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SUSTAINABILITY FINANCING AND INVESTMENT IN INTEGRATED WASTE MANAGEMENT: IMPLICATIONS FOR THE CIRCULAR ECONOMY IN GHANA

By

Daniel Agyapong

Doctoral thesis submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy

The Graduate School of Business Administration

University of the Witwatersrand

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ABSTRACT

The transition to a circular economy has been a major global developmental agenda, as reflected in the 17 Sustainable Development Goals (Agenda 2030). In line with this, Ghana has adopted the practice of integrating circularity into its development objectives to promote sustainability, particularly in the waste management sector, which has gained attention for its potential in efficient resource mobilization and access to secondary raw materials. However, despite policymakers integrating sustainability into the development framework, financing and investments in circular economy activities remain underexplored. Adequate financing and investments can transform waste streams into profitable projects and useful goods, such as recycling waste into secondary raw resources for further processing, recovering valuable resources like energy and precious metals, or converting waste into fuel or electricity through biological or thermal treatment.

The study examined sustainability financing and investment and implications for sustainable development in Ghana. The overarching aim of the thesis is to investigate the factors influencing circular economy financing and investment, the impact of such financing on circular economy practices, and the broader implications for the waste management sector in Ghana. The study is structured into three self-contained empirical chapters, each addressing specific objectives through distinct analyses. Chapter Three examined the determinants of circular economy financing and investment supply, emphasizing the moderating role of the financial environment. Chapter Four assessed the effect of circular economy finance and investment supply on the adoption of circular economy practices in the waste management sector. Chapter Five examined the implications of circular economy practices on the performance of firms in the integrated waste sector.

The study used a cross-sectional design and a quantitative research method. The target populations were the owner/managers of integrated waste management firms in the Environmental Service Providers Association of Ghana (ESPA) database. In all, there were 7,190 registered members of ESPA spread across the sixteen regions (16) of Ghana. A total of 524 firms participated in the survey. The data was collected using a closed-ended questionnaire consisting of a seven-point Likert-like scale. The analytical techniques were PLS-SEM, necessary condition analysis and partial correlation.

The results for Chapter Three revealed financial readiness and investment preparedness influence circular economy finance and investment supply. The country-level financial environment enhances the relationship between financial readiness, circular economy financing, and investment supply. Moreover, the country-level financial environment enhances the relationship between investment preparedness and circular economy finance and investment supply. Results for Chapter Four indicated that business environment, investment and finance are precursors of circular economy practices among waste management organisations. The result for Chapter Four also revealed that adequate and right investment supply, finance, and the appropriate business environment are necessary determinants for circular economy practices. The outcome of Chapter Five showed that waste recovery and upcycling positively and significantly affect firm performance in terms of economic, social, environmental, and governance. The results from the partial correlation network provide further insight into the nature of relationships among the circular economy practices and the associated drivers. The network diagram showed the importance of waste recovery, an important element in the waste hierarchy that significantly affects environmental performance. The network analysis shows waste recovery as a core activity because it is fundamental to subsequent circular economy practices such as upcycling.

It was recommended that waste management firms develop a solid alliance with financial institutions and green funding organisations in addition to formalising corporate processes. Also, incentives like tax breaks or subsidised taxes could be provided by policymakers to investors and waste management owners who adopt sustainable development or circular economy practices.

Keywords: Circular Economy Finance and Investment Supply, Financial Environment, Financial Readiness, Investment Preparedness

JEL Classification: E22, F64, F65, G21, G23, L25, L26, O16, Q53, Q560

LIST OF PUBLICATIONS AND RESEARCH OUTPUT

Before submission, portions of the thesis were published in peer-reviewed journals.

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree at this University or elsewhere.



Candidate's Signature……Date…… 26 February 2023

Name: Daniel Agyapong

DEDICATION

To my wife, Gloria Agyapong and children, Solidad Aseda Agyapong, Jaiden Ayeyi Agyapong, and Annaya Aboagyewa Adom Agyapong.

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I want to express my profound gratitude to my friend and lecturer, Dr. Daniel Ofori, from the University of Cape Coast, for his continuous support. His encouragement and assistance have been essential in keeping me motivated and focused. I also want to acknowledge all the faculty members of Wits Business School for their incredible support and mentorship. I would like to thank Prof. Jones Odei Mensah for his encouragement and academic guidance. Prof. Eric Schaling, PhD/Research Director, deserves special thanks for his strategic insights and advice which significantly shaped my research direction. Prof. Odongo Kodongo provided critical feedback that refined my work, and I am deeply grateful for his contributions.

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ABBREVIATION	MEANING
AU	African Union
AVE	Average Variable Extraction
BFR	Brominated Flame Retardants
CSIR	Centre for Scientific and Industrial Research
CFCs	Chlorofluorocarbons
CE	Circular Economy
CFA	Confirmatory Factor Analyses
CSR	Corporate Social Responsibility
EEE	Electrical and Electronic Equipment
EPA	Environmental Protection Act
ESPA	Environmental Service Providers Association
GTZ	German Agency for Technical Cooperation
GCF	Green Climate Fund
HTMT	Heterotrait-Monotrait Correlation Ratio
HCFCs	Hydrochlorofluorocarbons
IDCs	International Development Corporations
MMDAs	Metropolitan, Municipal and District Assemblies
NPAP	National Plastic Alliance Partnership
NCA	Necessary Condition Analyses
PLS-SEM	Partial Least Squares-Structural Equation Modelling
SCP	Sustainable Consumption, and Production
SDGs	Sustainable Development Goals
RBV	Resource-Based View
ZL	Zoomlion Ghana Limited

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

The United Nations issued a call to action in 2015 by establishing the seventeen Sustainable Development Goals (SDGs), often known as the United Nations 2030 Agenda for Sustainable Development. Some of the goals included developing actions to control natural resource depletion and the potential climate change consequences without complicating the resource demands of future generations. Regional and national agendas for sustainable development were triggered and set in motion by the United Nations Agenda 2030. According to the African Union Commission (AUC), the African Union's Agenda 2063 strategy which was introduced in 2015 closely resembles the United Nations' Agenda 2030 (AUC, 2015). In Ghana, medium- and long-term goals usually reaffirm these international and regional strategies. For instance, about 70% of the SDGs and Agenda 2063 are found in Ghana's Medium-Term National Development Policy Framework (2014–2021) (National Development Planning Commission, 2021).

Sustainable environmental management, sustainable consumption and production, and environmentally friendly corporate practices are aspects of these goals that are shared at national, regional, and international levels. SDGs 6, 11, and 12 collectively call on the global community to ensure access to and sustainable management of water and sanitation for all. These goals also advocate for the creation of inclusive, secure, resilient, and sustainable cities and human settlements, as well as the promotion of sustainable consumption and production practices. The range of global, regional, and national challenges—including climate change, natural disasters, pollution, deforestation, resource shortages, food insecurity, and health risks—caused by

economic and resource constraints underscores the urgency of these goals (Terragni, 2014; Kapur, 2016; World Resource Institute, 2017; Schwartz & Popovich, 2019).

These issues not only create physical, informational, and mental challenges but also introduce significant financial and investment hurdles. All sustainable development initiatives, whether national, regional, or international, require substantial funding. Sustainable investment is crucial for achieving global goals (Kapur, 2016; World Resource Institute, 2017). According to the 2013 World Economic Forum Green Investment Report, an additional USD 0.7 trillion annually is required to address climate-related challenges in sectors such as forestry, sustainable transportation, and renewable energy infrastructure.

Corporate entities have increasingly identified sustainable practices as a significant avenue for generating revenue (Mohanty, 2012). This is further reinforced by the waste-to-resource philosophy (Bharati et al., 2018). In this context, a circular economy is described as one in which businesses maximize the benefits they derive from resource use through recycling and regeneration (Stahel, 2016; Jorgensen & Pedersen, 2018; Agyapong, 2020). Firms' sustainability practices encompass their involvement in initiatives such as recycling, remanufacturing, reduction, recovery, and reinvestment.

Sustainable environmental management, consumption, and production, along with environmentally friendly corporate practices, are aligned with these goals at all levels. SDGs 6, 11, and 12 together emphasize the importance of guaranteeing sustainable access to water and sanitation while promoting the development of inclusive and sustainable cities and human settlements. They also encourage adopting sustainable production and consumption practices to tackle critical challenges. Global, regional, and national issues such as climate change, natural

disasters, pollution, deforestation, resource shortages, food insecurity, and health risks—largely driven by economic and resource pressures—highlight the timeliness of these goals (Terragni, 2014; Kapur, 2016; World Resource Institute, 2017; Schwartz & Popovich, 2019).

1.2 Statement of the Problem

Ghana faces a myriad of sustainability issues that require urgent attention. Climate change contributes to the country's global warming, while unsustainable business practices and inadequate household waste management contribute to environmental degradation. Additionally, resource depletion is significantly driving up the cost of goods and services. According to the Forestry Commission (2017), Ghana experienced an annual deforestation rate of 794,214 hectares between 2013 and 2015. Furthermore, reports indicate that the nation lost 60% of its forest cover between 1950 and the turn of the century (FAO, 2010; Forestry Commission, 2017).

Illegal surface mining, commonly referred to as galamsey, and logging are significant contributors to deforestation in Ghana. Moreover, galamsey activities not only pollute surface and groundwater but also reduce soil fertility (Antabe et al., 2017; Aboka, Cobbina & Doke, 2018). As a result of this pollution, freshwater sources for domestic and industrial use have become increasingly scarce. Additionally, plastic debris now blankets nearly every open area, sewer, and dump site. Studies by Kortei and Quansah (2016) and Lambert and Sabutey (2016) indicate that plastic waste constitutes a substantial portion of Ghana's total waste.

Furthermore, electronic and electrical waste (e-waste) has recently garnered attention due to its severe detrimental effects on both human health and the environment. However, research conducted by Mohanty (2012) and Baldé et al. (2014) suggests that effective management of e-

waste presents significant financial opportunities for society. In urban areas, issues related to food and water waste are also prevalent (Attipoe & ZaiGui, 2016). Additionally, challenges such as energy consumption and oil waste management further complicate the situation in the country.

The cumulative effects of these challenges—characterized by resource depletion and inadequate waste management—result in elevated levels of land, water, and air pollution, which pose serious threats to the nation. For instance, Raihan and Tuspekova (2022a) and Batala, Qiao, and Regmi (2023) argue that the depletion of forest resources drives climate change and increases temperatures. Wulandari, Utomo, and Narmaditya (2017) indicate that waste mismanagement adversely impacts public health and wellbeing. Similarly, Taghizadeh-Hesary and Taghizadeh-Hesary (2020) identify pollution as a major contributor to lung cancer. Waste mismanagement is a key source of pollution (Mihai et al., 2021), particularly in developing countries like Ghana.

The waste management crisis in Ghana is exacerbated by small to medium-sized enterprises that often lack the technical and financial capacity to address these challenges effectively. The question of financing and investment in integrated waste management remains a contentious issue. The eco-evolution theory (Ehrlich & Raven, 1964) posits that entities—whether living organisms or organizations—evolve in tandem with their environments (Baum & Singh, 1994). This concept has implications for understanding how human activities impact natural ecosystems and vice versa. From the perspective of the green growth hypothesis, current economic growth patterns are initially suboptimal due to resource misallocation among various production elements, underinvestment in natural resources, and overinvestment in activities that harm the environment (Chang et al., 2017). As previously suggested, these ideas emphasize the importance of

sustainability awareness but often fall short in addressing how to finance such initiatives or develop action plans to resolve these issues. The stakeholder theory closely aligns with the principles of green or sustainable funding, as it stresses the necessity of considering the interests of all stakeholders, including the environment, in decision-making processes. According to this theory, households, corporations, and the government have responsibilities as economic agents to consider the well-being of all stakeholders (Freeman et al., 2010). This responsibility encompasses efforts and strategies aimed at achieving both financial and ecological sustainability.

Ghana has taken steps to address the challenges of financing and investment in integrated waste management, including passing new legislation and amending existing laws to support sustainable development. For instance, the Environmental Protection Agency Act of 1994 (Act 490) proposed the establishment of the National Environment Fund to promote environmental education, research, and capacity building. This initiative was intended to equip individuals to effectively manage environmental issues. However, nearly 30 years later, no such fund has been created to mobilize the financial resources needed to tackle the country's environmental challenges.

Ghana also enacted the Hazardous and Electronic Waste Control and Management Act, 2016 (Act 917) to regulate the control, management, and disposal of hazardous, electrical, and electronic waste, among other objectives. A key provision of this law was the establishment of an e-waste fund to finance the management of electronic waste and mitigate its harmful effects on human health and the environment. However, despite the law being in place, there have been no disbursements from the fund to support e-waste management efforts in Ghana. Thes raise questions about the sources of financing and investment for waste management, particularly for e-waste. In

2020, Ghana developed the National Plastic Management Policy to establish a robust framework for managing plastics across their entire life cycle and value chain, aiming to transition the country toward a circular economy. However, the financial and investment considerations for implementing such initiatives remain largely unanswered. Furthermore, since the launch of the 17 Sustainable Development Goals (SDGs) in 2015 and the African Union's Agenda 2063, Ghana, like many other nations, has worked to integrate and align its national development strategies with these global and regional frameworks.

Ghana's Long-Term National Development Plan (2028–2057) aligns the country's five-point long-term goals with both the SDGs and the AU Agenda 2063. This plan incorporates the seventeen sustainable development goals and the twenty goals of Agenda 2063 (National Development Planning Commission, 2021). The rationale for adapting and adopting these global and regional targets is to synchronize the country's development efforts with broader international goals. However, a lack of a sustainable funding and investment plan is evident across government, business, and household levels. Investments and financing are often treated as secondary to sustainability initiatives, which could hinder the country's ability to fully realize its sustainability objectives.

Kortei and Quansah (2016) examined Ghana's plastic waste problem and recommended several solutions, including a gradual ban on plastic, the use of biodegradable alternatives, and the engineering of genetically modified organisms to break down unwanted plastics. However, like many similar studies, this one proposes strategies for managing plastic waste without addressing the financial and investment implications. Similarly, Sabutey (2016) argues that Ghana's waste

management challenges stem from a lack of public awareness. On the other hand, this author suggested that the lack of investment in waste management is primarily due to insufficient household income.

Public awareness and interest in waste management can significantly drive investment in this sector. Worlanyo and Jiangfeng (2021) highlighted that mining activities and mining waste negatively impact surface water, ultimately affecting the health of both people and wildlife. While these studies address the various waste streams and their societal impacts, they often overlook the financial and investment aspects of integrated waste management. Alongside examining the nature, types, and effects of waste, some research has also explored the relevance of finance and investment in sustainability efforts. In their short communication, Majunder and Chakraborti (2018) emphasized the critical role of finance in sustainability strategies, suggesting that effective sustainable development programs should integrate financing and investment components. Unfortunately, many studies fail to adequately incorporate these financial considerations.

Indeed, these researchers recognized the critical role of finance and investment in sustainability efforts. For instance, Annan-Aggrey, Bandauko, and Arku (2021) argued in a working paper that financial resources are essential for achieving the Sustainable Development Goals (SDGs), particularly in developing countries. Similarly, Agyapong (2017) suggested, through a documentary review approach, that both domestic and foreign funding should be utilized to secure adequate resources for managing electronic waste. However, these studies have primarily been exploratory rather than empirical. Additionally, the discussions surrounding sustainability financing and investment have tended to be quite general. Current research is increasingly focused

on financing and investments specifically within the integrated waste management sector in developing countries.

Furthermore, current literature emphasizes waste management practices and technologies, along with the adverse effects of improper waste management on the environment, health, and society. Although a few studies, such as those by Annan-Aggrey, Bandauko, and Arku (2021), Hajdys and Kogut-Jaworska (2018), and Agyapong (2017), have addressed funding and investments in waste management, they did not employ rigorous analytical techniques in their analyses. In contrast, the current study utilizes structural equation modeling, a method capable of handling small sample sizes and testing theoretical frameworks from a predictive perspective, particularly in cases where the structural model is complex.

1.3 Motivation

One of the primary motivations for the current study is the desire to facilitate the transition to a circular economy. Understanding how to finance such initiatives is essential as nations strive to achieve sustainable development goals. As previously highlighted in the works of Mihai et al. (2021), Wulandari, Utomo, and Narmaditya (2017), and Arfasa, Owusu-Sekyere, and Doke (2023), waste management poses a significant threat to both human health and the environment in developing countries, including Ghana. More importantly, it is crucial to assess how prepared businesses in the integrated waste management sector are for financing and investment. Currently, there is a limited understanding of the origins and drivers behind the financial efforts, models, supplies, and sustainability-related instruments within the circular economy. To date, no previous study has explored the phenomenon of sustainability finance in Ghana.

With the right funding structure and conducive environmental conditions, certain waste streams can be transformed into profitable ventures and useful products (Tulashie, Boadu, & Dapaah, 2019; Qiu et al., 2020). For instance, recycling can convert plastic and electronic waste into secondary resources for further processing in other industries (Awasthi et al., 2019; Qiu et al., 2020). Valuable resources such as plastics, precious metals, and secondary raw materials can be retrieved from waste (Agyapong, 2017; Tesfaya, Lindberg, & Hamuyuni, 2017). Lu (2018) found that waste can generate energy and raw materials, including metallic products. Similarly, Xue et al. (2008) described waste as a resource in transition. Lu (2018) concluded that biological or thermal treatment could convert general waste into fuel or electricity when resource recovery is not feasible. In 2022, the United Nations Development Programme estimated that Ghana generates approximately 12,710 metric tonnes of solid waste daily, of which only 10% is collected and disposed of properly. This implies that nearly 90% of the waste remains improperly collected, disposed of, or processed. The waste management sector is predominantly composed of small businesses with limited financial resources, complicating the challenge. There are relatively few larger organizations involved in waste collection, and those that exist typically collect and dump waste in designated landfill sites without adding or processing any value (Ministry of Sanitation and Water Resources, 2020).

Several landfill sites have been established across the country for towns and cities, illustrating this issue. Small-scale waste collectors exacerbate the problem with their rudimentary waste management methods, such as open burning (Owusu-Sekyere, 2022). In many instances, small-scale collectors only extract specific waste streams (e.g., copper wire); their limited technology often leads to the improper disposal of parts they cannot process. This suggests that appropriate

technology and infrastructure can transform waste into valuable products, but this transformation hinges on adequate financing and investment. Research on integrated waste management is crucial for developing nations like Ghana, which continue to grapple with managing increasing waste in cities, towns, and villages (Gbadamassi et al., 2020). Solid waste, encompassing plastic, metal, electronics, gaseous oil, and other liquid and solid materials, constitutes the majority of waste (Das et al., 2019). Numerous studies, including those by Adanu, Gbedemah, and Attah (2020), Mensah (2020), and Grant and Oteng-Ababio (2019), have documented diverse efforts aimed at initiating and implementing programs to address waste issues.

Adanu et al. (2020) focused on potential hazards, such as physical harm to individuals involved in e-waste operations, emphasizing the lack of technology stemming from financial constraints. However, this study did not investigate the financing and investment needs of waste management businesses. Mensah (2020) concentrated on proper waste management practices and concluded that these practices did not adhere to the waste management hierarchy. Grant and Oteng-Ababio (2019) examined the value of e-waste processing in Ghana, analyzing the roles of both formal and informal firms while highlighting the inadequacies of government policy and technology in promoting effective waste management. These studies reveal that the existing literature primarily addresses waste management practices and technology, as well as the negative consequences of improper waste management on the environment, health, and society. Only a few studies, including those by Annan-Aggrey, Bandauko, and Arku (2021), Hajdys and Kogut-Jaworska (2018), and Agyapong (2017), have tackled funding and investment in waste management, and they did not employ rigorous analytical techniques. In contrast, the current study utilizes structural equation

modeling, a method that can accommodate small sample sizes and test theoretical frameworks from a predictive perspective, particularly when the structural model is complex.

As previously indicated, studies such as Sarfo-Mensah (2019) propose that waste is a resource in transition. There is currently a growing interest among entrepreneurs and businesspeople in creating new products and businesses that transform waste into profitable ventures. Therefore, the availability of funds and investments to support initiatives in integrated waste management is crucial. However, current studies rarely describe the financial services and products accessible to waste management enterprises in Ghana. Additionally, existing financial structures may not adequately support the circular economy (Brunstein et al., 2019). Research has shown that numerous existing financial models have failed to serve their intended purposes (Geissdoerfer et al., 2017; Mähönen, 2019; Rizos et al., 2015). While sustainability financing models focus on socially responsible investing, traditional models emphasize profit and wealth maximization. Larson and Henderson (2022) and Martin (2024) argue that, whereas the sustainability investing model aims to balance financial returns with positive social, environmental, and governance impacts, traditional investing prioritizes financial returns. Traditional credit-granting institutions, for example, often adhere to the 5Cs (character, capacity, capital, collateral, and conditions) model; however, this may not be suitable for credit seekers engaged in sustainability activities.

Currently, there is no evidence that the traditional approach to financing and investment, which predominates in developing countries like Ghana, effectively supports sustainability initiatives, including waste management. The conventional financing model lacks the social and environmental focus that underpins sustainable financing and investment. Existing studies have

outlined various sustainable finance strategies relevant to developed economies. For instance, Soppe (2009) suggests strategies for financing sustainability, including sustainable corporate finance (SCF), which integrates a corporate entity's financial, social, and environmental considerations.

Kats et al. (2011) advocate for long-term state funding mechanisms and federal initiatives to raise financing for sustainability activities, including carbon market funding, mortgage-backed energy financing, and state/municipal loan programs. Lagoarde-Segot (2019) also proposed a regional-level sustainability financing approach. Although these financial strategies could support sustainability activities like waste management, variations in the financial environment and system may pose limitations. Therefore, an empirical investigation into the Ghanaian context is necessary to contribute to policy and practice. Ghana's quest to transition to a circular economy necessitates the effective management of all waste streams. This requires an investigation into strategy, technology, policy, finance, and investments, all of which are essential components for a successful transition to circularity. Previous studies in Ghana have extensively examined these elements, specifically focusing on sustainable financing and investment. Thus, the motivation for this study arose from the need to analyze the financial environment, its impact on financing and investment for the circular economy, and the nation's readiness to support sustainable financing. Furthermore, it aims to evaluate the readiness of firms in the waste management sector for financial planning and investment, which is a critical factor in attracting funding. Notably, no study has addressed the financial and investment readiness of the integrated waste management sector.

1.4 Research Objectives

The purpose of the study was to analyse sustainability financing and investment and its implications for sustainable development in Ghana. The specific objectives are:

1. To analyse the antecedents of circular economy financing and investment supply.
2. To assess the precursors of circular economy practices among waste management firms in Ghana.
3. To examine the implications of circular economy practices of firms in the integrated waste sector.

