastic industry?

13. Do the implemented circular plastic models create new business opportunities (e.g. partnerships) for your business?

14. In your opinion, what are the key success factors for a thriving CE in Ghana's plastic sector?

15. From your perspective, what are the fundamental weaknesses of Ghana's current approach to circularity in the plastic industry, and what alternative strategies could improve sustainability?

Section C: Semi-structured interview questions for informal waste collectors

1. How do you perceive your relationship with formal businesses in the plastic recycling sector?

2. What challenges do you face in collaborating with formal businesses, and how could these challenges be addressed?
3. What support or resources would help you improve your operations and income?
4. What are the main social and economic challenges you face as an informal waste collector?
5. How do you ensure fair wages and safe working conditions for yourself and others in your network?
6. What role do your cooperatives or associations play in addressing your challenges?
7. How do your activities contribute to environmental sustainability in your community?
8. What challenges do you face in managing plastic waste sustainably, and how do you address them?
9. How do you perceive the environmental impact of your work compared to formal waste management systems?

Appendix IV- Interview guide

	Guide for plastic recycling, manufacturing, and packaging businesses
Section	**Content**
Introduction	• Thank the participant for their time and explain the purpose of the interview. • Assure confidentiality and obtain consent to record the interview.
Opening Questions	1. Can you describe your company's role in the plastic industry and your involvement in CE initiatives? • Prompt: What does your existing plastic business model look like in terms of value proposition, creation, and delivery to the market? • Rationale: Establish context and understand the company's perspective.
Main Questions	2. What are the main sustainability challenges your business faces when implementing CE practices in Ghana's plastic sector? • Prompt: Can you provide examples of specific challenges, such as cost, technology, or consumer behavior? • Rationale: Identify barriers to CE adoption specifically to the plastic industry. 3. How have government legislative initiatives contributed to a sustainable transition toward circularity in Ghana's plastic industry? • Prompt: Are there specific policies or regulations that have been particularly effective or ineffective? • Rationale: Evaluate the role of government in promoting circularity. 4. What primary critiques surround the CE as applied to your business model? • Prompt: Are there concerns about environmental, social, or economic impacts? • Rationale: Explore criticisms of CE practices. 5. What distinctive attributes are evident in the processes and outcomes of your CE initiatives in Ghana's plastic industry? • Prompt: Can you describe the process involved in your model implementation and any unique successes or challenges? • Rationale: Identify key characteristics of CE initiatives in Ghana. 6. How do these processes and outcomes influence the opportunities and challenges your business faces in implementing CE models in the Ghanaian plastic sector? • Prompt: Are there specific examples of how CE practices have impacted your business? • Rationale: Understand the practical implications of CE initiatives.
Closing Questions	7. Is there anything else you would like to share about your experiences with CE practices in Ghana's plastic industry? • Prompt: Are there any issues or opportunities we haven't discussed? • Rationale: Allow participants to raise additional insights or concerns.

	Guide for plastic recycling, manufacturing, and packaging businesses
Section	**Content**
Conclusion	• Thank the participant for their time and contributions. • Explain the next steps in the research process.

	Guide for environmental and circularity experts, non-profit, and advocacy groups
Section	**Content**
Introduction	• Thank the participant for their time and explain the purpose of the interview. • Assure confidentiality and obtain consent to record the interview.
Opening Questions	1. Can you describe your role in the plastic industry and your involvement in CE initiatives? • Prompt: How long have you been in this role? What are your main responsibilities? • Rationale: Establish context and understand the participant's perspective.
Main Questions	2. What are the main sustainability challenges businesses face when implementing CE practices in Ghana's plastic sector? • Prompt: Can you provide examples of specific challenges, such as cost, technology, or consumer behavior? • Rationale: Identify barriers to CE adoption. 3. How have government legislative initiatives contributed to a sustainable transition toward circularity in Ghana's plastic industry? • Prompt: Are there specific policies or regulations that have been particularly effective or ineffective? • Rationale: Evaluate the role of government in promoting circularity. 4. What are the primary critiques surrounding the CE as applied to the plastic industry in Ghana? • Prompt: Are there concerns about environmental, social, or economic