1.5 Research Questions

To analyse the sustainability financing and investment and implications for sustainable development in Ghana, the following questions were asked:

1. What are the antecedents of circular economy financing and investments supply?
2. What are the precursors of circular economy practices among waste management firms in Ghana?
3. What are the implications of circular economy practices of firms in the integrated waste sector?

1.6 Contributions of the Study

This thesis contributes to the knowledge on circular economy finance in Ghana and serves as a valuable reference document for informing policy and guiding practice in the waste management sector. These contributions are outlined below.

This study makes significant contributions to academic research by enhancing the understanding of circular economy finance and its determinants within Ghanaian waste management companies. It addresses a critical gap in the literature by examining how financial environments impact investment decisions in the circular economy. Additionally, it provides a framework for future research that could explore the relationships between financing, sustainability, and operational efficiency in similar contexts, thereby enriching the scholarly discourse on sustainable business practices.

The insights generated from this study hold substantial implications for policymakers. By highlighting the financial challenges faced by small waste management businesses, it encourages the development of targeted policies that facilitate access to financing. Recommendations for tax incentives or supportive regulatory frameworks could empower these businesses and stimulate foreign investment in the sector. Policymakers can utilize the findings to craft policies that align with the broader goals of sustainable development and economic growth, ultimately fostering a more resilient and environmentally conscious economy.

From a practical standpoint, the study offers actionable recommendations for waste management companies seeking to navigate their financial environments effectively. By advocating for the formalization of internal processes and the establishment of partnerships with financial institutions, it provides a roadmap for these firms to enhance their credibility and access necessary funding. Additionally, the emphasis on adopting circular economy principles encourages businesses to innovate and create sustainable practices that can lead to increased profitability. The

findings serve as a catalyst for change, inspiring stakeholders within the waste management sector to pursue sustainable practices and secure their role in the circular economy.

1.7 Limitations of Thesis

The thesis had some limitations. The instrument used did not permit respondents to give information other than the ones presented on the scale. Also, the longitudinal study methodology could have revealed a more accurate measurement of these organizations' performance. The analyses for integrated waste management firms did not consider cluster analysis. All waste management firms were treated as homogenous firms.

1.8 Organisation of the Thesis

The thesis consists of six chapters. The background, statement of the research problem, study motivation, research objectives, and questions are in Chapter One. The review of related literature is in Chapter Two and includes a theoretical assessment of the thesis. It looks at both theoretical and empirical ideas about where the circular economy came from, how it affects the waste management industry in terms of money and investments, and what effects circular economy practices have on businesses in the integrated waste industry. Chapters Three, Four and Five discussed the objectives of the research (or questions). Chapter Six of the study contains the summary, conclusions, and recommendations. The chapter also suggests possible areas for further research.

1.9 Chapter Summary

Chapter One provides the introduction to the study on sustainability financing and investment in Ghana's integrated waste management sector. It contextualizes the research within the frameworks of the United Nations' Sustainable Development Goals (SDGs) and the African Union's Agenda

2063, highlighting the urgency of addressing critical sustainability issues like climate change and waste mismanagement. The chapter identifies key environmental challenges, including deforestation and plastic waste, linked to unsustainable practices and inadequate financial support. It emphasizes the motivation for transitioning to a circular economy and the necessity of understanding financial mechanisms to support this shift. The chapter outlines research objectives focused on analyzing circular economy financing and assessing practices among waste management firms while articulating specific research questions. Finally, it highlights the study's contributions to policy and practice, aiming to enhance the financial environment for waste management and outlining the thesis organization for subsequent chapters.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter of the dissertation delved into an extensive review of literature pertinent to the study's objectives. It encompassed three main sections: conceptual review, theoretical review, empirical review, and the development of a conceptual framework. the conceptual review, literature pertaining to the core concepts central to the study was synthesized. This included definitions and discussions around sustainability financing, circular economy practices, integrated waste management, and the specific environmental and economic contexts in which these concepts operate. The conceptual review aimed to establish a clear understanding of the key terms and their interrelationships within the study's scope.

The theoretical review section provided a comprehensive examination of the theoretical foundations that underpin the study. It explored various theories relevant to sustainability financing and investment, focusing on how these theories inform the understanding of financial mechanisms in waste management sectors, particularly in developing countries like Ghana. The empirical review critically analysed existing studies that directly relate to each of the study objectives. This section reviewed empirical research conducted in similar contexts, examining findings and methodologies used in exploring sustainability financing in waste management sectors. It identified gaps and insights from previous studies that contributed to shaping the research questions and hypotheses.

Lastly, the conceptual framework visually depicted the interplay between the study objectives, theoretical underpinnings, and empirical findings. It provided a structured overview that connected theoretical concepts with practical applications, illustrating how theories inform the study's exploration of sustainability financing and investment in Ghana's integrated waste management sector.

2.2 Conceptual Review

This section of the study presents on the review of the key concepts.

2.2.1 Integrated Waste Management Sector in Ghana

Ghana is currently grappling with a waste management crisis, as evidenced by the indiscriminate disposal of waste in urban areas. This issue is particularly acute in major cities and towns in Ghana (Knott, 2020). The challenges stem from poor behavioural control exhibited by households, commercial establishments, and waste management service providers. Inadequate, ineffective, or unaffordable service delivery arrangements exacerbate these issues (Kassah, 2020). According to Lissah et al. (2021), waste transfer stations are often poorly located and insufficient in number, leading to irregular waste collection. Door-to-door collection services are prevalent, especially in metropolitan areas, but private sector providers tend to serve selectively due to ambiguous zoning regulations, leaving marginalised households underserved or resorting to informal waste disposal methods.

Waste collection and transportation in Ghana are predominantly handled by private sector providers, varying in size and operational models (Bening, Kahlert & Asiedu, 2022). According to the Ministry of Sanitation and Water Resources (2020), primary waste collection involves door-

to-door or curb-based services provided by formal contractors working for local government bodies or informal small-scale providers serving households directly. Secondary collection focuses on national-scale waste evacuation services for communal skip containers and public areas, managed under the Sanitation Improvement Package (SIP). The SIP, a critical component of Ghana's waste management system, involves service agreements between MMDAs and private providers at the national level.

Most urban areas in Ghana rely on designated dump sites managed by local government contractors. However, there is a lack of widespread waste reduction, re-use, and recycling initiatives across the country (Gyeduaah, 2020). Ad-hoc recycling activities occasionally occur, primarily in Ghana's urban centres. Because there are few recycling facilities nationwide, these regions frequently receive recyclables for processing. The waste management sector in Ghana mainly focuses on common recyclable materials such as single-use plastics, e-waste plastics, and other subtypes such as cardboard, glass, and metals (Ministry of Sanitation and Water Resources, 2020). While there are a variety of recycling facilities, ranging from informal aggregation points to small-scale enterprises, there is little investment available for advanced and commercially sustainable recycling businesses capable of producing export-grade recyclables.

2.2.2 Waste Contributors in Ghana

The main environmental issue facing authorities in Ghana is the disposal of trash, especially solid waste. With a population of 27,043,093 in 2017 and an estimated garbage output rate of 0.47 per person per day, Ghana generated 12,710 metric tonnes of rubbish daily. The United Nations estimates that Ghana's population will reach 32,790,257 by 2023, with each individual expected to produce 15,411 metric tonnes of trash daily. The detrimental effects of garbage in the numerous

towns and cities throughout Ghana are a result of the country's ongoing population growth and related economic activity. Tacoli (2012) emphasised that garbage generation outpaces waste management in emerging nations. Over time, a variety of sources, types, and classifications of solid waste have emerged. According to Abdel-Shafy and Mansour (2018), the main sources are home garbage, waste from buildings, waste from businesses, automobile wrecks, other worn-out parts, and industrial waste. According to Chati's (2012) classification, garbage falls into commercial waste (waste that originates from residential sources, excluding those related to cooking and eating), institutional waste (including waste from schools, state offices, prisons, and hospitals). Tchobanoglous et al. (1993) submitted construction and demolition waste as other type. These wastes are generated by repairs to individual residences, commercial buildings, and other structures. Other forms include waste from razed buildings, broken-out streets, sidewalks, and bridges. Others include municipal waste that emanate from street sweeping, roadside litter, landscaping, municipal litter, dead animals, abandoned vehicles, and tree trimmings. There are also trash include agricultural waste, industrial solid waste, and garbage from treatment plants.

Evidence from studies such as Nabegu (2010), Nagabooshnam (2011), and Okot-Okumu (2012) indicates that most of the waste produced in developing countries emanates from households. According to them, the household generates about fifty-five to eighty percent (55%–80%) of solid waste, and the remaining ten to thirty percent (10%–30%) emanates from economic activities such as market areas and institutions, among others. Valkenburg et al. (2008) further stressed that the waste generated from these sources is very heterogeneous and possesses variable physical features depending on its specific source.

According to Okine (2014), waste from used electrical and electronic equipment (UEEE), normally referred to as e-waste, is another major source of waste. Okine (2014) opined that, like many other developing countries, Ghana has become a recipient of large volumes of UEEE, mostly from developed countries. The author emphasized that Ghana lacks an effective mechanism to control and manage the import of obsolete and non-functioning UEEEs. Also, enforcement authorities at the various ports in Ghana do not have the necessary or sufficient logistical, technical, and legal ability to handle the flow of such equipment into the country. Okine (2014) further stated that while Energy Commission officials seize prohibited and banned UEEE imports such as used air conditioners, refrigerator freezers, and other freezers, the country currently does not physically examine its WEEE imports at the ports to determine whether they are e-waste or not, due to a lack of legislation in that regard (Yousif & Scott, 2007).

2.2.3 Composition of Waste in Ghana

In both urban and rural settings, waste disposal is a serious and pervasive issue in many developed and developing nations (Hussein & Mona, 2018). For instance, in some of Vietnam's largest cities, organic waste makes up roughly 60%–70% of the total trash, while plastics make up 10%–15% of the waste. In Ghana, waste production ranges from 0.2 to 0.8 kg per individual per day, which is also the same as the total amount of waste produced in many West African towns (UNEP, 2013). According to this estimation, individuals in the highest socioeconomic class generated the most waste of the highest quality, followed by those in the middle and lower classes, respectively. This implies that the composition of waste is critical in both developed and developing countries. However, the collection and disposal of waste is currently a problem in several countries (Hussein & Mona, 2018). The composition of waste is critical for proper handling and effective waste management.

The composition of waste materials determines the potential for recovery and recycling of usable resources, as well as emissions during waste processing and final disposal. For waste management planning and decision-making, knowledge of waste composition is essential. Effective techniques are required to evaluate the impact of governmental, logistical, and technological actions on the waste stream. Analysing trash trends and their composition regularly is required to gauge the success of such initiatives. The Waste Composition Analysis (WCA) research provides data on the weight of the components that make up a particular waste stream. To accomplish this, we must collect samples from various waste streams and sort them into weighted groups based on a predetermined criterion. Meizah et al. (2015) report that 61% of garbage in Ghana is organic, 14% is plastic, six percent is inert, five percent is paper, three percent is metal, one percent is leather and rubber, and five percent is other.

Waste in Ghana typically consists of municipal organic waste and Agri-industrial leftovers (non-municipal waste). Market remnants, solid waste, sewage waste, and waste from food production comprise municipal garbage. The Agri-industrial residues include oil palm, fruit, cocoa, starch, breweries, cashew processing, animal farming, and slaughterhouses (Ghana Market Survey, 2019). Homes dispose of fifty-eight percent (58%) of their solid waste in approved dumping sites, 25% in other unmarked areas, and only 15% not collected (Bowan & Tierobaar, 2014). Because of garbage collection and transportation factors, determining the composition of waste has become difficult. Poor bin collection techniques, collection, transfer, and/or transport systems have a significant impact on solid waste properties. Poor route design, a lack of knowledge about the

collection schedule, the number of vehicles used for collection, bad roads, and inadequate infrastructure can also impact the characteristics of solid trash.

In general, Ghana's waste composition has turned into a problem rather than a chance for circular economic operations. Particularly for plastic residues. Ghana collects approximately 9.5% of its annual production of 840,000 metric tonnes of plastic garbage for recycling. More than 2,000 trash collectors are improving the environment by scrubbing down sewers, beaches, and other places. Currently, electronic trash (e-waste) is getting a lot of attention. The issue of e-waste in the country has piqued the government's interest. The government initiated a programme in cooperation with the European Union to ensure the correct waste composition of e-waste. We launched the "E-waste Management in Ghana: From Grave to Cradle" initiative to educate and raise awareness about e-waste.

Major cities in Ghana generate 2000 metric tonnes of mixed municipal waste every day, of which 80% is collected (Cofie et al., 2009). People dispose of waste either publicly or at one of the few easily accessible landfills. There are now just five landfills in Ghana, and the bulk of them are not functional. Due to the absence of a landfill in Accra, the city transfers the majority of its waste to Kpone. Tema, a city 24 kilometres distant. Compared to plastic garbage, organic waste in Ghana has not received as much attention (Ghana Market Survey, 2019).

2.2.3.1 Plastics

The amount of plastic produced worldwide in 2017 was 348 million metric tonnes (Trust Magazine, 2020). Despite growing concerns about the environmental issues associated with both plastic manufacturing and plastic waste, recent predictions indicate that plastic output and related

trash will quadruple by 2035 (European Commission, 2018). From 1950 to 2017, the creation of an estimated 9,200 million metric tonnes of plastic resulted in 75% of it becoming waste. Of this garbage, less than 10% was recycled. What's left? We either burn, dispose of, or allow these items to pollute our rivers, lakes, and seas (Gardner, 2022; Lamb et al., 2018). The European Union recently sought a study on the possibility of taxing plastic items to reduce the amount of plastic waste polluting the environment and the oceans (Walker et al., 2020). In 2018, the EU began a programme to recycle all plastic packaging by 2030 (World Bank Group, 2018). As a result of the current global trend, garbage creation will eventually overtake population growth.

By 2050, global trash will contain twice as much plastic. Managing such a large volume of garbage responsibly is one of the biggest challenges for countries around the world. Since waste management is a complicated issue, we must take the necessary actions to strive towards sustainable solid waste management that is suitable from an environmental, economic, and social standpoint. Data on solid waste production and management are essential for local government and planning (Sharma & Jain, 2020). Plastics enter the ocean and the marine food chain at the present rate of 11 million metric tonnes annually, which includes our seafood (Gardner, 2022; Garcia, Fang & Lin, 2019).

The garbage that is tossed into the environment rather than being collected accounts for two-thirds of the land-based plastic debris that ends up in the seas, while the remaining one-third is the product of ineffective waste management techniques. According to some studies, a one percent decline in marine ecosystem services may cost the world's ecosystems $500 billion a year. We still do not fully understand how micro- and nano-plastics affect both human and ecological

health. Recent research revealed that 2,400 chemicals used in the production of plastics are potentially harmful to human health. They include substances that mimic, block, or otherwise alter the action of hormones (Gardner, 2022; Lamb et al., 2018).

2.2.3.2 Electronic Waste

Since 2014, the global amount of electronic trash (e-waste) has increased by 9.2 million metric tonnes, and projections indicate that it will reach 7.7 million metric tonnes by 2030. Asia created the most e-waste (24.9 Mt) in 2019, followed by America (13.1 Mt) and Europe (12 Mt). E-waste production in Africa and Oceania was 2.9 MT and 0.7 MT, respectively (Global E-waste Monitor, 2020). Screens and displays (6.7 Mt), small IT and communications equipment (4.7 Mt), lights (4.7 Mt), big equipment (13.1 Mt), tiny equipment (17.4 Mt), and temperature exchange equipment (10.8 Mt) made up most of the world's e-waste in 2019. (0.9 Mt). "E-waste" refers to electrical and electronic equipment discarded without any consideration for reuse (Gupta, 2011). EEE consumes at higher rates, has shorter life cycles, and offers fewer repair options, all contributing to an increase in e-waste (Arya & Kumar, 2020).

Toxic materials found in e-waste, such as mercury, brominated flame retardants (BFR), chlorofluorocarbons (CFCs), and hydrochlorofluorocarbons (HCFCs), both threaten the environment and human health (Shittu, Williams & Shaw, 2021). Rising rates of e-waste, poor collection rates, and ecologically irresponsible disposal and treatment increase the risks to the environment and human health (Li & Achal, 2020). The management of e-waste accomplishes some of the sustainable development objectives (SDGs). These include SDGs 3 (excellent health and well-being), 6 (clean water and sanitation), 8 (decent job and economic growth), and 14 (life below water) (Forti, Baldé, Kuehr & Bel, 2020).

2.2.3.3 Organic Waste

Food trash is responsible for a significant portion of organic waste produced worldwide. The Food Agricultural Organisation (FAO) estimates that each year, we lose 30 percent, or around 1.3 billion metric tonnes, of all food produced globally. Food waste is both a resource waste and a significant source of greenhouse gases that contribute to climate change (FAO, 2010). This impacts the economy, environmental sustainability, and food security. According to World Bank Group data from 2018, organic waste makes up around 44% of all globally managed solid waste. However, as growing nations move from lower to medium and higher income levels, increasing urbanization and population expansion make it increasingly difficult to manage waste collection, removal, and treatment (Sharma & Jain, 2020). Globally, food waste accounts for a sizable amount of organic waste.

The Food Agriculture Organisation estimates that food waste accounts for around 1.3 billion metric tonnes annually, or 30% of all food produced worldwide. Food waste is not only a waste of resources, but it also has a significant impact on climate change through GHG emissions (FAO, 2010). This poses a problem for the sustainability of the environment, the economy, and food security. The World Bank Group estimates that in 2018, organic garbage made up around 44% of all solid waste managed globally. However, rapid urbanisation and population growth make the collection, disposal, and treatment of waste more and more challenging to handle (Sharma & Jain, 2020). As developing countries move from lower-income levels to middle- and higher-income levels, their organic waste management conditions also change. According to Kumar et al. (2017), unmanaged rubbish hinders Ghana's economic growth, pollutes the seas, clogs sewers, spreads illnesses, and worsens breathing problems.

Recycling organic wastes for agricultural use has the potential to become a viable solution that will allow for value addition and innovative applications. Organic wastes are a bountiful source of organic matter and vital plant nutrients (Sharma et al., 2019). The total quantity of garbage produced in low-income nations is predicted to have grown by more than three times by 2050 (World Bank Report, 2023).

2.2.4 Waste Management in Ghana

The Environmental Protection Act of Ghana from 1993 defines trash as any abandoned, undesired, or surplus item, regardless of its intended sale, recycling, reprocessing, recovery, or purification (EPA, 2009). Typically, we label items as garbage when they cease to function as intended or when the owner no longer considers them valuable. With a daily output of 13,000 metric tonnes of solid trash, Ghana produces an average of 0.45 kg of solid waste per day, or 3.0 million metric tonnes, annually (Miezah et al., 2015; Foray, 2012; Puopiel, 2010). Now, managing solid waste is the responsibility of several Metropolitan, Municipal, and District Assemblies (MMDAs) around the country.

Techniques and practices for solid waste management have significantly changed over time. The cost of adoption, the ease and simplicity of the strategy, the accessibility of technology, and the strategy's environmental friendliness are all factors in its progression. In Ghana, waste management methods, most of which are unrelated to engineering, involve gathering and disposing of landfill sites. A few assemblies have created sanitary landfills. Other assemblies rely on dirty open-dumping techniques (Adu-Boahen, 2012). Up until 1985, Ghana's main rubbish disposal strategy included incinerators (Kyere, Addaney & Akudugu, 2019). This model has

trouble remaining viable due to financial support. The only option left was waste disposal at every location (Asase & Oduro-Kwarteng, 2010). The Ghanaian government established the Waste Management Department as a brand-new component to manage waste. The German Agency for Technical Cooperation (GTZ) provided funding for the department (Kyere, Addaney & Akudugu, 2019).

2.2.4.1 Urban Waste Management

To minimise its effects on people and the environment, garbage must be collected, handled, dumped, controlled, and monitored (Pacione, 2005; Anomanyo, 2004). Trash management is defined by the United Nations Statistics Division as "all the activities and actions required to handle waste from its conception to its final disposal." Okine (2014) asserts that waste management must consider the diverse types of waste and their impact from various analyses and measurements. As a result, we can manage waste from a financial, business, and environmental perspective to minimise its impact. Over time, most developing nations, including Ghana, have identified the metropolitan areas as the primary producers and sources of trash. This has significantly expanded due to the increasing population and the expansion of urban infrastructure (Dorji et al., 2019). According to Dorji (2017), managing waste in cities has been a very challenging task. Waste's quality and substance have evolved because of the ongoing changes in lifestyle and consumption patterns, which have a growingly negative impact on these cities.

In metropolitan areas, dry trash from households and offices, organic waste from hotels and restaurants, and waste from food and vegetable markets are the most common types of trash. Business owners and other junk dealers benefit from waste management innovation (Rebehy, Costa, Campello, de Freitas Espinoza, & Neto, 2017). According to Rebehy et al. (2017), waste

management can lead to people starting small enterprises and finding other employment opportunities. There are ways to ensure trash reduction, separation, processing, management, recycling, and reuse. Solutions for improving urban trash collection, management, and disposal can improve both urban settlements' social behaviour and climate. Three of the strategies for controlling garbage in metropolitan areas include incineration, sanitary landfills, and waste recycling.

The incineration method of waste management involves the process of burning waste materials and substances. It is the most used technique in countries with a lack of landfills, and it is also particularly prevalent in Ghana's rural areas and other developing nations. Experts have described this method as both highly impactful and hazardous. Therefore, while this method significantly reduces waste, it also leads to contamination. Examples include hospital waste and hazardous waste produced by manufacturing operations. Sanitary landfills typically identify and select large areas away from people, where they then dump or deposit their waste. This method typically involves sorting the waste into different categories based on similarities and composition and dumping it accordingly.

Waste recycling is the process of converting used or discarded materials into new, useful materials or products. Recycling is critical because it reduces energy consumption and helps to control air, water, and land populations. A certain level of innovation is required to ensure the proper recycling of waste. Individuals, households, and personal waste in offices can recycle themselves, provided they possess some creative skills. Research indicates that this method is the most effective in reducing costs and generating income.

2.2.5 Characteristics of Waste Management Firms in Ghana

Despite numerous laws, the informal sector largely dominates the waste management space. There is currently no single database for integrated waste management firms in the country, except for the Environmental Service Providers Association (ESPA). The association has membership in sixteen (16) regions of Ghana. It is by far Ghana's largest and most comprehensive database of integrated waste organizations. Members of ESPA are private waste management companies working in a public-private partnership (PPP) arrangement to manage waste in the Metropolitan, Municipal, and District Assemblies (MMDAs).

The largest waste management companies, including Zoomlion Ghana Limited (ZL), comprise ESPA. Established in 2006, Zoomlion Ghana Limited (ZL) manages over eighty-five thousand (85,000) workers under various PPP arrangements, with a core staff of three thousand (3,000). Others include the J. Stanley Owusu (JSO) Group, incorporated in 1970. JSO works in various sectors of the economy, engaging in recycling, landfill management systems, and waste treatment. Information on the size of JSO and similar integrated waste management systems is not readily available. Figure 2.1 presents the characteristics of the various categories of integrated waste management firms found in the ESPA database.

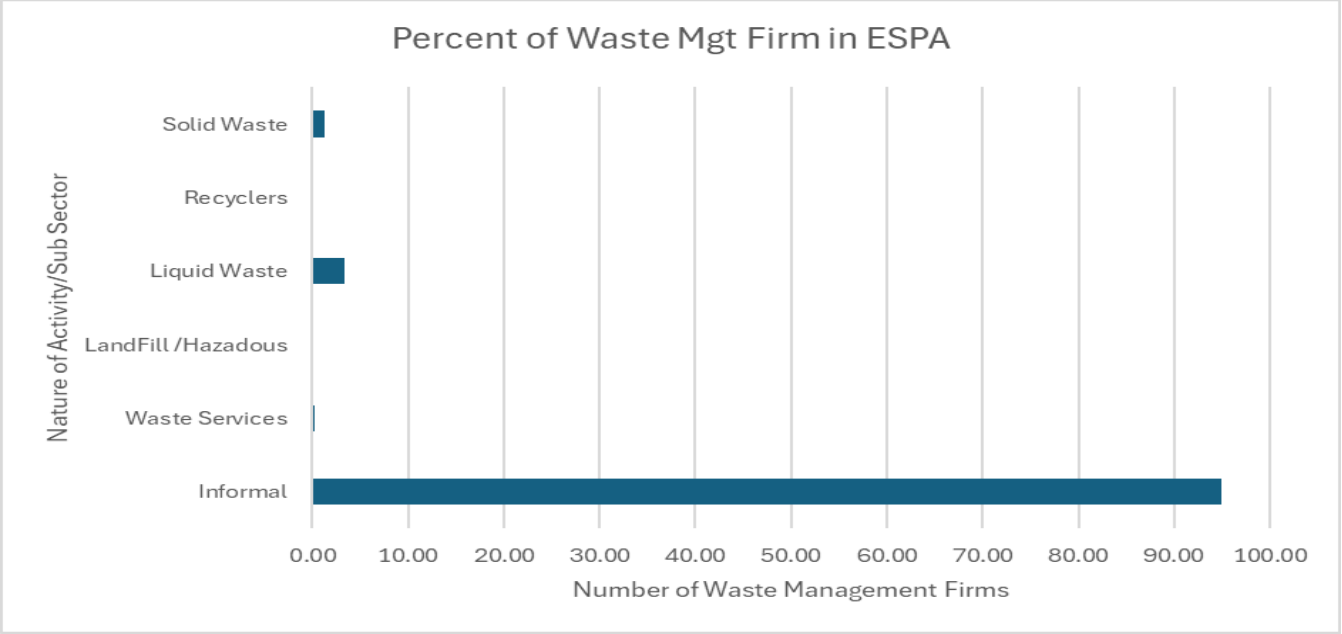


Figure 2.1. Integrated Waste Management Organisations
Source: The Environmental Services Providers Association Database, 2020

According to Figure 2.1, 95% (6,831) of the firms are in the informal sector, with only about 5% (359) in formal business. This is a reflection of the situation in Ghana's general waste management landscape. The characteristics of the informal waste management sector are that the firms are largely micro firms, unregistered, and often employ crude methods in their operations, thus compounding the sustainability challenges with regards to waste. Another intriguing characteristic of the informal waste management firms is that they worked with individual clients and households, whereas larger formal firms like Zoomlion Ghana Limited work with the MMDAs and thus are able to raise a sizable investment to build waste management infrastructure.

Furthermore, Figure 2.1 shows that less than one percent (5 firms) are involved in recycling. This also indicates that few waste management companies are involved in waste processing. Informal waste processors fill the gap in the number of waste management processing firms. However, the

lack of appropriate technology and financial constraints have rendered the waste management activities of these micro firms unsustainable. Among other things, micro firms' waste management practices include open-buying (Owusu-Sekyere, 2022). This practice tends to negatively affect the environment. The few larger waste management firms, such as Zoomlion Ghana Limited, with their considerable number and state-of-the-art equipment, can engage in relatively more proper waste management activities than the micro firms.

For instance, since 2019, Zoom lion has projected to spend US$20 million on the construction of recycling plants across the country (Takouleu, 2019). Takouleu (2019) expects the construction of these plants to supply 100 metric tonnes of organic compost per day, thereby reducing chemical fertiliser imports by 864,000 per year. The plants also plan to create a total of 1,000 youth jobs. This implies that implementing waste management requires significant financial resources and investment if it is to have a significant impact on Ghana's economy.

2.2.6 Financing of Waste Management

Over the years, manual collection, landfilling, and improper disposal of waste have characterised Ghana's waste management system. However, this approach has typically been ineffective and unsustainable because of the low wages paid to workers engaged in waste collection at the municipal level. The massive amount of rubbish produced daily in these cities overburden the waste management firms with modern infrastructure for collection (Meizah et al., 2015; Mensah, 2005). Local authorities anticipate dedicating between 50 and 70 percent of their budget to trash management (Ocran, 2006). Additionally, the Ghanaian government spends GHS 6.7 million a year on garbage collection and disposal, as well as GHS 550,000 every month on paying waste contractors and maintaining landfills (Water and Sanitation Programme, 2012).

To reduce waste disposal problems and their consequences, the Ghanaian government settled debts amounting to $200 million to waste management contractors in 2019 (Teta et al., 2020). The Ministry of Sanitation and Water Resources published the Medium-Term Expenditure Framework for 2019–2022, revealing that the government of Ghana has allocated GHS 71,047,355 to address liquid waste, solid waste, environmental management, health, and hygiene education. In 2019, the Ministry also received donations amounting to GHS164,187,158 and GHS2,394,867 from internally generated funds for sanitation management (Ministry of Sanitation and Water Resources, 2019). The Ministry authorised a budget of GHS255,531,354.00 for the 2017 fiscal year, allocating GHS3,919,475.00 for goods and services for the industry's internal management.

We set aside a capital expenditure budget of GHS28,000,000.00 to implement programmes and projects in sanitation and water. We allocated a total of GHS216,122,028 to the donor and set aside GHS5,094,774 for employee remuneration. We paid out sums of GHS1,498,978.00 and GHS5,094,774.00 for supplies and services and employee remuneration, respectively, from the permitted budget. Capital expenses received no release. Within the same time frame, donor funds and internally generated fund expenditures totalled GHS205,960,000.00 and GHS1,470,000.00, respectively.

2.2.7 Recycling of Waste

Approximately 9.5 per cent of Ghana's annual plastic waste production (840,000 tonnes), is collected for recycling. Beaches, sewers, and other areas are being cleaned up with the assistance of more than 2,000 garbage pickers. Typically, 40% of solid waste is recyclable and 29% is compostable (Agyei, 2020). Recycling trash has become a popular financial option around the

country, despite the high cost of collection. Some businesses may lower their demand for raw materials, energy, and water while simultaneously reducing the requirement for waste treatment, discharge, and disposal by utilising garbage recycling technology.

Recycling waste is a beneficial tactic for improving items' economic competitiveness. Nineteen per cent (19%) of all imported plastic items are made from recycled plastic, compared to a meagre 0.1 per cent from plastic reuse. The research estimates that Ghana produces 12.710 tonnes of solid trash per day for the total population or 0.47 kilogram per person per day. Several enterprises have formed in Ghana due to diminishing concentrations of important metals in electronic items and miniaturised products, which are increasingly difficult to recycle. One such sector that is having problems right now is recycling.

More research has been conducted since the previous e-waste monitor was released in 2017 on the connections between unlimited e-waste recycling and unfavourable health impacts. Large populations might be in danger in hotspots for recycling e-waste. It does not follow that a country does not have an e-waste problem if there is no concentrated region for e-waste recycling. E-waste is a part of a larger waste context that is typically collected door to door or disposed of alongside other rubbish in landfills. Waste-pickers, who are among the most vulnerable and impoverished people in communities across the world, might be exposed (Gutberlet & Uddin, 2017). E-waste is commonly recycled locally in Latin American towns, as opposed to being centralised (UNIDO, 2022).

Around 51 trillion plastic particles may be present in the oceans and along the shoreline, and 12.7 million tonnes of plastic garbage wash into the sea each year, according to the United Nations Environment Programme (Mambra, 2020). The regional capital of Accra is home to many plastic waste recycling plants. The firms driving Accra's effort to manage plastic trash include 3G Plastic Limited, GP Waste Recycle Company Ltd, Universal Royal, and Super Paper Product Co. Ltd. These businesses are some of those involved in the recycling of waste. These companies collect and recycle plastic waste from small-scale pickers and Zoomlion Company (Okai, 2020). Water supply companies Bela Aqua and Voltic make a significant contribution to reducing plastic waste by collecting their customers' plastic water bottles for recycling. For instance, the cleaning staff at our school site gathers used water bottles and sells them for a set price per kilogram to these recycling companies in the area.

In Ghana, only a small selection of plastics is recycled (Kortei & Quansah, 2016). Ghana could annually save millions of gallons of oil and countless cubic metres of landfill space if it, like industrialised nations, could recycle 50% of its plastic garbage (Agbai, 2018). If the plastic garbage produced in Ghana could be recycled, GHS1.2 million might be created each month, according to a feasibility study by the Centre for Scientific and Industrial Research (CSIR) (Teta et al., 2020).

2.2.8 Investment preparedness and financial readiness

Investment preparedness entails multiple factors, such as securing foreign equity financing and ensuring enterprises are prepared to participate in this type of funding. Equity aversion, investability, and presentational faults are the main components of investment preparedness. Myers (1984) emphasizes that small and medium-sized enterprises frequently oppose equity

capital because owners are reluctant to give up ownership and control as their company grows (Hutchinson, 1995; Howorth, 2001; Oakey, 2007). Entrepreneurs typically exhibit hesitation when considering equity funding, viewing it as relinquishing a share of ownership in their company. Equity aversion among entrepreneurs may result from a lack of comprehension regarding market dynamics and other funding options (Van Auken, 2001).

Insufficient understanding of the various financial sources typically causes many potential venture capital candidates to be ineffective in their presentations. Improved understanding of how different financial instruments support organizations' growth can motivate more enterprises to explore equity funding (Mason & Kwok, 2010). However, the problem goes beyond just knowledge to the basic preparedness of firms for investment, referred to as investability. Studies (Granz, Henn & Lutz, 2020; Capizzi, Croce & Tenca, 2022) show that many businesses looking for outside funding do not match the requirements established by venture capital firms and business angel investors.

The investment decision-making process consists of two separate stages. Investors initially assess prospects using predetermined criteria, including industry sector, firm stage, investment amount, and geographical location (Granz, Henn & Lutz, 2020). While evaluating possible investments, business angels prioritize aligning investment prospects with their criteria (Mason & Kwok, 2010). Geographical location, financial needs, and market knowledge have a substantial impact on investment choices. Therefore, investors frequently reject enterprises that do not meet these criteria due to a discrepancy between entrepreneurs' presentations and their standards.

Identifying appropriate investors can be somewhat challenging, because most business angels choose to maintain anonymity. The appraisal process persists as possible investments face additional examination, with rejections usually linked to entrepreneurial or company-related deficiencies (Feeney et al., 1999). These factors may consist of a lack of entrepreneurial foresight, honesty, or dedication, along with shortcomings in managerial skills, marketing tactics, and financial forecasts. The majority of rejected possibilities have several problems, whereas those excluded after thorough evaluation usually have fundamental concerns that make them inappropriate for investment (Mason & Harrison, 1996).

Reuter (2020) found that business angels' decision-making shows that companies without focus, thorough market data, and a distinctive selling offer frequently struggle to attract funding. Investors prioritize unique features that differentiate products or services from competitors and lead to long-term competitive advantages. Ventures must meet these requirements to make themselves more appealing to potential investors. Investment preparedness entails overcoming equity aversion and presenting a compelling investment argument that aligns with investors' expectations and preferences.

2.2.9 Circular economy practices

In addressing the challenges of the twenty-first century, which encompass economic, social, and environmental dimensions, the limitations of the prevailing linear economic model become evident. A critical imperative emerges to devise innovative approaches capable of mitigating the adverse impacts of existing production processes (Genovese et al., 2017). Central to this discourse is the imperative of developing a model that effectively integrates environmental, social, and

economic considerations. Numerous organisations actively pursue the implementation of the circular economy (CE), a prominent paradigm that aims to achieve this overarching objective.

The core idea of the circular economy (CE) is to prolong the life of products and create closed cycles for resources, waste, and components. The Circular Economy (CE), in contrast to the conventional "cradle to grave" approach, advocates for a "cradle to cradle" philosophy that incorporates products back into the production cycle instead of discarding them (Maqbool et al., 2020). By embracing this paradigm, the CE holds the potential to mitigate the adverse social and environmental impacts inherent in traditional supply chains. Furthermore, the circular economy encourages enterprises to implement resource-efficient methods, leading to increased value generation (Khan & Haleem, 2020; Bag et al., 2019). This involves retrieving, renewing, and reusing products and components that have reached the end of their functional lifespan (Govindan & Hasanagic, 2018).

Academic and professional circles widely discuss both the concepts of circular economy and sustainability, each with its unique focus and approach. Sustainability encompasses economic, environmental, and social goals, while the CE focuses on closed-loop systems to improve resource management and reduce waste (Govindan, Soleimani & Kannan, 2015). The circular economy model is essential for improving supply chain and business sustainability by implementing circular business practices to maximise resource efficiency and minimise environmental harm (De Angelis, Howard & Miemczyk, 2018; Luthra & Mangla, 2018). Circular business models strive to minimise carbon footprints and incorporate environmental considerations into operational frameworks by utilising principles of reuse, reduction, and recycling (Favi et al., 2016; Yazdani,

Gonzalez & Chatterjee, 2019). Implementing circular practices requires strong techniques for assessment and tracking.

Recent literature discusses different approaches for assessing circularity in supply chains, such as circularity indices and performance metrics (Elia, Gnoni & Tornese, 2017; Gaustad et al., 2018; Gusmerotti et al., 2019). Research emphasises the significance of overcoming obstacles in adopting circular business models, including the involvement of senior management and external factors (Dubey et al., 2019; Shahbazi et al., 2016; Bressanelli, Perona & Saccani, 2018). Organisations can help create a more sustainable and resilient economic landscape by overcoming these hurdles and promoting circular practices.

Scholars and practitioners have extensively researched to identify and tackle difficulties related to transitioning to circular business models. Masi et al. (2018) performed an extensive survey and literature study to identify barriers and possible circular business models. Subsequent research, such as Garza-Reyes et al. (2019), has enhanced their work by broadening the range of circular practices. According to Dubey et al. (2019), research has focused on elements of circularity, namely the effects of external factors and top management participation on supplier relationship management practices in the circular economy.

Empirical research has explored the practical consequences of circular practices within various situations, in addition to conceptual improvements. Shahbazi et al. (2016), for instance, evaluated the potential for boosting material efficiency in Swedish manufacturing businesses while identifying constraints that may hamper growth. Bressanelli, Perona and Saccani (2018)

conducted a comprehensive assessment to pinpoint 24 possible obstacles to supply chain redesign in the context of the circular economy. The rise of the circular economy as a central focus of academic research and real-world implementation highlights its importance as a powerful agent of change in modern business environments.

The discussion on the circular economy is advancing from theoretical models to practical research, propelled by the need to tackle economic, social, and environmental issues simultaneously. Organisations may improve their sustainability and promote a more equitable and resilient economy for future generations by applying circular ideas and adopting innovative business models. The circular economy signifies a fundamental change from linear consumption patterns to a regenerative and sustainable resource utilisation method. By collaborating, innovating, and aligning strategically, stakeholders from all industries can utilise the transformative power of the circular economy to create a fairer and more environmentally responsible future.

2.2.10 Circular economy finance and investment supply

The circular economy is gaining ground as a tactic for achieving local, societal, and global sustainability (CE). A circular economy prioritizes sharing, reusing, renting, repairing, and recycling already-existing resources and goods for as long as it is practical. It has received increased attention from multinational firms and policymakers in industrialised countries (Čičková et al., 2015). A theory of economics known as the "circular economy" aims to minimise waste and make the most of our limited resources. It offers an alternative to the traditional linear economy, which relies on taking resources out of their finite supply, converting them into things, consuming those goods, and finally throwing the goods away.

With a focus on the design-based implementation of the model's three guiding principles, CE seeks to address problems including biodiversity loss, climate change, waste, and pollution. The three guiding principles required to make the switch to a circular economy are eliminating waste and pollution, rotating commodities and resources, and ecological regeneration (Korhonen, Nuur, Feldmann & Birkie, 2018). According to Schroeder, Anggraeni and Weber (2019), circular economy projects aim to reduce overconsumption, eliminate waste, and restore and replenish ecosystems and natural resources. We need new financial tools and investments to facilitate the wider adoption of these business models and technologies (Centobelli et al., 2020).

Financial institutions and investors are under increasing pressure to address sustainability issues in their portfolios as the effects of global warming are becoming more widely understood. One way to do this is to invest in initiatives that promote the growth of the circular economy. Investments in the circular economy can also achieve Sustainable Development Goals (SDGs), particularly SDG 12 (sustainable consumption and production) (Rodriguez-Anton et al., 2019). According to MacArthur (2020), the financial sector is starting to acknowledge the potential of the circular economy. Over the past several years, there has been a significant surge in the development of debt and equity instruments associated with the circular economy.

By the middle of 2020, leading providers including BlackRock, Credit Suisse, and Goldman Sachs had established eleven public equity funds that were primarily or devoted to the circular economy. In contrast, no such fund existed in 2017. Since 2016, the volume of private market funds supporting circular economy initiatives has increased. This includes venture capital,

private equity, and private debt. Bank lending, project funding, and insurers all display a similar tendency. In partnership with five of the largest national financial institutions and banks in Europe, the European Investment Bank launched a loan and investment programme worth €10 billion for the circular economy.

Intesa Sanpaolo introduced a €5 billion credit facility. These illustrations highlight the potential advantages of the circular economy for asset managers, banks, and other financial services firms. The assets managed by public equity funds with the circular economy as their sole or primary investment focus have increased sixfold since the start of 2020, from USD 0.3 billion to over USD 2.0 billion, demonstrating how it may attract money. In the first half of 2020, these funds exceeded the Morningstar category benchmarks by an average of five percentage points, illustrating the potential for extra earnings from the circular economy. If outperformance persists over time, more research will be required. Now is the time for finance to seize this momentum and speed up the shift to a circular economy.

Although the current increase in finance is encouraging, scaling the circular economy and realizing its full potential will require significantly more funding and effort (Mendoza, Gallego-Schmid, & Azapagic, 2019; Hofstetter et al., 2021). All parts of finance will aid in advancing the transformation to a circular economy. Investors, banks, and other providers of financial services possess the scale, scope, and expertise necessary to support and assist in the transition of businesses. This necessitates not only investing in fully circular companies or divesting from extractive ones, but also engaging with and assisting enterprises in every sector to make the move. Governments, central banks, and financial regulators can support and enable

transformation in the private sector. Governments have the authority to actively support innovations and circular economy-related initiatives, set policies, and level the playing field, for example, by using pricing externalities (Preston, 2012). The policies Ghana has historically taken the lead in implementing to support greener economic development across Africa will enable the emergence of a circular economy in Ghana. Ghana's National Plastics Authority is formulating a circular plastics strategy. The Plastic Alliance Partnership (NPAP). Ghana recently became the first nation in Africa to join the Global Plastic Alliance Partnership. The African Development Bank funds the African Circular Economy Alliance, which Ghana also joined to spread the best circular economy policies throughout Africa (Virtanen & Kojo Sakyi, 2018).

Ghana's ecosystem is suffering serious damage due to unethical corporate business activities and inadequate household waste management practices. As a result, the SDGs' global call to action from 2015 was appropriate. Plastic garbage has practically filled the nation's open spaces, sewers, and landfills, destroying the habitat for plants and animals, and eroding the natural beauty of the land. According to studies by Ofori and Opoku Mensah (2022), plastic waste makes up most of Ghana's garbage. There have been several national sustainability projects. Among these are adopting new legislation and amending current ones to take sustainability requirements into account. Additionally, efforts have been made to integrate sustainable development objectives into the nation's framework for national development policy. The circular economy idea is one of many management plans put up in response to the waste problem.

Homes, companies, and the government in Ghana produce the majority of the garbage (Ofori & Opoku Mensah, 2022). Despite considerable attention to its recycling pillar, knowledge of the

circular economy is still in its infancy. The current initiatives are all independent of one another and do not have a comprehensive framework that may promote collaboration and enable the revolutionary potential of the circular economy. The development of a Circular Economy Action Plan and Roadmap presents an opportunity to lead a comprehensive policy intervention that could lead to a change in several industries, including waste management, manufacturing, agriculture, extractive industries, and tourism. Additionally, this paradigm will accelerate Ghana's sustainable economic and social growth (Ali, Anufriev & Amfo, 2021).

The circular economy method, which is mostly adopted by the private sector and typically by small businesses that find it difficult to obtain the necessary financial assistance, places a strong emphasis on turning trash into usable resources. The availability of funding and the investment climate surrounding integrated waste management received relatively little attention from the SDGs and discussions about the circular economy over a decade (Mudu et al., 2021; MacArthur, 2020). At the national, business, and household levels, most strategic initiatives lack money and investment plans. However, these initiatives don't significantly contribute to the implementation of strategies aimed at addressing sustainability challenges. It would prevent the country from pursuing sustainable development (MacArthur, 2020).

2.2.11 Financial environments

The financial environment is a web of connected markets, middlemen, and tools. This ecosystem includes the conversion of savings into investments (Jeucken, 2010). An economic and commercial environment is necessary for a business to operate. The financial environment, or financial system, is part of a larger economic environment. Borrowers would have to obtain capital directly from savers in the absence of financial markets and institutions (Brandl, 2020; Stephen, 2018). It is easy

to imagine that in such a situation, very little borrowing would take place, given how difficult it would be for individuals who needed money to find others who were willing and able to loan it to them on the same terms (time, interest rate, collateral, etc.). In other words, we need "a double coincidence of wants." Consequently, a successful economy depends on a functioning financial system.