	Guide for environmental and circularity experts, non-profit, and advocacy groups
Section	**Content**
	impacts? • Rationale: Explore criticisms of CE practices. 5. What distinctive attributes are evident in the outcomes and processes of CE initiatives in Ghana's plastic industry? • Prompt: Can you describe any unique successes or challenges? • Rationale: Identify key characteristics of CE initiatives in Ghana. 6. How do these processes and outcomes influence the opportunities and challenges businesses face in implementing CE models in the Ghanaian plastic sector? • Prompt: Are there specific examples of how CE practices have impacted your business? • Rationale: Understand the practical implications of CE initiatives.
Closing Questions	7. Is there anything else you would like to share about your experiences with CE practices in Ghana's plastic industry? • Prompt: Are there any issues or opportunities we haven't discussed? • Rationale: Allow participants to raise additional insights or concerns.
Conclusion	• Thank the participant for their time and contributions. • Explain the next steps in the research process.

	Guide for informal plastic collectors
Section	**Content**
Introduction	• Purpose: Explain the purpose of the interview and how the information will be used. • Confidentiality: Assure the participant that their responses will remain confidential. • Consent: Obtain written consent to record the interview.

	Guide for informal plastic collectors
Section	**Content**
Section 1: Perspectives on Collaboration	1. How do you perceive your relationship with formal businesses in the plastic recycling sector? • Prompt: Do you feel valued as a partner in the recycling process? Why or why not? • Rationale: Explores the dynamics of the relationship between informal waste collectors and formal businesses. 2. What challenges do you face in collaborating with formal businesses, and how could these challenges be addressed? • Prompt: Are there issues with pricing, payment, or communication? What solutions would you suggest? • Rationale: Identifies barriers to collaboration and potential strategies for improvement. 3. What support or resources would help you improve your operations and income? • Prompt: Do you need access to better tools, training, or financial support? How would these help? • Rationale: Highlights the needs of informal waste collectors and potential interventions to enhance their livelihoods.
Section 2: Social and Economic Challenges	4. What are the main social and economic challenges you face as an informal waste collector? • Prompt: Do you face issues such as low wages, unsafe working conditions, or lack of social protection? • Rationale: Identifies the key challenges that affect the well-being and livelihoods of informal waste collectors. 5. How do you ensure fair wages and safe working conditions for yourself and others in your network? • Prompt: Do you negotiate prices with buyers? How do you protect yourself from health and safety risks? • Rationale: Explores strategies used by informal waste collectors to improve their working conditions. 6. What role do your cooperatives or associations play in addressing your challenges? • Prompt: Do you belong to a cooperative or association? How does it support you?

	Guide for informal plastic collectors
Section	**Content**
	• Rationale: Assesses the effectiveness of collective organisations in addressing the challenges faced by informal waste collectors.
Section 3: Environmental Contributions	7. How do your activities contribute to environmental sustainability in your community? • Prompt: Do you see your work as helping to reduce plastic pollution? How? • Rationale: Highlights the environmental benefits of informal waste collection and its role in promoting sustainability. 8. What challenges do you face in managing plastic waste sustainably, and how do you address them? • Prompt: Are there issues with sorting, storage, or transportation? How do you overcome these? • Rationale: Identifies the practical challenges of sustainable waste management and potential solutions. 9. How do you perceive the environmental impact of your work compared to formal waste management systems? • Prompt: Do you think informal waste collection is more or less effective than formal systems? Why? • Rationale: Explores the informal waste collectors' perspectives on their role in the broader waste management system.
Section 4: Additional Questions	10. Is there anything else you would like to share about your experiences as an informal waste collector? • Prompt: Are there any issues or opportunities we haven't discussed? • Rationale: Allows participants to raise additional insights or concerns that may not have been covered in the interview.
Conclusion	• Thank the participant for their time and contributions. • Explain the next steps in the research process.