Every financial market has financial institutions that act as intermediaries. The equity market facilitates the sale of shares between firms and investors. Certain financial institutions act as middlemen by facilitating transactions between prospective buyers and sellers of shares at predetermined prices. Thanks to the debt markets, businesses can obtain debt financing from institutional and retail investors or transfer ownership of debt instruments between investors. Some financial institutions serve as middlemen by organising the transfer of funds in exchange for debt securities at a set price (Gonçalves et al., 2022; Yu et al., 2022). In this approach, it is common for one financial institution to act as the institutional investor, while other financial institutions act as the middleman, facilitating the transfer of funds to a business in need of capital.

Investors and financiers are those who provide capital to enterprises, governmental entities, or individuals in need. Individual investors most frequently contribute money to firms by purchasing their instruments or securities (stocks and debt instruments) (Yu et al., 2022). The state of the nation's finances influences the relationship between financial readiness, capital availability, and investments in the circular economy. The financial environment at the national level further strengthens the relationship between investment readiness, financing for the circular economy, and investment supply. Studies by Yaoteng and Xin (2022); Nedopil Wang et al. (2022); and Tian

(2018) further generate discussion on circular economy finance options that may promote the expansion of green businesses.

These authors agree that institutions and policies can help combat climate change. The ecological finance theory contends that the financial environment, including investments and organisations' access to money, is incidental to the efficient operation of the financial system. Additionally, firms in the waste management sector, especially those from developing countries, confront obstacles and financial incentives to adopt environmentally friendly business practices. These companies' access to finance and investment in the circular economy may either encourage or limit them, depending on their level of financial and investment readiness. Masi, Day and Godsell's (2017) paper underlines the necessity of financial support in the recycling sector, where financial support through subsidies and other incentives is vital (Pan, 2015).

Numerous studies have highlighted public subsidies as a factor supporting research, development, and innovation activity (Pereiras & Orejas, 2006). Ghisetti and Rennings (2014), and Triguero Cuerva and Alvarez-Aledo (2017) both point out the advantages of public subsidies for implementing environmental innovation in firms. Since they lack the necessary funds, small enterprises need stronger government support to develop sustainable manufacturing techniques, as demonstrated by Moktadir et al. (2018). By providing businesses with financial tools that support resource conservation, the circular economy, and waste avoidance or reduction, banks, insurers, and investors may play a significant role in the circular economy (Zhongming, 2020). Financial institutions now lack the circular knowledge, capabilities, resources, and services required to capitalise on economic opportunities.

2.3 Theoretical Review

This section reviewed the theories that underpin the study.

2.3.1 Ecological Finance Theory

The ecological finance theory emphasises the importance of aligning financial models and policies with social and biogeophysical limits (Xiaochuan, 2004; Lagoarde-Segot & Martinez, 2020). This suggests that in the Ghanaian context, circular economy financing and investments should prioritise sustainability objectives alongside economic considerations. By analysing the antecedents and determinants of circular economy financing, the study can identify factors that influence the adoption and implementation of sustainable financing practices among waste management firms in Ghana.

Secondly, the ecological finance theory underscores the interconnectedness between organisations and financial institutions in maintaining social and environmental resilience (Lagoarde-Segot & Martínez, 2021). This suggests that waste management firms in Ghana should integrate circular economy practices into the wider financial ecosystem. The study assessed the precursors of circular economy practices among waste management firms by examining how financial systems and organisational environments influence the adoption of sustainable practices.

Furthermore, the theory highlights the role of the financial environment, financial system, and financial ecological control in shaping investment decisions and corporate operations (Wei et al., 2015). By examining the implications of circular economy practices among waste management firms in Ghana, the study can elucidate how sustainable financing and investments contribute to the integrated waste sector's development and resilience. This includes evaluating the environmental and social impacts of circular economy practices, as well as their financial

implications for firms operating within the waste management industry. Drawing on the Ecological Finance Theory, this thesis assessed the drivers, challenges, and opportunities associated with circular economy practices among waste management firms, ultimately contributing to more effective strategies for sustainable development in Ghana.

2.3.2 The Natural Resource-Based Theory

The resource-based view (RBV) emphasises how an organisation's internal and external resources, which are expensive, challenging to duplicate, and non-substitutable, at least temporarily, provide the skills that support a firm's competitive edge (Wernerfelt, 1984; Barney, 1991). The thesis suggests that having control, possession, and efficient use of resources are strategically important for creating value and gaining a competitive advantage (Frimpong et al., 2022). Grant (1991) emphasises the importance of assessing resources, analysing capabilities, and identifying resource constraints in order to gain a competitive advantage.

Within sustainability financing and investment, the RBV proposes that organisations strategically manage their resources to seek funding and investment for circular economy activities. This entails assessing the presence of internal resources such as organizational capital, human capital, and physical capital (Barney, 1991) and integrating them with circular economy goals. Organisations can improve their appeal to investors and financing institutions by efficiently using their internal resources, which can help secure circular economy finance and investment. The RBV theory frequently fails to consider the limitations imposed by external sources, such as the biophysical environment (Hart, 1995). When examining circular economy techniques in Ghanaian waste management firms, it is critical to consider the environmental constraints and legal frameworks that impact resource utilisation and waste management tactics. The transition to a circular

economy model demonstrates an increasing recognition of the limited availability of natural resources and the necessity for sustainable resource management methods (Hart, 1995).

The use of the RBV framework in Ghana's integrated garbage sector underscores the importance of developing capacities that foster sustainable development and enhance resource effectiveness. Waste management organizations can reduce environmental impacts and improve resource utilization efficiency by implementing circular economy strategies, including garbage recovery and upcycling. The Resource-Based View (RBV) approach highlights the importance of aligning organisational capabilities with circular economy goals to accomplish sustainable development objectives. Ultimately, the RBV theory offers useful perspectives on sustainable financing, investment, and circular economy practices in Ghana's waste management sector. Organisations can support sustainable growth and promote circular economy concepts in Ghana's waste management business by utilising internal resources, aligning capabilities with circular economy goals, and overcoming environmental restrictions.

In the context of integrated waste management firms in Ghana, the natural resource-based theory provides valuable insights into how these companies can develop and sustain competitive advantages through circular economy practices. By focusing on environmental capabilities, such as efficient waste segregation, recycling technologies, and resource recovery systems, these firms can optimize their operations to minimize waste and maximize resource use. This approach aligns with circular economy principles, enabling firms to reduce costs, enhance profitability, and address the growing demand for sustainable waste management solutions in Ghana.

Moreover, the NRBT emphasizes the role of innovation and external pressures, such as regulatory requirements and market demands, in driving the adoption of circular economy practices. For integrated waste management firms in Ghana, investing in cutting-edge recycling technologies and responding proactively to environmental regulations can position them as leaders in the industry. By doing so, these firms not only contribute to Ghana's sustainability goals but also secure long-term competitive advantages, turning waste into valuable resources and playing a crucial role in the country's transition to a more sustainable economy.

2.3.3 The Corporate Sustainability Principle

Within sustainability, the circular economy is a key notion that is driving significant disruptive change. The circular economy, as defined by the Ellen MacArthur Foundation, is a new approach focused on restoring natural resources, encouraging ongoing use of products and materials, and minimising waste and pollution (Purwanto & Prasetio, 2021). This stands in sharp contrast to the linear economy's approach of extracting resources and disposing of them, providing a sustainable alternative (Lobova & Tyryshkin, 2021). The waste-to-resource paradigm is central to the circular economy, emphasising the crucial function of waste management organisations. They exemplify the practical implementation of circular economy ideas through their actions to regenerate resources, minimise waste, and reduce pollution (Purwanto & Prasetio, 2021).

The circular economy aligns well with the overall discussion on business sustainability as proposed by Kantabutra and Ketprapakorn (2020) and WCED (1987). Corporate sustainability theory proposes that corporations can provide lasting value by promoting moral, cultural, environmental, social, and economic well-being (Mehmaz, 2019). Furthermore, the shift to a circular economy relies on a diverse and comprehensive strategy. The concept encompasses internal operations inside companies, reactions from stakeholders, and the necessity of

harmonious coexistence among businesses, society, and government (Ofori et al., 2021). This change is critical to the financial environment. Brussels et al. (2021) argue that macroeconomic circumstances and regulatory frameworks play a crucial role in shaping the acceptance of circularity.

The waste-to-wealth concept emphasises the interconnectedness of growth and sustainability, promoting a unified approach to circularity (Lacy & Ruttqvist, 2015). The shift to circularity requires a comprehensive approach that considers regulatory, economic, and social aspects (Oliveira et al., 2021). The theoretical framework of sustainability financing and investment in the circular economy highlights the interdependence of economic, social, and environmental aspects. Understanding the factors that lead to funding in the circular economy, the impact of the financial setting, and the consequences for circular economy practices is crucial for advancing sustainable development goals, particularly in regions like Ghana where these shifts hold significant potential.

2.3.4 The Stakeholder Theory

The stakeholder theory (Freeman, 1984) is a component of businesses' sustainability thinking as part of the larger body of theory relating to sustainable development. The philosophy of sustainable development promotes growth that satisfies the requirements of the present generation without sacrificing the capacity to satiate future generations (World Commission on Environment and Development, 1987). This suggests businesses prioritise social, environmental, and economic benefits (Elkington, 1997). According to the stakeholder theory, economic agents, including households, enterprises, and the government, are accountable to all stakeholders (Freeman et al., 2010).

According to the theory's premises, an organisation must do everything in its power to maximise the value of its stakeholders, including taking the demands of the environment into account. The approach places a strong emphasis on creating sustainable prosperity for its core and auxiliary stakeholders. Stakeholders may impact the corporation's operations, a crucial point to consider. They use their influence, particularly when their interests are not being pursued. They accomplish this by acting badly towards the company. Through their actions, they can persuade financiers or stakeholders to stop investing in the company. Additionally, they can encourage lawmakers to pass laws to protect stakeholders' interests, when necessary, which will prompt regulators to act.

The Stakeholder Theory, which emphasizes the importance of balancing the interests of all stakeholders in a business, provides a compelling framework for understanding the implications of circular economy practices among integrated waste management firms in Ghana. In this context, stakeholders include not only shareholders and employees but also customers, local communities, government agencies, and the environment itself. By adopting circular economy practices, these firms can create value for a broad range of stakeholders, enhancing their overall social, environmental, and economic impact.

For instance, implementing circular economy practices can lead to improved waste management efficiency and resource recovery, benefiting the environment by reducing landfill use and pollution. This directly supports the interests of environmental stakeholders and aligns with government sustainability goals. Additionally, local communities' benefit from cleaner environments and potentially new job opportunities created through recycling and remanufacturing processes. Customers also gain from these practices as they become part of a more sustainable supply chain, potentially leading to cost savings and increased brand loyalty. By addressing the needs and

expectations of these diverse stakeholders through circular economy practices, integrated waste management firms in Ghana can strengthen their reputation, foster long-term relationships, and contribute to sustainable development, thereby achieving a balanced and responsible approach to business.

2.3.5 Summary of the Theoretical Review

The ecological finance theory, as described by Xiaochuan (2004), and Lagoarde-Segot and Martinez (2020), is a crucial element of this paradigm. It emphasizes the importance of aligning financial models and policies with social and bio-geophysical constraints, particularly in Ghana. This idea advocates for the integration of circular economy concepts into funding and investment decisions, underscoring the importance of prioritizing sustainability goals alongside economic factors. It is essential to use this method to pinpoint the elements that impact the acceptance and execution of sustainable financing methods by waste management companies in Ghana.

Sapountzaki (2007) emphasises the interdependence of organisations and financial institutions in upholding environmental and social resilience. Understanding the integration of circular economy techniques into Ghana's larger financial environment is crucial from this viewpoint. Wei et al. (2015) add depth to this theory by emphasizing the influence of the financial environment, system, and ecological control on investment decisions and company operations. Understanding the interconnectedness of sustainable finance and investments aids in assessing their role in enhancing the development and resilience of the integrated waste industry, as well as their environmental, social, and financial effects.

The natural resource-based theory, in conjunction with the ecological finance theory, highlights the strategic use of resources to gain a competitive edge, as outlined by Wernerfelt (1984), Barney (1991), and further developed by Frimpong et al. (2022) and Minola and Cassia (2012). This idea suggests that the management, ownership, and effective utilisation of resources are crucial for generating value and achieving a competitive advantage. To secure sustainable funding and investment in the field of waste management in Ghana, organizations must efficiently utilize internal resources and match competencies with circular economy goals. Grant (1991) emphasises the significance of evaluating resources, analysing capabilities, and acknowledging resource restrictions for waste management companies to adapt to environmental limitations and regulatory frameworks that impact resource allocation.

The framework highlights the connection between financial models that support environmental and social objectives, efficient resource management, and the overall organisational and financial environment. This comprehensive strategy allows waste management companies in Ghana to effectively deal with the challenges of sustainable development by balancing economic profitability with environmental protection and social accountability. By doing this, they can make a substantial contribution to the country's sustainable development objectives, establishing a model for other sectors to emulate.

The corporate sustainability principle enhances the existing framework established by the Ecological Finance Theory and the Natural Resource-Based Theory. This notion, emphasised by Mehmaz (2019), Purwanto and Prasetio (2021), and Lobova and Tyryshkin (2021), underscores the obligation of corporations to promote environmental, social, and economic well-being. This

principle is very relevant in Ghana's waste management sector. The circular economy, a type of sustainable economic model, focuses on restoring natural resources and reducing waste and pollution. Waste management organisations contribute to sustainable prosperity by applying circular economy principles, including legal, economic, and social aspects. This principle requires organizations to consider financial and resource optimization, as well as integrating environmental stewardship and social responsibility into their fundamental operations and strategy.

The stakeholder theory, as presented by Freeman (1984), Elkington (1997), and Freeman et al. (2010), adds a crucial aspect to the framework. Firms have a responsibility to consider the interests of all stakeholders, especially those about environmental issues. In Ghana's waste management business, the focus is on prioritising the interests of investors, customers, the community, the environment, and other stakeholders impacted by the firms' activities. This approach promotes achieving equilibrium by satisfying stakeholder needs and considering environmental elements to mitigate risks related to stakeholder discontent and enhance long-term sustainability.

Combining the ecological finance theory, the natural resource-based theory, the corporate sustainability principle, and the stakeholder theory forms a thorough and multi-faceted framework. This paradigm offers a strong foundation for comprehending and tackling sustainability issues in Ghana's waste management sector. It highlights the significance of connecting financial models with environmental and social goals, strategically managing resources, promoting corporate sustainability, and addressing stakeholder issues. Organizations can effectively manage the intricate process of funding and investing in sustainability by adopting

this integrated strategy, ensuring that their actions have a positive impact on the nation's environmental resilience and sustainable development.

2.4 Empirical Review

This section of the study reviewed related literature on the study objectives.

2.4.1 The Antecedents of Circular Economy Finance and Investment Supply

The firm dynamic capabilities' framework (Nelson, 1991), the natural resource-based view (Hart, 1995), and the legitimacy theory (Suchman, 1995) explain the linkage between finance and circular economy practices. The dynamic capabilities framework explains the firm's strategic move to create, extend, integrate, modify, and deploy its financial resources to enable it to take advantage of the opportunities in the circular economy ecosystem. The key issue is how they systematically and efficiently allocate internal financial resources to achieve the needed sustainable and competitive outcome. This implies that the nature of a firm's internal resources (internal capabilities) impacts its financial readiness and investment preparedness within the financial environment.

Engaging senior managers of financial institutions is one of the precursors of sustainability finance (Kawabata, 2019). Senior managers decide on the financial institutions' strategic financing and investment decisions, which is why it is necessary to involve them. Samuwai and Hills (2018) stress preparation as the key to successful climate finance. According to Hjalager et al. (2022), green financing components include the availability of infrastructure for green investments, financial incentives for making green investments, awareness of green investments among businesses, government support, and the firm’s strategic plan. Other factors include knowledge of

green capital availability and green capital mobilisation methods. The antecedents of a circular economy cause businesses to have a greater sense of responsibility and make more effort to engage in circular operations. Additionally, they mirror the expectations of their various stakeholders. If businesses want to stay in business for an extended period of time, in that case, they must satisfy stakeholders and innovate sustainably. Therefore, the study hypothesised that:

H_1: Financial readiness and investment preparedness have a positive influence on circular economy finance and investment supply.

Berensmann and Lindenberg (2016) stressed the importance of banks, institutional investors, global financial institutions, regulators, and central banks in their analysis of the factors affecting sustainable financing and investments. These actors are the primary architects behind the creation, application, and enforcement of laws supporting the financial system's greening, and their actions have an impact on the financial market environment. According to Lau et al. (2024), eco-fiscal and eco-monetary policies, which are elements of the financial environment, encourage investments and financing in the sustainability sector. The Ellen MacArthur Foundation (2020) cites the development and promotion of circular financing and investment products as a strategy to boost operations in the industry when analysing sustainability finance and investment within the context of the circular economy.

As a result, financial institutions must promote circular economy financial services and products. Meanwhile, it is necessary to examine whether traditional financial system practitioners are aware of the challenges associated with sustainability financing and its consequences. The issue is even more severe in developing nations, where the idea of a green economy is still evolving.

Institutional theory discusses the type of environmental impact on the enterprise's activities (Hussain & Hoque, 2002; Zattoni & Cuomo, 2008; Kloviene, 2012). Research (Ismanu & Kusmintarti, 2020; Shahbaz et al., 2020; Zhang et al., 2020) has examined the impact of the business environment on the firm's activities. The focus has, however, been on advanced economies. There are limited studies on the effect of the financial environment on eco-business in Sub-Saharan African countries, including Ghana. Meanwhile, the context may make it inappropriate to apply findings from other environments due to the differences in social and economic structure.

The firm dynamic capabilities' framework (Nelson, 1991), the natural resource-based view (Hart, 1995), and the legitimacy theory (Suchman, 1995) explain the linkage between finance and circular economy practices. The dynamic capabilities framework explains the firm's strategic move to create, extend, integrate, modify, and deploy its financial resources in a manner that enables it to advantage over the opportunities in the circular economy ecosystem. The key issue is how they systematically and efficiently allocate internal financial resources to achieve the needed sustainable and competitive outcome. This implies that the nature of a firm's internal resources (internal capabilities) impacts its financial readiness and investment preparedness within the financial environment.

According to Schoenmaker (2019), preventing financial institutions from engaging in certain practices is the first step towards sustainable finance. Studies on sustainability in developing nations have concentrated on green supply chains, firm performance, and non-financial performance, as well as green banking practices, green financing behavior, and environmental

performance (Agyabeng Mensah et al., 2020; Yusof et al., 2020). Furthermore, firm management should be able to accommodate the demands of the financial environment and the firm's objectives to achieve a competitive advantage. A firm's internal operations impact its financial readiness and investment preparedness within the financial environment. The study, therefore, hypothesised that the:

H_2: financial environment plays a moderating role in the relationship between financial readiness and circular economy financial and investment supply.

H_3: financial environment plays a moderating role in the relationship between investment preparedness and circular economy financial and investment supply.

2.4.2 Precursors of Circular Economy Practices

Circular economy practices are predicted by market, technological, regulatory, and firm-specific variables (Cai & Zhou, 2014). De Jesus and Menonca (2018) reiterate this and mention social, institutional, and legislative considerations as the driving forces behind the move to a circular economy. Goovaerts and Verbeek (2018) contend that financial institutions help businesses make the shift to the circular economy by giving them access to financial resources. As a result, Aranda-Uson (2019) observed that state subsidies, the quality of a company's financial resources, and the availability of cash all have a favourable impact on circular economy projects. However, Atan et al. (2018) did not discover any evidence of a connection between ESG measures and company financial performance. From empirical assessments, sustainability practices are impacted by the type of financial model and scheme (Schoenmaker, 2017; Al Breiki & Nobanee, 2019; La Torre et al., 2019). That is, the availability of financing and investment options geared towards sustainability will probably encourage the use of the circular economy.

Studies like those by Goovaerts and Verbeek (2018) and Aranda-Uson (2019) imply a connection between finance and the circular economy. According to Ghisetti and Montresor (2020), the adoption of circular economy techniques is facilitated by conventional funding channels. Circular accounting reporting, measuring and analysing a company's financial and non-financial performance to reflect circularity, was proposed by Mrowczyska, Fischer, and Nusseck (2021) as essential for circular economy practices. According to Bianchi et al. (2022), how organisations view control has an impact on their choice to adopt circular economy methods. Based on this, it was hypothesised that:

H1: The firm's internal financial environment is a precursor to its circular economy practices.

H1a: The firm's financial readiness is a precursor to its circular economy practices.

H1b: The firm's investment preparedness is a precursor of its circular economy practices.

$H_{1c:}$ *The firm-level financial environment is a precursor to its circular economy practices*.

Acheampong (2016) suggested that after considering internal resources and largely retained earnings, an organisation's value proposition defines its financing needs, emphasising the necessity for external financing. It promotes credibility, judicial independence, justice, and market transparency. It also serves as a fair regulatory framework that ensures transparency and accountability to improve the business climate and promote healthy economic activity (Avram, Grosanu & Rachisan, 2015). Mrowczyska et al. (2021) claim that accounting and finance are the driving forces behind the shift to a circular economy.

In general, research articles on national governance acknowledge the importance of country-level governance quality. They contend that an effective national government is an important engine of advancement in both the economy and society (Rachisan, Bota-Avram & Grosanu, 2017). However, corporate compliance and commercial organisations' adherence to a nation's legal framework strongly depend on effective governance at the national level (Agyemang, Fantini & Frimpong, 2015). The transition to a circular economy is influenced by the external financial environment, regional sustainable financing policy, the Economic Community of West African States (ECOWAS), the African Union, and the United Nations Sustainable Development Goals (Raes, 2020).

International development corporations (IDCs) have reportedly been at the forefront of funding several circular economy initiatives in Ghana. Countries have benefited from financing for upcoming climate action through the Green Climate Fund (GCF, 2022). FDI into Ghana surged by 39% in 2021 to reach US$2.6 billion (World Investment Report, 2022). In terms of the volume of FDI influx in 2021, the nation placed second in ECOWAS and seventh in Africa. However, Ghana's integrated trash sector does not receive a lot of foreign direct investment (FDI). The extractive and construction industries, which frequently cause environmental issues in the nation, are priority areas for investment. Given the global effort to raise private money for investments in ecologically friendly projects (Ananthakrishnan et al., 2022), we anticipate that these initiatives will influence Ghana's shift towards a circular economy.

Additionally, there is a global initiative to include sustainability within the framework of financial policy to mobilise funding for sustainable growth (Kreibiehl & Patel, 2014; Chiu,

2022). In general, donor organisations are now sponsoring green economy projects because they are interested in financing sustainability. There are several financial market programs and new products, such as green bonds, to promote activities like renewable energy, energy efficiency, sustainable waste management, and land use (HSBC, 2015). Green mortgages, Eco-Fund, Carbon Funds, Carbon Banks, and impact investment efforts are additional financial innovations and products in the circular finance sector (Blyth & Baron, 2003; Louman et al., 2020). Maheshwari et al. (2016), however, believed that a green transformation of the financial sector should include strong measures that track progress.

The circular economy financing strategy is relatively new to the national financial market environment. 23 banks, including the Association of Rural Banks in Ghana (Bank of Ghana, 2021), signed Guiding Notes in 2019 to embrace sustainable banking practices as part of sustainability finance. To fund and refinance sustainability, it created a framework in 2021 for the issuance of bonds (green, social, and sustainability-indexed bonds) and other debt instruments (Ministry of Finance, 2021). However, the Ghanaian financial industry only offers a small number of circular economy financial products, procedures, and transactions. Furthermore, there are not many circular economy funding options available to the informal sector, which processes most of the garbage. Based on this, it was hypothesised that:

H2: The firm's external financial environment is a precursor to its circular economy practices.

$H_{2a:}$ The firm's country-level financial environment is a precursor to its circular economy practices.

$H_{2b:}$ The firm's international-level financial environment is a precursor to its circular economy practices.

H_{2c}: The circular economy's finance and investment supply is a precursor to its circular economy practices.

2.4.3 Implications of Circular Economy Practices of Firms in the Integrated Waste Management Sector

Depending on the type of CSR activity investigated and the business performance measurement used, there was conflicting evidence connecting higher value corporate social responsibility (CSR) rankings. According to Dalal and Thaker (2019), businesses with excellent corporate governance, environmental, and social practices do better overall. Atan et al. (2018), on the other hand, had a different viewpoint. According to Schoenmaker (2019), financial institutions are starting to include social and environmental factors in their stakeholder models. He asserts that one must consider ESG concerns when contemplating an investment. Apparently, financial institutions are now supporting sustainability.

We anticipate that investing in sustainable companies will enable them to transition from risk avoidance to seizing opportunities for sustainability. As a result, they would put a greater emphasis on initiatives for sustainable development, such as funding for health care, environmentally friendly structures, wind turbines, electric vehicle manufacturers, upcycling, waste management practices, and programmes for land reuse. This is because Scarpellini et al. (2020) found a positive correlation between corporate social responsibility, environmental accounting procedures used by businesses, and circular economy strategies, including upcycling and trash recovery. Upcycling focuses on enhancing the value of materials that can be reintegrated into the system, not just as recycled or recovered entities, but also through the creation of advanced materials. Researchers develop these sophisticated materials for their potential to achieve recuperative and restorative

benefits (Mahabir et al., 2021; Horodytska et al., 2020). On the other hand, waste recovery refers to the process of collecting, processing, and converting waste materials into usable resources or energy. It's an integral part of waste management strategies aimed at reducing waste's environmental impact by diverting it from landfills and finding productive uses for it (Shahrashoub & Bakhtiari, 2021; Liao & Wang, 2020).

Meanwhile, research suggests that a company might attain economic prosperity, environmental quality, and social justice by aligning its actions with the triple-bottom-line strategy (Elkington, 1998). According to Onyali (2014), the triple bottom line has an impact on corporate performance. According to the OECD (2019), sustainability financing strategies (e.g., socially responsible investment) have benefits for both the social and financial spheres. Waste management companies use the triple bottom-line theory to measure sustainability, focusing on their economic, environmental, social, and governance actions. It was, therefore, hypothesised that:

H_{1a}: Upcycling has positive influence on the performance of firms in integrated waste management.

H_{1b}: Waste recovery has positive influence the performance of firms in integrated waste management.

According to research, not all sustainability challenges are critical from an investment standpoint. Therefore, it's crucial to recognise material sustainability challenges, which can vary between businesses and industries (Khan et al., 2016). There is also the "business case" or opportunities made possible by the demonstration that integrating sustainability criteria into investment decisions increases financial returns (UNEP FI & Mercer, 2007; Cadman, 2011).

Because of these benefits, ESG factors like "impact on activism" from shareholders and fiduciary duty are given more weight in traditional corporate governance frameworks when investment decisions are being made (Waygood, 2011; Hachigan & McGill, 2012).

The nature of a company's activities attracts investments. Because of the focus on sustainable development, SRI has expanded. Investors base their decision to invest in a company on its environmental policies. Studies by Widyawati (2020) and the OECD (2019) highlight the importance of investments, particularly social investments, for sustainability practices. The study, therefore, hypotheses that:

H_{2a}: Upcycling significantly influences the financial readiness of firms and investment preparedness in integrated waste management.

H_{2b}: Waste recovery significantly influences firms' financial readiness and investment preparedness in integrated waste management.

2.5 Conceptual Framework

The section presented on the conceptual frameworks for the standalone three study objectives.

2.5.1 Conceptual framework for antecedents of circular economy finance and investment supply

The conceptual framework for the first objective was presented in Figure 2.2.

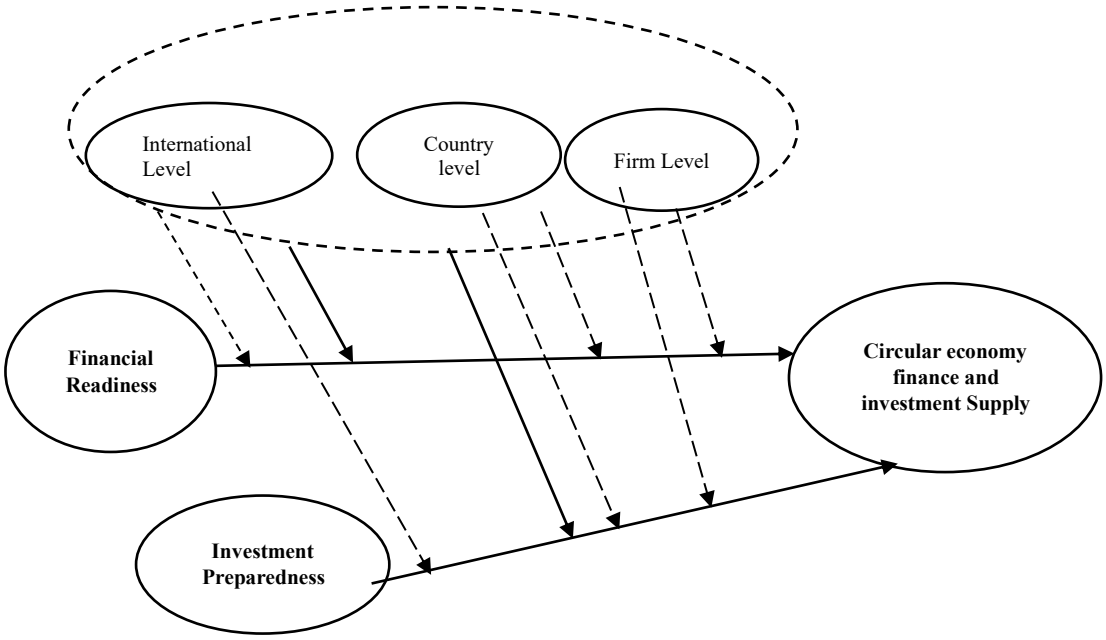


Figure 2.2. Conceptual framework for antecedents of circular economy finance and investment supply
Source: Author's creation (2024)

The conceptual framework in Figure 2.2 illustrates the relationship between financial readiness, investment preparedness, and circular economy finance and investment supply. This framework suggests that the economic and policy conditions conceptualised as the financial environment are important factors in deciding how ready a waste management firm is to engage in financial activities and invest in circular economy practices. The conceptual framework indicates that these factors jointly influence the availability of finance and investment specifically targeted at promoting circular economy projects. It demonstrates the importance of coordination and preparedness among waste management firms to guarantee a consistent flow of funding and

investment for sustainable economic practices that reduce waste and promote efficient use of resources.

2.5.2 Conceptual framework for precursors of circular economy practices

The conceptual framework for the second objective was presented in Figure 2.3.

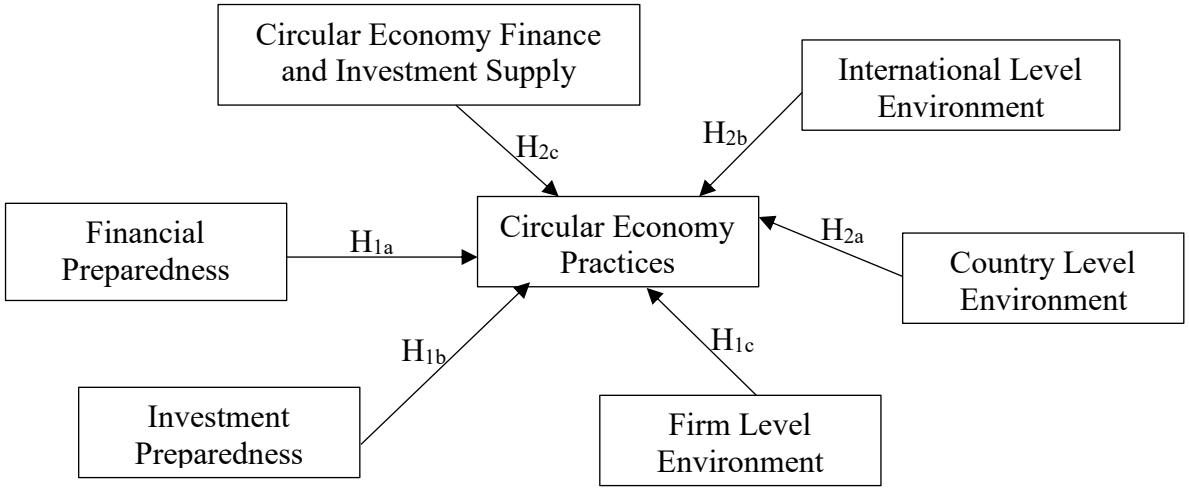


Figure 2.3. Conceptual framework for precursors of circular economy finance and investment supply

Source: Author's creation (2024)

The framework portrays the financial environment as a crucial factor that shapes and facilitates investment supply for waste management firms. We recognise firm, country, and international environments as elements of the financial environment that encourage such investments. We view the development and promotion of financing and investment products for the circular economy as strategies to improve its operations. Particularly in developing economies, the impact of the financial environment on circular economy practices has garnered increased attention, indicating a difference in the way these regions engage with and experience financial systems compared to more developed economies. This calls for the need to assess the influence of the financial

environment on the relationship between financial readiness, investment preparedness, and circular economy finance and investment supply.

Figure 2.3 depicts that the various hypotheses to be tested in the case of objective two. The framework in Figure 2.3 shows that the study tested if financial readiness, investment preparedness, firm level environment, country level environment, international level environment and circular economy finance and investment supply were precursors of circular economy practices.

2.5.3 Conceptual framework for implications of circular economy for waste management firms

The conceptual framework for third objective was presented in Figure 2.4.

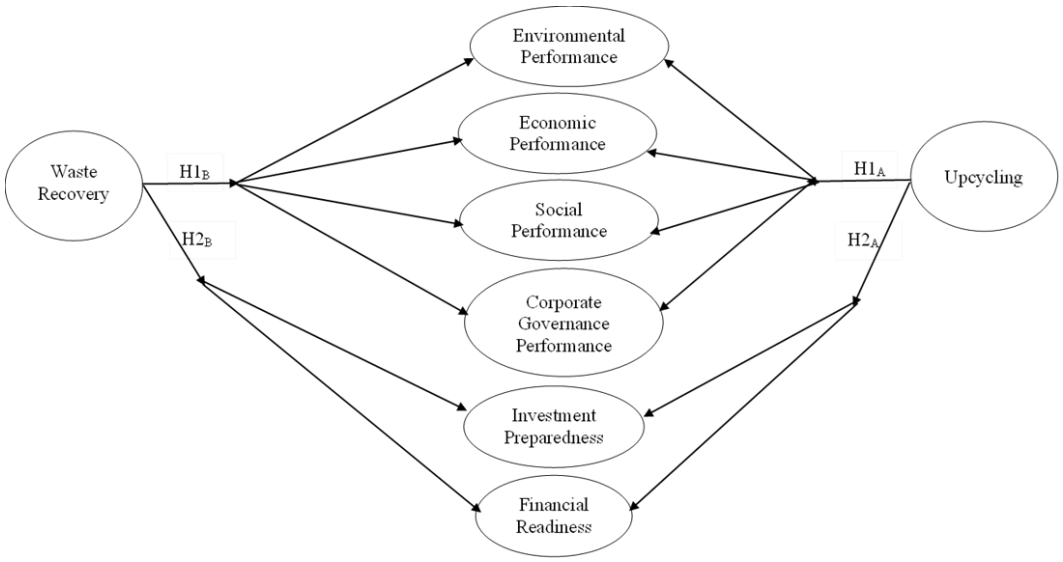


Figure 2.4. Conceptual framework for implications of circular economy for waste management firms *Source: Author's creation (2024)*

According to the conceptual framework in Figure 2.4, waste recovery and upcycling were the circular economy practices and independent variables for the study. Economic performance, environmental performance, social performance, corporate governance performance, investment

preparedness, and financial readiness were the dependent variables. The framework in Figure 2.4 depicts that the study tested if waste recovery and upcycling had a significant effect on economic performance, environmental performance, social performance, corporate governance performance, investment preparedness, and financial readiness.

2.6 Gaps in the Existing Literature

Indeed, there is currently enthusiasm among businesspeople and entrepreneurs for creating new goods and businesses to turn garbage into profitable ventures. As a result, the availability of funds and investments to support their initiatives in integrated waste management is critical. Current studies seldom describe the financial services and products that waste management enterprises in Ghana can access. Also, there are few studies that have documented diverse efforts in the search to start and implement programs as a method for dealing with garbage (Adanu, Gbedemah & Attah, 2020; Mensah, 2020; and Grant & Oteng-Ababio, 2019).

These studies reveal that the current literature focuses on waste management practices and technology, as well as the negative effects of improper waste management on the environment, health, and society. Few studies, including Annan-Aggrey, Bandauko and Arku (2021), Hajdys and Kogut-Jaworska (2018), and Agyapong (2017), addressed funding and investments in waste management. However, they did not use any rigorous analytical techniques in their study. The current study employs structural equation modelling, a technique that can handle a small sample size and perform tests of the theoretical framework from a prediction perspective in cases where the structural model is complex.

2.7 Chapter Summary

This chapter has critically reviewed the literature essential for understanding sustainability financing and investment within Ghana's integrated waste management sector. It is structured into theoretical, conceptual, and empirical reviews, culminating in the development of a conceptual framework that serves as a foundational exploration relevant to the study objectives. The theoretical review synthesizes key theories such as sustainability theory, stakeholder theory, and ecological economics, framing discussions on sustainability financing and circular economy practices. The conceptual review defines core concepts, clarifying their relationships and providing a theoretical framework for their application in Ghana. The empirical review examines previous studies on financing mechanisms, investment practices, and outcomes of circular economy initiatives, drawing insights from similar contexts. The conceptual framework visually synthesizes theoretical and empirical insights, aligning study objectives with key constructs, thereby informing the research methodology and identifying gaps in current knowledge. Overall, this chapter advances the understanding of sustainability financing in waste management sectors, particularly in developing countries like Ghana, and lays the groundwork for empirical investigation in subsequent chapters.

CHAPTER THREE

ANTECEDENTS OF CIRCULAR ECONOMY FINANCE AND INVESTMENT SUPPLY: THE ROLE OF FINANCIAL ENVIRONMENT

3.1 Introduction

Ghana is experiencing significant environmental degradation due to unsustainable corporate business practices and improper domestic waste management. Thus, the worldwide call to action in 2015, mirrored in the SDGs, was timely. For instance, the country's natural beauty is degrading, and the habitat for plants and animals has been destroyed by plastic garbage, filling almost all open spaces, drains, and landfill sites. According to studies by Ofori et al. (2021), plastic trash makes up most of Ghana's solid waste. Moreover, Ofori and Opoku Mensah (2021) described the current system of managing solid waste (i.e. electronic and plastic) as unsustainable and a developmental challenge facing most African economies. Srivastava and Pawlowska (2020) reported that environmental degradation costs Ghana US$6.3 billion annually. In addition, the report indicated that air pollution costs US$2 billion annually, resulting in 16,000 premature deaths each year. Water pollution causes damage equivalent to 3% of Ghana's annual GDP. Also, over 3,000 metric tonnes of plastic waste are dumped into improvised landfills.

On the other hand, several sustainability efforts have been observed at the national level. These include enacting new legislation and amending existing ones to consider sustainability needs. Additionally, there have been initiatives to incorporate sustainable development goals into the nation's framework for national development policy. The circular economy model is one of many management approaches that have been put forth in response to the waste problem. In Ghana,

waste is generated mainly by individuals, households, businesses, and the government. Ironically, the management of solid waste in developing economies is mostly undertaken by actors in the informal sector (Srivastava & Pawlowska, 2020).

It is estimated that approximately 30,000 to 55,000 informal workers are employed along Ghana's e-waste and plastic value chains (Kumi, Hemkhaus & Bauer, 2019). Although past governments have initiated various measures to address the worsening environmental problem, the current integrated solid waste management model has not addressed the rising waste challenge (Ofori et al., 2021). Local government authorities depend on the government for funding, and where their capacity falls short of the growing volumes, they rely on private waste collection firms. These firms mainly collect and discard waste at a fee, leaving most households who cannot afford to dump it in drainage systems and water bodies illegally.

The circular economy practice involves turning waste into valuable resources, primarily carried out by the private sector and, in many cases, small businesses that struggle to attract the needed financial support. Access to finance and the investment climate surrounding integrated waste management has received very little attention in the SDGs and circular economy discussions up until recently. Financing and investment strategies at the national, corporate, and household levels are missing in most strategic efforts. However, they are incidental to implementing any plan to deal with sustainability problems. It would be a limiting factor in the country's effort to achieve sustainable development. Sustainable funding and investments have received less attention in policy and practice discussions, and the theoretical and empirical research on this topic is still in its inception.

Similarly, evidence provided by Qin et al. (2022) suggests that, in most cases, financial institutions apply the same traditional financing models to sustainability. Also, Urban and Wójcik (2019) underscore the lack of a coherent approach to determining and valuing sustainable investment portfolios in investment banking underwriting processes. According to the authors, although some international bodies such as the World Bank, Societe Generale, HSBC, and Credit Agricole have demonstrated commitment and leadership in taking a stance on climate change with new financing policies, there are still uncertainties and inconsistencies in terms of a wholistic approach towards green financing schemes.

Studies by Durrani et al. (2020), Nedopil et al. (2022), and Urban and Wójcik (2019) also open further debate on circular economy financing models that can promote the development of green businesses. These authors believe in the role of policies and institutions in climate action. However, the ecological finance theory argues that the financial environment, including investments and organisations' access to funds, is incidental to the efficient operation of the financial system. Again, firms in the waste management sector, especially from developing economies, are presented with several economic incentives and challenges to green their operations. These firms' financial readiness and investment preparedness can be both an incentive or a constraint on their ability to access circular economy finance and investment. The present study fills these gaps by examining the financial environment's circularity and its effects on the availability of sustainable finance and investments. By exposing the origins of circular economy finance and investment supply in the integrated waste management industry in Ghana, the research contributed to the body of knowledge.

First and foremost, this study's main contribution is to improve the understanding of circular economy finance and investment supply and its determinants in the waste management sector. The study further explored how different levels or intensities of the firm, country, and international financial environments influence the relationships between investment preparedness, financial readiness, circular economy financing, and investment supply. The study analysed sustainability financing and investment and their implications for sustainable development in Ghana. The rest of the chapters include the empirical methodology, empirical results, and discussion.

3.2 Methodology

The empirical methodology discusses the data and methods, including the research design, approach, population, sampling technique, and data collection procedures. It also discusses the underlying measurement theory of the various constructs and the instrument development processes.

3.2.1 Data and Methods

The study used a cross-sectional design and a quantitative research method. The target populations were the owners/managers of integrated waste management firms in the Environmental Service Providers Association of Ghana (ESPA) database. In all, there were 7,190 registered members of ESPA spread across the sixteen regions (16) of Ghana. Three hundred and sixty-seven (367) firms were selected using Bartlett, Kotrlik and Higgins's (2001) Sample Size Determination formula. However, the sampling size is the minimum required based on assumptions of continuous data characteristics, a 5 per cent margin of error, and a significance level of 5%.

However, an oversampling strategy was used to account for the high nonresponse rate that characterises primary data-based surveys, especially those involving actors in the waste management sector. This resulted in 524 responses obtained from the participants in the study. The objective of oversampling was to help better estimate the attributes of the firms. It was also to help inch closer to precision despite the delays and costs encountered (Vaughan, 2017).

Data was collected from integrated waste management firms using a questionnaire consisting of a ten-point Likert-like scale with closed-ended questions. The scale ranged from zero (0), the lowest to ten (10) the highest. The questions focused on investment preparedness, financial readiness, circular economy finance, investment supply, and the financial environment. The aim was to assess the determinants of circular economy finance and investment supply among integrated waste management firms in Ghana.

3.2.2 Sampling Procedure

The study used a simple random sampling (SRS) technique. This technique is appropriate for populations that are homogeneous and permit uniform selection (Etikan & Bala 2017) as in the case of the firms in the ESPA database. Furthermore, the approach offered every firm an equal chance of being included in the study (Noor, Tajik & Golzar, 2022; Berndt, 2020). Therefore, this approach has the benefit of producing an unbiased and representative sample (Stratton, 2021). To obtain the list of participants, the computerised randomisation method in Microsoft Excel was used. This was done by importing the list of the integrated waste management firms in the sampling frame into Microsoft Excel. The list of waste management firms was coded (1, 2, 3….7190) before being imported. Then the RAND function was used to generate the list of participants for the data collection.

3.2.3 Analytical Procedure

Partial least squares structural equation modelling (PLS-SEM) was used to analyse the data. Standard results evaluation criteria were employed, including reflective measurement, structural model, and goodness of fit (Ramayah et al., 2016). Confirmatory factor analyses (CFA) are assisted by this analytical method using the PLS approach. To gather fluctuations in the real-endogenous (observable) variable, PLS extracts the latent (non-observable) variable (Mateos-Aparicio, 2011). As a result of the connection between the exogenous and endogenous variables, it also estimates regression parameters to maximise the variance of the endogenous variable. PLS combines factor analysis and path analysis into a much more rigorous statistical tool (Kaplan, 2009; Hair et al., 2006). It is suitable for making measurements and predictions and testing complex models. The study used the SEM PLS approach.

The formulation and validity assessment of the reflective measurement model was the first phase, while the analysis of the structural model which involves the model's interpretation was the second. The reflective theory connects variables considering how the measures reflect (or manifest) a concept. Before a construct was included in the path model, the reflective measurement model estimation procedure was used to test construct validity and reliability. The four reliability and validity tests were internal consistency, indicator, convergent and discriminant validity. The measurement models in this study were reflectively conceptualised; hence, the consistent PLS approach was adopted over the traditional PLS procedure. This is because it is more robust than conventional PLS in estimating convergent validity and path coefficients. Also, the consistent PLS yields better power–coefficient of determination (R^2) and effect size (f^2) in full reflective models (Cheah et al., 2018). The PLS generates better holdout results than traditional PLS. The PLS-SEM was conducted using SmartPLS software version 3 (Ringle, 2015), which employs a graphical user

interface for variance-based SEM using the PLS path modelling technique (Wong, 2013; Hair et al., 2016; Hair et al., 2017)

Table 3.1. Measurement of Variables

Variables	Measurement
Financial Environment	The finance environment is measured using modified indicators within the firm, country, and international level framework (see. Dopfer, Foster & Potts, 2004, Sheng & Geng, 2012).
Investment preparedness	The constructs for investment preparedness followed the elements in Mason and Kwok (2010), including equity aversion (dilution of control and ownership), instability (knowledge of the sector), presentational failings, functioning product and service, good corporate governance, experience of managers, quality of the board, NPD potential and assets quality.
Financial Readiness	Financial readiness is measured by composite indicators, including the understanding of the firm's risks, business survival potential, employee retention strategy of crucial personnel, understanding and mitigating costs, identifying other sources of potential funding, assessing liquidity needs, presence of loss response team and evaluating insurance coverage (Melton, 2017).
Circular economy financing and investments supply	This is subjectively measured by funds and investment availability, ease of access, cost, perceived quantity, flexibility, alternative sources, and level of financial infrastructure (Petrov, 2015).

3.3 Results

This section presents the results of the antecedents of circular economy finance and investment supply among integrated waste management firms in Ghana. The results first present the socio-demographics of the firms and then the three hypotheses tested.

3.3.1 Socio-Demographic Characteristics of Firms

To understand the background of the integrated waste management firms that participated in the study, their socio-demographic characteristics were presented in Table 7.11 (see appendix). Table 7.11 shows that 483 respondents were males and 41 were females. This reflects the waste management sector in Ghana. Despite the opportunities provided by the sector, it is largely dominated by men. Furthermore, Table 7.11 shows that 378 of the businesses that participated in the survey were sole traders, 90 were partnership ventures, and 50 were limited liability companies. This is also another characteristic of this sector.

Sole proprietorship dominates, as it is the easiest legal form of business to form in Ghana. The sector is largely dominated by the informal sector and sole trading constitutes an easier transition from informality to formality. Another reason that may compel people to choose sole trading is the high level of corporate tax (25%) businesses pay in Ghana, as well as the financial complexities in forming companies. For partnership, a lot more businessmen and women would avoid due to the challenges associated with finding a trustworthy partner to do business with.

From Table 7.11, the ages of the firms that participated in the survey were presented. The result shows the majority (169) of the businesses had operated between 11-15 years in the sector. A total of 414 businesses had operated for 15 years or less. This suggests the relative stability and longevity of businesses operating in the sector. Having about 126 firms with 5 years or less suggests business opportunities in the sector and hence the need for direct investment and finance in the sector. Table 7.11 further presented the nature of the waste business, of which 114 firms were into waste recycling, 357 were into waste collection, and 53 were into waste research. The

difficulty in accessing finance and investment required in waste management by the mostly sole traders in the sector means they operate at the easiest part of the waste value chain, and that is waste collection. Therefore, the majority (68.1%) were found to be in the collection. It was not surprising to see only a few (10%) involved in waste research. This is because the idea of waste-to-resource as part of circularity and the green economy is at its embryonic stage in Ghana.

Table 7.11 presented the location of the business, of which 72 were in the Metro Area, 397 were in the municipality and 55 were in the district. This result also shows the concentration of waste in Ghana and, therefore, the location of the businesses. Most of the waste in the country is found in urban areas, largely due to the concentration of population in these areas. A plausible reason for the concentration of firms in urban areas is also the availability of institutions and infrastructure that promote the running of enterprises, including finance, investments, good road networks, and technology.

3.3.2 Hypotheses Tested

The results of the hypotheses tested were presented with various diagnostic checks, including validity, reliability, and multicollinearity. The hypotheses were as follows:

H_1: Financial readiness and investment preparedness have a positive influence on circular economy finance and investment supply.

H_2: Financial environment plays a moderating role in the relationship between financial readiness and circular economy financial and investment supply.

H_3: Financial environment plays a moderating role in the relationship between investment preparedness and circular economy financial and investment supply.

3.3.3 Assessment of Measurement Model

The measurement model shows how constructs and their indicators relate to one another. By minimising the residual variances of the endogenous constructs, the partial least squares-structural equation modelling (PLS-SEM) analytical approach combines factor analysis with multiple regression (Hair et al., 2011). Because the PLS method calculates latent variable scores as linear combinations of the observed variables, which serve as proxies for latent variables, to estimate model relationships, the technique produces more accurate estimates of factor scores (Lowry & Gaskin, 2014). PLS-SEM is suitable for estimating complicated models, including higher-order construct modelling, because latent variable scores are used in later analyses. An evaluation of the measurement model is advised as the initial step before the structural model can be further analysed to ensure the hypothesised linkages among structural models are successfully interpreted and presented (Hair et al., 2018).

Researchers do this to ensure the measuring models measure what they want to measure (Campbell & Fiske 1959). In more detail, the PLS-SEM algorithm initially optimises the measurement model parameters before estimating the path coefficients in the structural model in a subsequent step. The proposed techniques for evaluating the quality of the measurement model include indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Table 3.2 displays the indicator reliability and internal consistency metrics.

Table 3.2. Reliability and Validity Assessment

Code	Latent constructs	Factor Loadings	rho_A	Composite Reliability	AVE
Financial Readiness			**0.937**	**0.936**	**0.648**
FR3	There is a strategy for identifying and mitigating financial and business risks	**0.766**			
FR4	The firm has other sources of potential funding	**0.863**			
FR5	The firm can determine its liquidity and financing needs	**0.751**			
FR6	There is the presence of a loss response team	**0.766**			
FR7	The firm has insurance coverage for projects it finances	**0.842**			
FR8	The firm has financed its projects previously from equity.	**0.841**			
FR9	Debt financing has been the means for financing the firm's projects	**0.804**			
FR10	Integrated waste management firms often engage in financial planning	0.800			
Investment Preparedness			**0.884**	**0.880**	**0.711**
IP6	There are experienced managers in the firm	0.802			
IP8	There is new product development potential for the firm	0.897			
IP9	The firm boosts quality assets for its operations	0.822			
Circular Economy Finance and Investment Supply			**0.954**	**0.952**	**0.666**
CEF1	There are funds readily available for	0.758			

	firms engaged in sustainable production activities (Availability).	
CEF2	Access to funds for circular economy activities (green businesses) is easy (Accessibility)	**0.808**
CEF3	The cost of credit for firms involved in circular economy activities is affordable (Affordability)	**0.810**
CEF4	The arrangement for obtaining and paying back credit accepted from financial institutions or other lenders is flexible (Flexibility)	**0.874**
CEF5	There are numerous alternatives to the supply of funds for the circular economy activities in the country (Accommodation)	**0.807**
CEF6	It is perceived that sufficient funds are available for circular economy activities (Adequacy).	**0.890**
CEF7	There is a well-developed and functioning financial infrastructure for circular economy activities in the country (Appropriateness)	**0.889**
CEF8	The system for credit appraisal for firms in the circular economy is the same as that of	**0.700**

	other sectors (Credit Appraisal)				
CEF9	The supply of funds for circular economy business activities in the country often comes from international donors (External Funding)	**0.799**			
CEF10	There is a provision of funds from the state to firms engaged in green businesses (Internal Funding)	0.817			
Firm-Level Environment			**0.910**	**0.908**	**0.585**
ME1	The integrated waste management sector is among the attractive sectors for financial institutions' lending	**0.716**			
ME2	Firms in the sector are among the high financial performing businesses in the country	**0.764**			
ME4	There is a strategic alliance of firms to finance joint projects	**0.704**			
MI3	The firm engages in environmental accounting- incorporating the use or depletion of natural resources in the accounting system	**0.725**			
MI6	The firm has investments in green financial products.	**0.836**			
MI8	The competitive pricing strategy of the firm reflects its support for green business	**0.830**			
MI9	The firm pre-finance suppliers to ensure	**0.768**			

	their compliance with sustainable business practices				
Country-Level Environment			**0.914**	**0.912**	**0.635**
MA1	Lending institutions have a separate rate of interest for firms within the circular economy (interest rate)	0.794			
MA5	There is a reduction in taxes for the import of organic products	**0.778**			
MA6	There are tax breaks for firms engaged in sustainable business practices	**0.834**			
MA7	Lending institutions have separate credit appraisal requirements for firms within the circular economy	**0.829**			
MA8	The country has a measure for sustainable gross domestic product	**0.786**			
MA9	There are well-known legislations and policies on the circular economy in the country	**0.758**			
International-Level Environment			0.936	0.936	0.646
MT1	There is a regional policy on financing sustainability within ECOWAS	0.831			
MT2	International development corporations are the main financiers of activities in the circular economy in the country	0.799			

MT3	I only buy electronic equipment when there is an immediate need	0.840
MT4	There is a flow of foreign direct investment into the integrated waste sector in Ghana	0.814
MT5	There is an increasing level of investment in the importation of different waste streams into the country	0.822
MT6	The export of processed waste to the country's export destinations has increased in recent times	0.778
MT8	There is a global move towards the mobilisation of private capital towards environmentally sustainable investments	0.737
MT10	The country has benefited from the Green Climate Fund for future climate action	0.804

Table 3.2 presents results to assess the reliability and convergent validity of the model. The reliability of indicators is examined from the factor loadings, where items with loadings above 0.7 were retained. Factor loadings show how well items represent the conceptual domain of a construct. Since factor loadings above 0.7 are recommended (Ringle et al.,2018), as part of the measurement model evaluation, items with low factor loadings (< 0.60) were removed. For

example, investment preparedness has 10 items, of which, after the consistent PLS algorithm was applied, only three indicators (IP6, IP8 and IP9) were retained. Internal consistency as a reliability measure estimates how well items on a test that one proposes to measure the same construct yield similar results. It focuses on the consistency of results delivered by a test of various items, measuring the different constructs to deliver a consistent result.

The study employs two diagnostic methods (composite reliability and Cronbach's alpha) to check for internal consistency reliability. Cronbach's alpha (α) tests the averages and correlation between every possible combination of split halves and permits multi-level response. This test often produces a score between zero and one. The general rule is that any value above 0.7 is an indicator of acceptable reliability. In addition to the Cronbach alpha, Composite reliability, regarded as a more accurate measure of reliability in a PLS-SEM environment – was also reported as an additional check on construct dependability (Hair et al., 2018). It is the overall value of the real score variance to the entire scale score variance (Brunner & SÜ, 2005). It is an indicator of the shared variation among the observed variables used as an indicator of a latent construct (Fornell & Larcker, 1981). The decision rule in applying this test is that there should be a composite reliability score (C.R.) > 0.708. In the case of an exploratory study, a C.R. of 0.60 to 0.70 is acceptable.

3.3.4 Test of Convergent and Discriminant Validity

The percentage of the indicator variables that the latent variable was able to account for was examined in the test of indicator reliability. According to Hulland (1999), the general rule was to eliminate reflected indicators with loadings of less than 0.708 from the measurement model, even though some authors advise factor loadings over 0.6. A convergent and discriminant validity test

was performed in addition to indicator reliability. This test assisted in analysing the extent to which indicators of the same construct had positive correlations with one another. The process involved analysing the indicators' outer loadings and the average extracted variance. The latent variable accounted for at least 50% of the variance in each indicator. Convergent validity demonstrates how items measuring the same construct correlate better with the underlying construct than other constructs in the measurement model.

Factor loadings influence the AVE's ultimate score because it is determined by the average variance extracted (AVE) method. Therefore, the measurement model's likelihood of not achieving convergent validity increases as more factor loadings drop below 0.708. From Table 3.2, all the constructs possess convergent validity because the AVE score is above 0.5. A diagnostic test of discriminant validity was conducted. The measurement criteria were cross-loading (Table 7.1, see Appendix), Fornell-Larcker criterion (FLC) (Table 7.2, See Appendix), and Heterotrait-Monotrait Correlation Ratio (HTMT).

According to the cross-loading criterion, the outer loadings on a construct were supposed to be higher than all its cross-loadings with other constructs. Henseler et al. (2014) state that the cross-loading approach to discriminant validity is established when a construct indicator exhibits a poor correlation with all other constructs other than the one to which it is supposedly related. The PLS algorithm technique generates cross-loadings (Table 7.1, See Appendix), which can be checked for the presence of discriminant validity. Based on the results in Table 7.1, indicators loaded more highly on their parent constructs than the cross-loadings on other constructs, hence discriminant validity using cross-loadings was achieved.

The Fornell-Larcker criterion claims that if a construct achieves a higher square root of the AVE than the correlations with other indicators, the construct is said to be discriminant valid (Fornell & Larcker, 1981). Values in bold indicate the AVE's squared root (Table 7.2, See Appendix). The correlations between the latent constructs are listed below the squared root of the AVE. Any construct for which the squared root of the AVE is larger than the highest correlation with other constructs suggests discriminant validity. The heterotrait-monotrait ratio of correlations and the cross-loadings and Fornell-Larcker criteria were used to assess if an indicator is discriminant valid (HTMT) (Table 7.3, see Appendix). It is recommended as a more robust approach to assessing discriminant validity in variance-based SEM (Henseler et al., 2014). In the HTMT, considered more robust, a final value close to one shows a lack of discriminant validity. Henseler et al. (2015) propose a threshold value of 0.90 for structural models with constructs that are conceptually very similar in operationalisation and conceptual domain. But when constructs are conceptually more distinct, a lower, more conservative, threshold value of 0.85 is suggested (Henseler et al., 2015).

Thus, the smaller the HTMT ratio, the better indicators perform in discriminating among constructs with which they are not theoretically associated. In Table 7.3 (See Appendix), all the HTMT values are below the threshold value of 0.9 (Gold, Malhotra & Segars, 2001), with most of them meeting the more stringent threshold of 0.85 (Kline, 2011). Thus, again, based on HTMT, it suggests that indicators significantly perform well in discriminating against unrelated constructs and loading high on the parent constructs. After the quality of the measurement model is established, the structural model is further evaluated based on collinearity diagnostics,

significance tests of hypothesised relationships, and the explanatory and predictive power of the model.

3.3.5 Collinearity Diagnostics

In analysing the structural model, further model fit issues were first addressed. These included collinearity, structural model relevance and significance, effect size, the combined effect of the exogenous variables, and the predictive relevance of the path model. A basic test conducted before estimating the path model was to check collinearity and spurious outcomes in the estimation of the path coefficients in the structural model. According to Hair et al. (2017, 2019), a significant number of VIF (variance inflation factors) values of 5 and above indicate a collinearity problem. Becker et al. (2015) suggest a more stringent criterion, where VIF values close to 3 and lower are preferred. The examination of the VIFs shows almost all values are below 3, as recommended by Becker et al. (2015), except the VIF between circular economy finance and investment supply and financial readiness (5.515) (see Table 7.4 Appendix).

3.3.6 Financial readiness, investment preparedness and circular economy finance and investment supply

The first hypothesis tested the effect of financial readiness and investment preparedness on circular economy finance and investment supply. Figures 3.1 and 3.2 are path models showing the effect of each exogenous construct on the target construct. Further results, including t-values, p-values, and biased-corrected bootstrapped confidence intervals, are shown in Table 7.5 (Appendix).

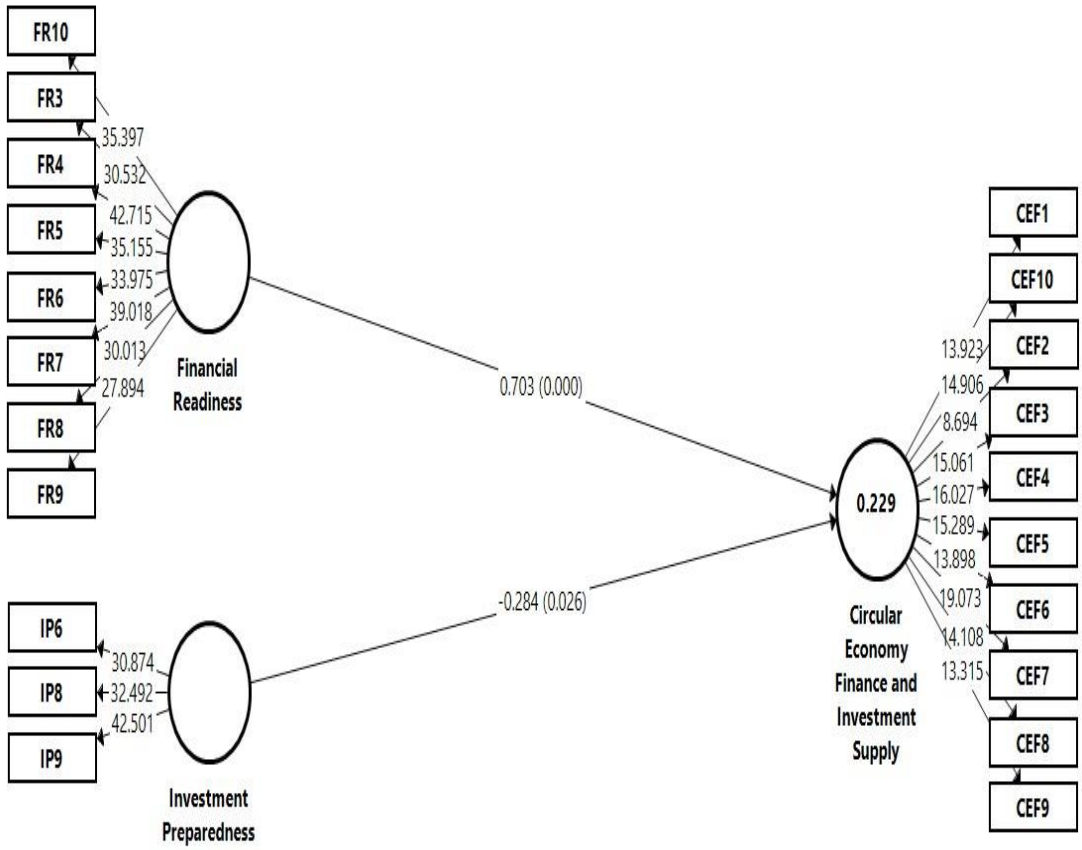


Figure 3.1. Structural Model

Table 7.5 (Appendix) shows the results of the hypothesis H_1 tests at a 5% significance level. The results revealed that financial readiness (β = 0.703, t=5.766, p = 0.000) has a positive and significant effect on circular economy finance and investment supply. In contrast, investment preparedness (β= -0.284, t=2.222, p = 0.026) had a negative and significant negative effect on circular economy finance and investment supply.

3.3.6 Financial Environment, Financial Readiness and Circular Economy Finance and Investment Supply

A moderator variable influences the nature and intensity of a relationship between a predictor and an outcome variable. According to Baron and Keney (1986), moderators might be qualitative

or categorical (e.g., based on sex, race, or class) or quantitative or continuous (e.g., income or level of reward). In statistical models, moderating variables are often referred to as an interaction term. The influence of a predictor on an outcome can be improved, diminished, or reversed by moderators. The second hypothesis was to test the moderating role of the financial environment in the relationships between financial readiness, and circular economy finance and investment supply. The significance of the moderating hypothesis is tested through a bootstrapping procedure which is presented in Tables 20 and 21 (See Appendix).

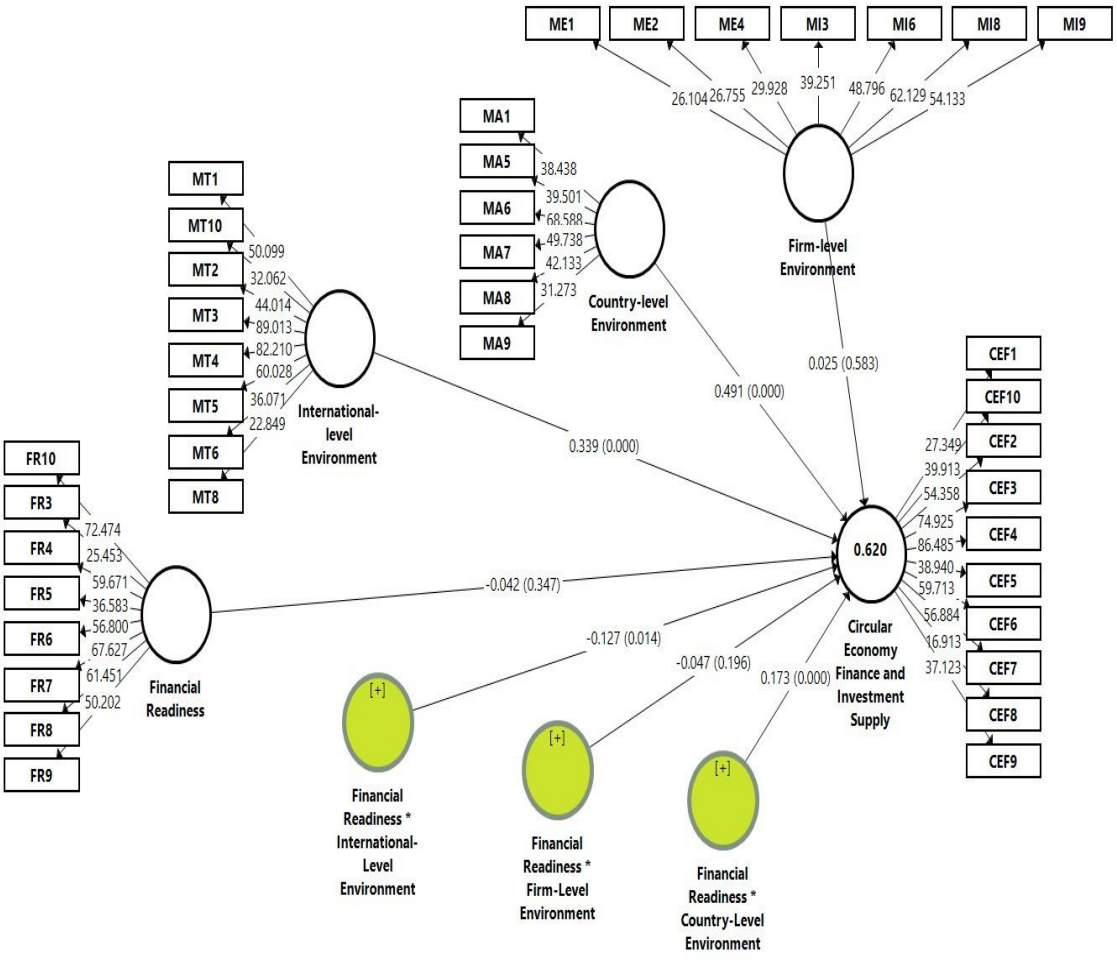


Figure 3.2. Structural Model

From Table 7.7 (See Appendix), the results for H_2 showed that the country-level financial environment significantly moderated the relationship between financial readiness and circular economy finance and investment supply (β= 0.173, t=3.502, p = 0.000). The moderating effect of the international-level financial environment was negative and significant (β= -0.127, t=2.456, p = 0.014). However, the moderating role of the firm-level environment was not significant (β= -0. 047, t=1.296, p = 0.196). In addition to the significance test through bootstrapping, Simple slope tests using two-linear interaction are presented in Tables 13, 14 and 15 (See Appendix).

The slope tests follow procedures developed by Aiken and West (1991) and Dawson (2014). The graph allows one to perform simple slope tests to determine whether the relationship between a predictor and the outcome variable is significant at various moderator values. Furthermore, the graph makes it easier to visualise the relationship between the predictors (financial readiness and investment preparedness) and the outcome variable (circular economy finance and investment supply), at different levels of the moderator (firm-level, country-level and international-level environment).

Figures 7.1, 7.2 and 7.3 (Appendix) show the graph of the various interaction effects. Figure 7.1 shows a negative relationship (β= -0.042) between financial readiness and circular economy finance and investment supply (indicated by the red slope). However, Country-level environmental forces positively influence this negative relationship between financial readiness and circular economy finance and investment supply. So, when the moderator is introduced, it changes the negative to positive (β= 0.173, t=3.502, p = 0.000), depicting a reversal role. At low levels of the Country-level financial environment, the negative relationship is dampened.

Figure 7.3 shows the interaction within the observed range of values (disordinal interaction). Financial readiness and circular economy finance and investment supply have a negative relationship. The moderator further enhances the negative effect at higher levels of S.D. At a low level (-1 S.D.), the relationship between financial readiness becomes positive but marginal. The red line in Figure 7.3 (see appendix) shows the regular effect without the moderator variable and depicts a negative but weak relationship (β= -0.042) between financial readiness and circular economy finance and investment supply. However, the presence of an international-level environment further dampens the negative relationship. At the same time, the absence or low levels of international forces change the relationship between financial readiness and circular economy finance and investment supply to positive.

3.3.7 Financial environment, investment preparedness and circular economy finance and investment supply

The third hypothesis was to test the moderating role of the financial environment in the relationships between investment preparedness and circular economy finance and investment supply. The significance of the moderating hypothesis is tested through a bootstrapping procedure which is presented in Tables 7.6 and 7.7 (See Appendix).

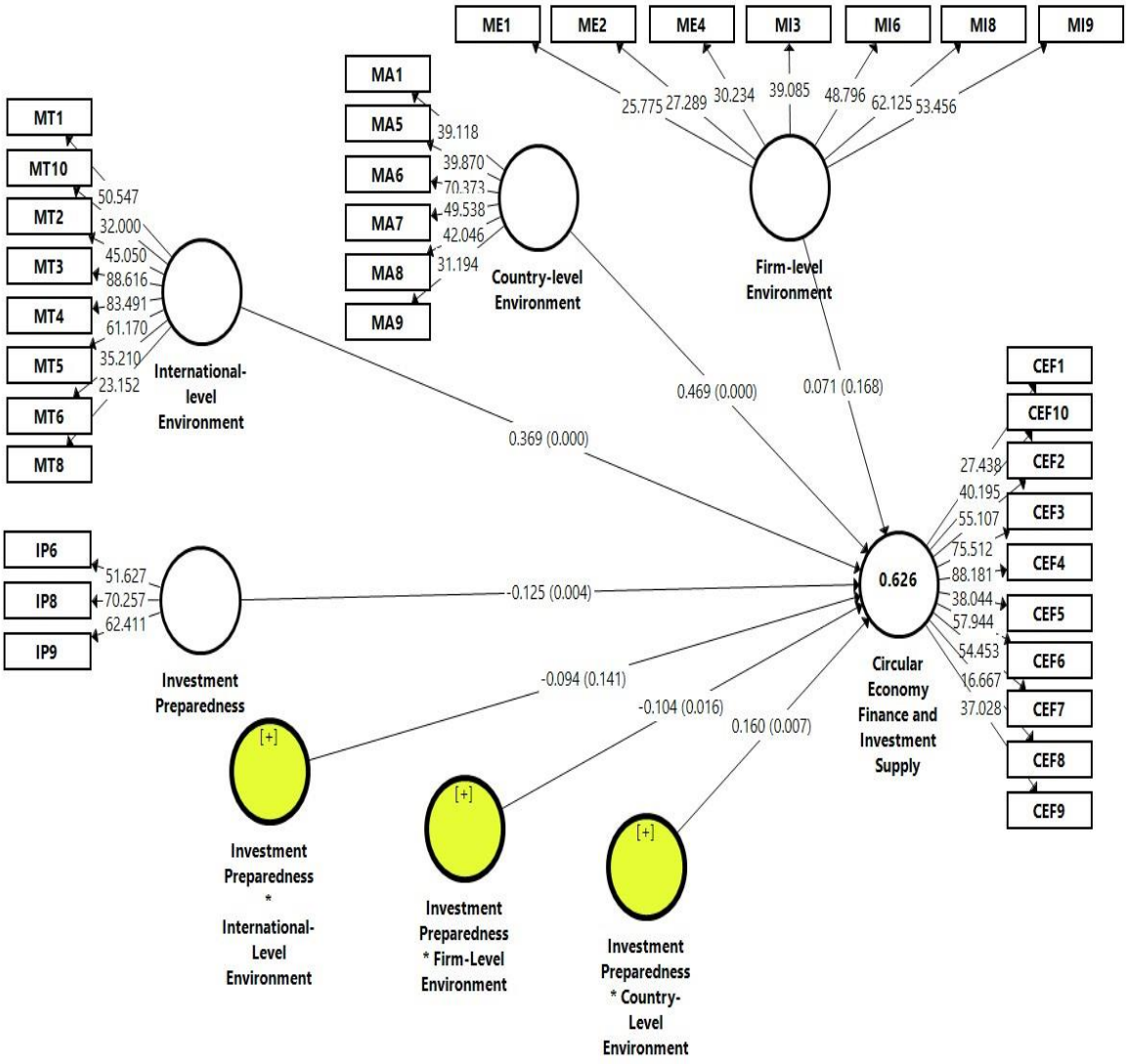


Figure 3.3. Structural Model

From Table 7.7 (See Appendix), the results for H_3 showed the moderating role of the firm-level financial environment in the relationship between investment preparedness and circular economy finance and investment supply was negative and significant (β= -0.104, t=2.409, p = 0.016). The moderating effect of the international level financial environment in the relationship between investment preparedness and circular economy finance and investment supply was positive but not significant (β= 0.094, t=1.472, p = 0.141). On the other hand, the country-level financial environment significantly and positively moderates the relationship between investment

preparedness and circular economy finance and investment supply (β= 0.160, t=2.71, p = 0.007, see Table 7.7 in Appendix). This implies taking advantage of the investment and financing opportunities associated with circular economy activities by businesses would be enhanced with the financial environment of the host country. Strategies to attract investment by firms towards circular economy project financing would be improved when the country's financial environment is favourable.

3.4 Discussions

The findings from the first hypothesis revealed that financial readiness has a positive and significant effect on circular economy finance and investment supply (β = 0.703, t=5.766, p = 0.000). The findings suggest that firms in integrated waste management believe that financial readiness enables businesses to have easy access to funding because such businesses are strategically positioned to leverage the necessary resources to implement circular economy initiatives effectively. This may involve having the financial capacity to invest in technology, infrastructure, and training needed to adopt more sustainable practices. Additionally, it implies that there may be a need for financial institutions and investors to consider the financial readiness of firms in integrated waste management in the country when providing financing for circular economy projects. This could include offering financial products tailored to the specific needs of firms in the waste management sector, providing technical assistance to build capacity, or creating incentives for businesses to adopt circular economy practices.

On the other hand, contrary to the hypothesis, investment preparedness has a negative and significant effect on circular economy finance and investment supply (β= -0.284, t=2.222, p = 0.026). This suggests that while being prepared for investment is important, these firms should

also focus on making their circular economy projects attractive to investors. This could involve highlighting the environmental, social, and economic benefits of their projects or making strategic adjustments to their investment readiness strategies. Also, firms should continue to focus on improving their financial readiness, managing their finances, and maintaining strong financial records to position themselves more effectively to attract investment for their circular economy projects.

According to Schoenmaker (2019), a firm's engagement in sustainable practices is the first step in sustainable finance. Including sustainable practices in business operations and having insurance cover for any loss signifies your readiness to enter the circular economy for financing and investment. Any investor who sees how ready a business is financially for circular economy activities would be attracted to the company. The results indicate that the above description of investment preparedness does not guarantee circular economy investment and financing. Findings of this objective support the views of Nelson (1991), who explained that a firm's strategic move to create, extend, integrate, modify, and deploy its financial resources in a manner enables the firm to take advantage of the opportunities in the circular economy ecosystem.

The second hypothesis aimed at testing the degree and nature of the influence of financial readiness and investment preparedness on circular economy financing and investment supply, given three main financial contexts: firm-level, country-level and international-level environments. From the results (see Table 7.7 in Appendix), the firm-level financial environment had a negative moderating effect on the relationship between financial readiness and circular economy financing and investment (β= -0.104, t=1.292, p = 0.196). However, the relationship

was not significant. Also, the moderating role of country-level environment and circular economy finance and investment supply was positive and significant (β= 0.173, t=3.502, p = 0.000). The moderating role of the international level financial environment in the relationship between financial readiness and circular economy finance and investment supply was negative and significant (β= -0.127, t=2.456, p = 0.014).

The results imply that within the context of firm-level financial environment, the effect of financial readiness on circular economy finance and investment supply is weak and non-significant. This implies that when it comes to attracting circular economy finance and investment supply, the firm's ability to position itself financially to be ready to be invested in does not depend on the firm's internal financial landscape such as the firm's access to capital, its capital structure, liquidity, credit policies, investment decisions, risk management practices, and overall financial strategy. This may be because the required internal financial environmental factors already exist or are within the control of the firm at any point in time (Faraz, Ahmed & Xiong, 2024).

On the other hand, the country-level financial environment enhanced the relationship between financial readiness and circular economy finance and investment supply among waste management firms. Countries with favourable financial conditions are more conducive to promoting circular economy finance and investment. This connotes that in attracting circular economy finance and investment supply, the firm's ability to position itself financially to be ready to be invested is significantly influenced by the broader economic and financial conditions prevailing within the country.

Further, a supportive country-level environment, including policies, regulations, and incentives, can play a crucial role in facilitating the relationship between financial readiness and circular economy financing and investment. Given that, firms should consider the country-level environment when assessing their investment readiness and seeking circular economy financing. This involves staying updated on local policies, regulations, and incentives, understanding how they impact circular economy projects, and aligning their investment strategies with the country's sustainability goals and priorities.

Lastly, the moderating role of the international-level financial environment in the relationship between financial readiness and circular economy finance and investment supply was negative and significant. The international-level financial environment contains complex factors that are usually beyond the control of waste management firms in Ghana, which makes it more difficult for these firms to translate their financial readiness into actual circular economy investments. Factors like exchange rate volatility, capital controls, or geopolitical tensions in the international environment could undermine the ability of financially ready firms to deploy capital towards circular economy initiatives. Also, the international financial landscape may favour different types of investments or priorities that are not well-aligned with circular economy financing. This implies that waste management firms need to carefully consider the role of broader macroeconomic and global financial factors when examining the drivers of circular economy investment flows.

The findings for the third hypothesis revealed that the moderating effect of the firm-level financial environment in the relationship between investment preparedness and circular economy finance

and investment supply was negative and significant. The findings suggest that even though investment preparedness (e.g., availability of capital, financial capabilities) would normally have a positive influence on the supply of circular economy finance and investment supply, this positive relationship is dampened when the firm-level financial environment is taken into account. The firm-level financial environment may introduce constraints, risks or competing priorities that prevent financially prepared firms from channelling resources towards circular economy initiatives, despite their investment readiness. Factors like access to credit, cost of capital, financial risks, or competing investment demands at the firm level could dampen the ability of investment-ready waste management firms to translate their preparedness into actual circular economy financing.

On the other hand, the moderating role of the country-level financial environment was positive and significant in the relationship between investment preparedness, circular economy finance, and investment supply. This means that as the country-level financial environment becomes more favourable or supportive, it strengthens or enhances the positive relationship between investment preparedness, circular economy finance, and investment supply among waste management firms in Ghana. A country-level financial environment characterised by easy access to capital, well-developed financial markets, and supportive circular economy policies enhances the ability of investment-ready firms to mobilise resources towards circular economy initiatives.

Favourable country-level financial conditions may create incentives, reduce barriers, or provide complementary support that enables investment-ready firms to effectively translate their preparedness into circular economy financing. The country-level financial context may positively

shape the risk-return profile of circular economy investments, making them more attractive to financially prepared waste management firms in Ghana.

Lastly, the moderating effect of the international level financial environment on the relationship between investment preparedness and circular economy finance and investment supply was positive but not significant. While this moderating effect was positive, the lack of statistical significance indicates that the international-level financial environment may not be a strong enough factor to significantly influence the relationship between investment preparedness and circular economy finance/investment.

3.5 Chapter Summary

This chapter has explored the antecedents of circular economy finance and investment supply in Ghana, focusing on the role of the financial environment. Using a survey technique, the views of owners and managers of integrated waste management firms were solicited, and the data were analyzed with PLS-SEM. The findings indicate that financial readiness and investment preparedness significantly influence circular economy finance and investment supply, with the country-level financial environment enhancing these relationships. Additionally, the chapter highlights the importance of demand-side factors as critical antecedents to green financing, noting that the impact of these factors on circular economy finance and investment supply is amplified when supportive financial conditions are present at the national level.

CHAPTER FOUR

PRECURSORS OF CIRCULAR ECONOMY PRACTICES

4.1 Introduction

Transition into the circular economy has been recognised as the panacea to the numerous global, regional, and local environmental and resource challenges confronting the world. The current rate of resource depletion means that countries increase their speed in transition into the circular economy. These problems result from unsustainable resource and environmental management, particularly by reducing inputs and lowering waste generation (Moraga et al., 2019). An unprecedented Arctic ozone depletion in 2020 led to an abnormally high springtime temperature across Asia and Europe (Barnes et al., 2022).

As reported in the Global Circularity Gap Report 2020, only 8.6% of the estimated 100 billion tonnes of resources consumed globally per annum cycle back into the economy (Mrówczyńska, Fischer & Nusseck, 2021). Ghana has had its fair share of environmental problems and climate change issues due to poor waste management practices by households, businesses and even the waste management sector (Owusu-Ansah et al., 2022). Chu and Karr (2017) said that poor environmental practices range from unsustainable mining practices, illegal logging, poor waste disposal and other activities that pollute the land, air, and water.

Waste management continues to be one of the country's major problems, especially plastic, electronic, oil and organic waste. Available statistics from a country report indicate that the country generates an estimated 4.60 million tons of MSW annually (Hemkhaus et al., 2020). The report shows that organic waste constitutes 61%, plastics (17%) and electronic waste (6%). Waste

from paper, metal, glass, textile, and leather constitutes about 14%, with other waste constituting about 3% (Hemkhaus et al., 2020). Studies show that less than 0.1% of the plastics generated are recycled.

The situation is no different for the other waste. To contain the growing waste streams and associated management challenges, Ghana has introduced several environmental and sanitation laws, including the Hazardous and Electronic Waste Control and Management Act 2016 (Act 917). Earlier, there was an introduction of 17.5% VAT on sachet water to use it to manage plastic waste. Others include the Minerals and Mining (Amended) Act, 2019 (Act 995) to regulate mining activity, the Environmental Protection Agency Act, 1994 (Act 490), and the Ghana Landfill Guidelines (2002) among others. Additionally, there is the National Solid Waste Management Strategy for Ghana 2020.

Despite these interventions, programmes, and policies to deal with waste, it continues to be a major environmental problem for the country and the situation is still the same. A key observation in the waste management space is that most participants are from the informal sector. In effect, waste management project interventions have targeted the informal actors. Despite the support and training they receive; they revert to their unsustainable waste management practices upon completing such projects. Mrówczyńska, Fischer and Nusseck (2021) have pointed out that the effect of resource-intensive and consumption-dependent on society and its environs has been destructive. Previous studies (Hemkhaus et al., 2020; Oduro-Appiah, 2019) have cited technical know-how, especially with issues of the circular economy, the use of waste management for survival by most people, and the application of crude methods in the processing of waste. Others

have focused on sustainable development in Ghana (Twerefou, 2007; Kortei & Quansah, 2016; Lambert & Sabutey, 2016; Cobbina & Doke, 2018).

The study analysed the precursors of the circular economy and its implications for sustainable development in Ghana. More specifically, it assessed the implications of the financial environment on circular economy practices within the waste management sector. The study is motivated by the quest for Ghana to transition into a circular economy. Like all other countries, Ghana is preparing to transition into a circular economy. Therefore, there is a need to understand the elements that facilitate the circular economy transition. Currently, no previous studies highlight the factors to be considered in the circular economy transition in Ghana. Thus, creating a research gap that needs to be filled. The study is also motivated by the need to contribute to the body of knowledge on the green economy as a strategy for achieving the sustainable development objectives of Ghana's Medium-Term National Development Policy Framework, Agenda 2030, and Agenda 2063. The remainder of this chapter is structured as follows: empirical methodology, results, discussion, and chapter summary.

4.2 Empirical Methodology

The empirical methodology discusses the data and methods, including the research design, approach, population, sample, and sampling technique. It also has measures and the measurement of variables.

4.2.1 Data and Methods

The study used a cross-sectional design and a quantitative research method. The target populations were the owners/managers of integrated waste management firms in the Environmental Service Providers Association of Ghana (ESPA) database. In all, there were 7,190 registered members of

ESPA spread across the sixteen regions (16) of Ghana. Three hundred and sixty-seven (367) firms were selected using Bartlett, Kotrlik and Higgins's (2001) Sample Size Determination formula. However, the sampling size is the minimum required based on assumptions of continuous data characteristics, a 5 per cent margin of error, and a significance level of 5%. However, an oversampling strategy was used to account for a high non-response rate that characterises primary data-based surveys, especially those involving actors in the waste management sector. This resulted in 524 responses obtained from the participants in the study. The objective of oversampling was to help better estimate the attributes of the firms. It was also to help inch closer to precision despite the delays and costs encountered (Vaughan, 2017).

Data was collected from integrated waste management firms using a questionnaire consisting of a ten-point Likert-like scale with closed-ended questions. The scale ranged from zero (0), the lowest to ten (10) the highest. The questions focused on circular economy finance and investment supply, circular economy practices, investment preparedness, financial readiness and financial environment. The aim was to assess the precursors of circular economy practices among integrated waste management firms in Ghana.

4.2.2 Sampling Procedure

The study used a simple random sampling (SRS) technique. This technique is appropriate for populations that are homogeneous and permit uniform selection (Etikan & Bala 2017) as in the case of the firms in the ESPA database. Furthermore, the approach offered every firm an equal chance of being included in the study (Noor, Tajik & Golzar, 2022; Berndt, 2020). Therefore, this approach has the benefit of producing an unbiased and representative sample (Stratton, 2021). To obtain the list of participants, the computerised randomisation method in Microsoft Excel was

used. This was done by importing the list of the integrated waste management firms in the sampling frame into Microsoft Excel. The list of waste management firms was coded (1, 2, 3….7190) before being imported. Then the RAND function was used to generate the list of participants for the data collection.

Table 4.1 Measurement of Variables

Variables	Measurement
Financial Environment	The finance environment is measured using modified indicators within the firm, country, and international level framework (see. Dopfer, Foster & Potts, 2004, Sheng & Geng, 2012).
Investment preparedness	The constructs for investment preparedness followed the elements in Mason and Kwok (2010), including equity aversion (dilution of control and ownership), instability (knowledge of the sector), presentational failings, functioning product and service, good corporate governance, experience of managers, quality of the board, NPD potential and assets quality.
Financial Readiness	Financial readiness is measured by composite indicators, including the understanding of the firm's risks, business survival potential, employee retention strategy of crucial personnel, understanding and mitigating costs, identifying other sources of potential funding, assessing liquidity needs, presence of loss response team and evaluating insurance coverage (Melton, 2017).
Circular economy financing and investments supply	This is subjectively measured by funds and investment availability, ease of access, cost, perceived quantity, flexibility, alternative sources, and level of financial infrastructure (Petrov, 2015).
Circular economy practices	This is measured by the firm's actions and involvement in activities such as re-manufacturing, reduction, recovery, reinvestment, regeneration, recycling etc. (Ekins *et al*., 2019; Dey *et al*., 2022).

The items in the questionnaire were scaled from one (1), the lowest to ten (7) highest level. The questions focused on investment readiness, financial readiness, circular economy practices and the financial environment. Although research in circular economy practices and sustainable finance is still evolving, widely adopted analytical approaches include multivariate statistical techniques such as regression. Accordingly, when combining partial least squares-structural equation

modelling (PLS-SEM) and NCA, the researcher must first review and outline the specific theoretical arguments on potential sufficient and necessary conditions that guide the analyses. The path model in PLS-SEM represents hypotheses on the relationships between different latent variables based on theoretical reasoning and the researchers' experience or logic.

4.2.3 Analytical Procedure

The proposed relationships were analysed using PLS-SEM. The PLS-SEM analytical approach combines factor analysis with multiple regression (Hair et al., 2011). Because the PLS method calculates latent variable scores as linear combinations of the observed variables, which serve as proxies for latent variables, to estimate model relationships, the technique produces more accurate estimates of factor scores (Lowry & Gaskin, 2014). PLS-SEM is suitable for estimating more complex models, including higher-order construct modelling, because latent variable scores are used in later analyses. Based on the theoretical arguments, the study complements the PLS-SEM results with necessary condition analysis (NCA), which assesses the non-linear relationship among constructs. The combined use of PLS-SEM and NCA provides a holistic perspective on the practical relevance of predicted relationships. NCA aims to reveal areas in scatter plots of dependent and independent variables that may indicate the presence of a necessary condition by examining other non-linear relationships (Figure 4.1).

4.3 Empirical Results

The data were first processed using SPSS software. The processing involves checking for extreme responses, outliers, and errors in coding. The PLS-SEM procedure involves an assessment of the measurement model for reliability and validity before any further assessment of the structural model is undertaken. According to Hair et al. (2019a), during this analysis step, researchers must

ensure that their construct measures meet all quality criteria to ensure the robustness of other analyses that depend on composite scores from the PLS-SEM algorithm.

4.3.1 Hypotheses Tested

The results of the hypotheses tested were presented with various diagnostic checks, including validity, reliability, and multicollinearity. The hypotheses were as follows:

H1: The firm's internal financial environment is a precursor to its circular economy practices.

H1a: The firm's financial readiness is a precursor to its circular economy practices.

H1b: The firm's investment preparedness is a precursor to its circular economy practices.

$H_{1c:}$ The firm-level financial environment is a precursor to its circular economy practices.

H2: The firm's external financial environment is a precursor to its circular economy practices.

$H_{2a:}$ The firm's country-level financial environment is a precursor to its circular economy practices.

$H_{2b:}$ The firm's international-level financial environment is a precursor to its circular economy practices.

$H_{2c:}$ The circular economy's finance and investment supply is a precursor of its circular economy practices.

4.3.2 Measurement Model Assessment

The PLS-SEM algorithm first optimises the measurement model parameters before estimating the path coefficients in the structural model. Hair et al. (2018) propose indicator reliability, internal consistency reliability, and convergent and discriminant validity procedures for the assessment of measurement model quality. As part of the measurement model quality assessment, indicator

reliability, internal consistency reliability, convergent, and discriminant validity diagnostics tests are presented in Tables 4.2, 4.3 and 4.4 respectively.

Table 4.2 Reliability and Validity Tests

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Circular Economy Finance and Investment Supply	0.949	0.953	0.948	0.671
Circular Economy Practices	0.936	0.939	0.937	0.650
Country-level Financial Environment	0.890	0.904	0.886	0.572
Financial Readiness	0.897	0.906	0.894	0.553
Firm-level Financial Environment	0.887	0.892	0.883	0.522
International-level Financial Environment	0.914	0.918	0.907	0.555
Investment Preparedness	0.931	0.935	0.931	0.601

Source: Field data (2024)

From Table 4.2, composite reliability values are all above 0.700. Values between 0.70 and 0.90 are described as "satisfactory to good (Hair et al., 2018). The convergent validity of the indicators of each construct was gauged with average variance extracted (AVE), which should yield a minimum value of 0.50 or higher. An examination of all AVEs in Table 4.2 shows that all

constructs explained at least 50% of the variation in their indicators, so convergent validity was achieved. There are about three criteria for assessing discriminant validity. Fornell and Larcker, (1981) suggested that to establish discriminant validity, the square root of the AVE of a construct should be greater than the correlation between the same construct and all other reflectively measured constructs. All the variables in Table 4.3 met the Fornell-Larcker criteria.

Table 4.3. Fornel-Larcker

Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Circular Economy Finance and Investment Supply	***0.819***						
Circular Economy Practices	0.378	***0.806***					
Country-level Financial Environment	0.750	0.454	***0.757***				
Financial Readiness	0.479	0.700	0.516	***0.743***			
Firm-level Financial Environment	0.498	0.714	0.574	0.716	***0.723***		
International-level Financial Environment	0.667	0.441	0.650	0.626	0.569	***0.745***	
Investment Preparedness	0.309	0.733	0.388	0.779	0.633	0.514	***0.775***

Source: Field data (2024)

Henseler, Ringle and Sarstedt (2015) proposed a more robust technique called Heterotrait-Monotrait Ratio (HTMT) as an alternative (Table 4.4). According to this new criterion,

discriminant validity is not achieved when HTMT values are above 0.85. The lower the values, the better the model meets discriminant and convergent validity criteria. The HTMT values show that the measurement model has met the more stringent threshold of 0.85 (Henseler et al., 2015). Thus, again, based on HTMT, it suggests that indicators significantly perform well in discriminating against unrelated constructs and loading high on the parent constructs.

Table 4.4. Heterotrait-Monotrait Ratio (HTMT)

Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Circular Economy Finance and Investment Supply							
Circular Economy Practices	0.372						
Country-level Financial Environment	0.765	0.444					
Financial Readiness	0.474	0.692	0.511				
Firm-level Financial Environment	0.505	0.702	0.577	0.701			
International-level Financial Environment	0.680	0.428	0.670	0.620	0.573		
Investment Preparedness	0.307	0.729	0.385	0.785	0.622	0.499	

4.3.3 Assessment of the Structural Model

The structural model depicts the relationships among the latent variables based on the theoretical framework. The latent variable estimates are linear aggregates of their observed indicators, whose loadings are obtained via the PLS estimation procedure Figure 4.1 shows the structural relationships. The significance test of the hypothesised relationships relies on a bootstrapping procedure, where 5000 subsamples are randomly generated. Efron and Tibshirani (1985), and Preacher, Rucker and Hayes (2007) also describe bootstrapping as a computer-based method that ensures the accuracy of an estimation, where type 1 and type 2 errors are eliminated. This approach implemented in PLS-SEM makes it more robust in producing high statistical power.

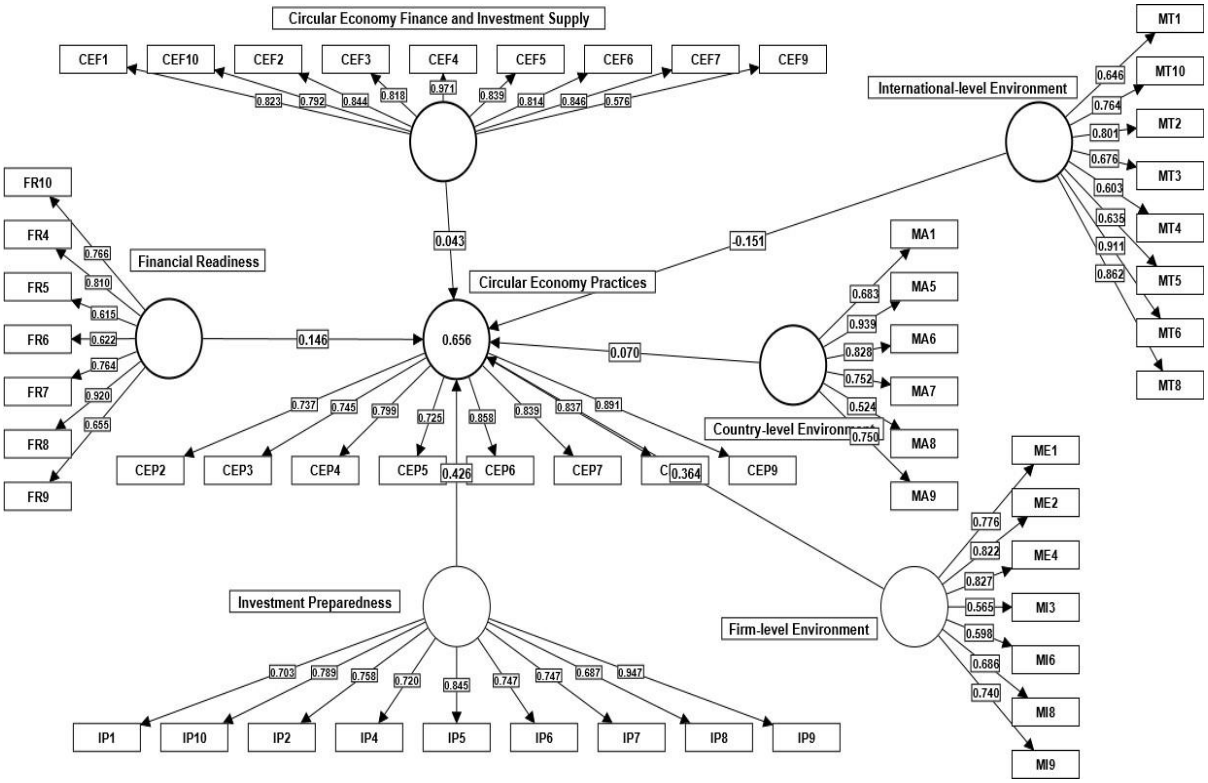


Figure 4.1. Structural model

4.3.4 Collinearity Diagnostics

In analysing the structural model, it is recommended that the correlations among the predictors be examined for collinearity. A basic test conducted before estimating the path model was to check collinearity and spurious outcomes in the estimation of the path coefficients in the structural model. According to Hair et al. (2017, 2019), a significant number of VIF (variance inflation factors) values of 5 and above indicate a collinearity problem. The examination of the VIFs (Table 4.5) shows all values are below the value of 5 as recommended by Hair et al. (2017, 2019) and Becker et al. (2015). Thus, we can conclude that the model has no collinearity issues.

4.3.5 Significance Test of Hypothesised Paths

The results of the two hypotheses H_1 and H_2 are presented in Table 4.5 and Figure 4.1. The path model was based on the theoretical arguments in the circular economy discourse. H_1 was further decomposed into the following sub hypotheses H_{1a}, H_{1b} and H_{1c}. In the case of H_{1a}, it was found that the waste management firms' financial readiness is a precursor to their circular economy practices ($\beta = 0.167$, $p = 0.006$). Financial readiness is the general financial health that is gauged by the implementation of financial risk controls, sound financial management practices, and good governance within the waste management firms in Ghana. Waste management firms that are in a stronger financial position, with greater access to capital, better financial management capabilities, and overall financial stability, are more likely to implement and adopt circular economy practices as part of their business operations.

For H_{1b} it was found that the firm-level financial environment of waste management firms is a precursor to their circular economy practices ($\beta = 0.315$, $p = 0.000$). This means that waste

management firms that operate within a more favourable financial environment at the firm level are much more likely to implement and adopt circular economy practices as part of their business operations.

In H_{1c}, investment preparedness was found to be a precursor for circular economy practices among waste management firms in Ghana (β= 0.398, p = 0.000). This means that waste management firms with greater levels of investment preparedness are more likely to implement and adopt circular economy practices as part of their business operations. Waste management firms with higher levels of investment preparedness are better positioned to channel their financial resources and expertise towards implementing and sustaining circular economy practices within their organisations.

Hypothesis H_2 consisted of H_{2a}, H_{2b} and H_{2c}. In the case of H_{2a}, it was found that the country-level financial environment was not a precursor to circular economy practices among waste management firms in Ghana (β = 0.070, p = 0.199). This means that the broader financial conditions at the country level, such as access to capital, financial sector development, and financial regulations, are not an important factor influencing the circular economy practices of the waste management firms in Ghana.

Also, in H_{2b}, it was found that the international-level environment was not a precursor of circular economy practices among waste management firms in Ghana (β= -0.103, p = 0. 055). Lastly, results for H_{2c} found that circular economy finance and investment supply were not a precursor for circular economy practices among waste management firms in Ghana. (β= 0.037, p = 0.554)

Table 4.5. Coefficients

Hypothesised relationships	Path coefficients	P values	95% BCI (Paths)	Sig.	Effect size (f^2)	VIFs
Circular Economy Finance and Investment Supply -> Circular Economy Practices	0.037	0.554	[-0.087,0.162]	No	0.002	2.701
Country-level Financial Environment -> Circular Economy Practices	0.070	0.199	[-0.033,0.181]	No	0.005	2.712
Financial Readiness -> Circular Economy Practices	0.167	0.006	[0.050,0.285]	Yes	0.017	3.593
Firm-level Financial Environment -> Circular Economy Practices	0.315	0.000	[0.216,0.414]	Yes	0.159	2.426
International-level Financial Environment -> Circular Economy Practices	-0.103	0.055	[-0.208,-0.001]	No	0.027	2.455
Investment Preparedness -> Circular Economy Practices	0.398	0.000	[0.300,0.498]	Yes	0.193	2.734

Source: Field data (2024)

4.3.6 PLS Predict

To evaluate a model's predictive value, it is necessary to examine both in-sample and out-of-sample predictions. In-sample prediction involves estimating a model from an accurate data set and utilising these estimates to predict observations from the same data set. R^2 and effect size are

the two most essential statistical techniques (f^2). Due to survey research's improved generalizability and the practical usefulness of findings for policy recommendations, there is a need to examine the robustness of the predictive power of models. Shmueli et al. (2016) developed PLS Predict as a robust algorithm to examine the predictive ability using new data. The procedure uses training and holds out samples to generate and evaluate predictions from PLS path model estimates.

Table 4.6. PLS Predict

	Q^2predict	**PLSSEM RMSE**	**PLSSEM MAE**	**LM_ RMSE**	**LM_ MAE**	**R^2**	**Q^2predict**
CEP2	0.324	0.766	0.578	0.756	0.571		
CEP3	0.331	0.784	0.597	0.746	0.569		
CEP4	0.385	0.851	0.655	0.824	0.635		
CEP5	0.312	0.778	0.598	0.804	0.598		
CEP6	0.448	0.756	0.574	0.760	0.564		
CEP7	0.425	0.787	0.594	0.810	0.602		
CEP8	0.425	0.762	0.582	0.780	0.583		
CEP9	0.481	0.736	0.559	0.704	0.530		
Circular Economy Practices						0.652	0.569

Source: Field data (2024)

PLS prediction is described as a goodness of fit test for structural models because it relies on the principle of cross-validation, and so a better estimate of predictive accuracy is obtained as a

result. The following test statistics, which are prediction errors, are reported as part of the procedure: RMSE (root mean square error of predictions), MAE (Mean absolute error), MAPE (Mean absolute percentile error) and Q^2 (like blindfolding-based Q^2). When a model has high predictive power, it is expected that the errors (RMSE, MAE and MAPE) in the linear model (LM) are larger than the errors produced in the partial least squares (PLS) model. Also, the Q^2_predict should be higher in the PLS model.

The test statistics in Table 4.6 show that the Q^2predict values are all greater than one, which satisfies the first requirement for predictive validity. However, not all scores in the RMSE and MAE in the LM model are higher than in the PLS model. Nevertheless, the overall model achieves predictive power because the $Q^{2,}$ value obtained from the PLS prediction is above 0.35 (Hair et al., 2018). Dul (2016a) suggested that an effect size above 0.5 can be described as a very large effect.

4.3.7 Necessary Condition Analysis

The necessary condition analysis was carried out using R software. First PLS SEM procedure was applied to generate latent variable scores exported to R. Although NCA and SEM are not bound by distributional assumptions, highly skewed data can affect the bootstrap results and reduce the statistical power. NCA runs on areas in scatter plots above the OLS regression line, so extreme outliers can affect the necessity effect size (Richter et al., 2020). On this note, the results for the NCA were presented in Tables 4.7, 4.8, and Figure 4.2.

Table 4.7. NCA Effect Sizes for Circular Economy Practices

Construct	CE-FDH	p-value
Circular Economy Finance and Investment Supply	0.000	1.000
Country level Environment	0.000	1.000
Financial Readiness	0.162	0.000
Firm-level Environment	0.128	0.000
International level Environment	0.000	1.000
Investment Preparedness	0.212	0.000

Source: Field data (2024)

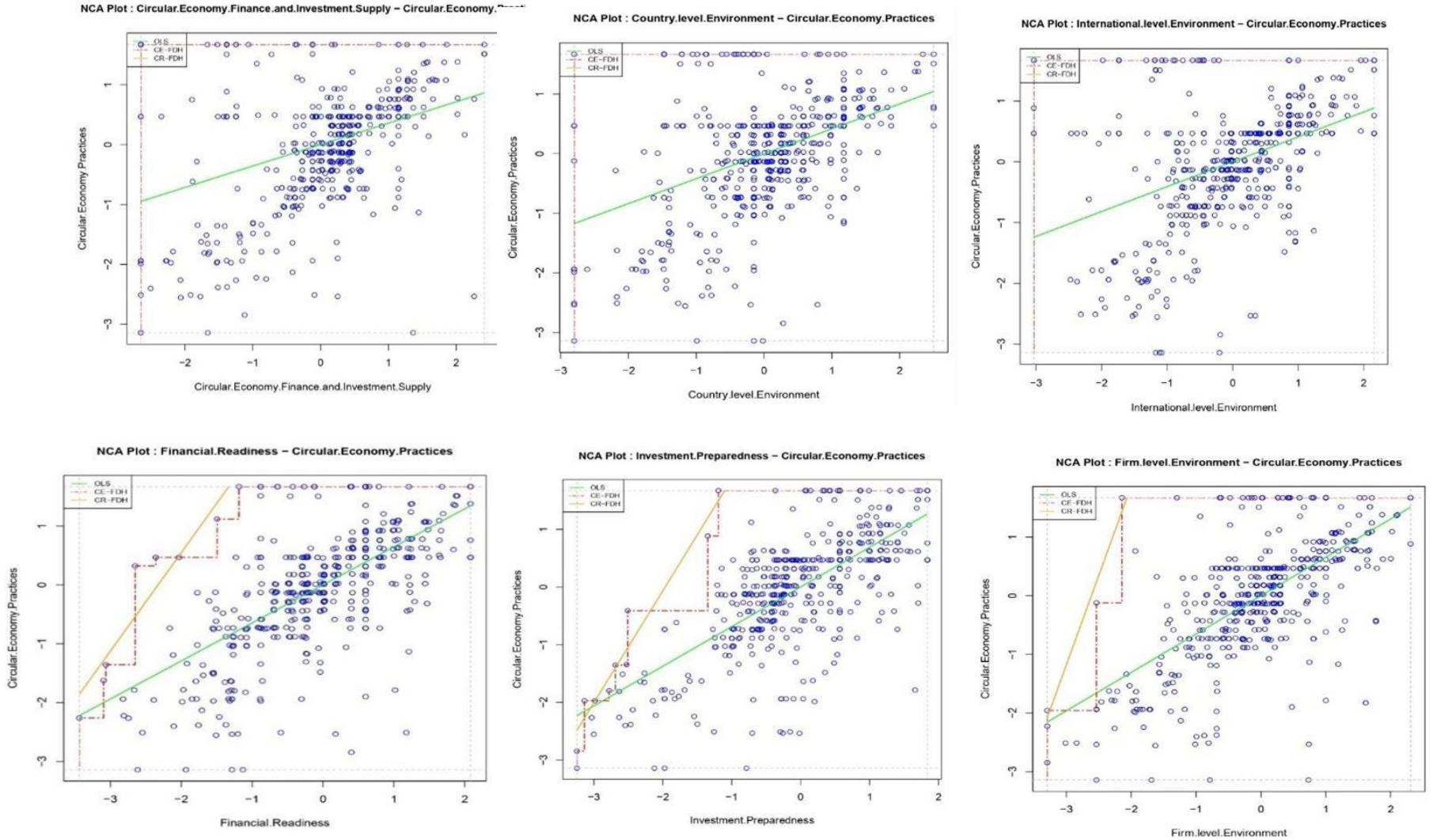


Figure 4.2. Scatter Plot

Table 4.8. Bottleneck

Circular Economy Practices	*Circular Economy Finance and Investment Supply*	*Country-level Financial Environment*	*Financial Readiness*	*Firm-level Financial Environment*	*International-level Financial Environment*	*Investment Preparedness*
0	NN	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN	2.1
20	NN	NN	6.2	NN	NN	2.1
30	NN	NN	6.2	13.5	NN	11.0
40	NN	NN	14.3	13.5	NN	14.5
50	NN	NN	14.3	13.5	NN	14.5
60	NN	NN	14.3	13.5	NN	37.3
70	NN	NN	14.3	20.6	NN	37.3
80	NN	NN	35.2	20.6	NN	37.3
90	NN	NN	40.8	20.6	NN	40.4
100	NN	NN	40.8	20.6	NN	40.4

Source: Field data (2024)

Table 4.5 provides information on the significance test of the proposed relationships in the structural model. The results show that investment preparedness recorded the strongest effect on circular economy practices (β= 0.398, p = 0.000), followed by a firm-level financial environment (β= 0.315, p = 0.000). Financial readiness also recorded a positive and significant effect. In contrast, circular economy finance and investment supply, and country-level and international-level financial environments show no significant impact on circular economy practices.

The NCA's results in Table 4.7 indicate that financial readiness, firm-level environment, and investment preparedness are meaningful ($d \geq 0.1$) and significant ($p < 0.05$) necessary conditions for circular economy practices. Again, it also shows the relationship between financial readiness, firm-level environment, and investment preparedness as independent constructs that are not necessarily linearly related to circular economy practices. A detailed examination of each necessary condition is presented in the bottleneck in Table 4.8. For example, the bottleneck table highlights that to reach a 20% level of circular economy practices, two necessary conditions need to be set at specific levels: financial readiness at no less than 6.2%, and investment preparedness at no less than 2.1%.

To reach a higher level, such as 70% of circular economy practices, three necessary conditions need to be in place: financial readiness at no less than 14.3%, the firm-level financial environment at no less than 20.6%, and investment preparedness at no less than 37.3%. Circular economy finance and investment supply, country-level financial environment and international-level financial environment are neither significant determinants in the PLS-SEM results nor necessary

conditions in the bottleneck table. In effect, the NCA results provide a robust test and a confirmation of the PLS-SEM results.

4.4 Discussions

The study assessed the effect of the internal and external environment of circular economy practices among waste management firms in Ghana. Regarding the first hypothesis, it was found that financial readiness was a significant and necessary condition for circular economy practices. This suggests that the overall financial capability, capacity, and preparedness of the waste management firms, in terms of access to capital, financial management expertise, and financial stability, are crucial enablers of their engagement in circular economy practices. Firms with a stronger financial foundation appear to be better positioned to invest in and implement circular economy practices.

Again, the firm-level financial environment as a measure of the internal environment of the waste management firm was found to be a significant and necessary condition for circular economy practices. This implies that the firm's internal financial landscape, such as access to capital, its capital structure, liquidity, credit policies, investment decisions, risk management practices, and overall financial strategy, plays a vital role in facilitating its transition towards circular business models. A more supportive firm-level financial environment seems to be a prerequisite for the adoption of circular economy practices.

Also, investment preparedness as a measure of the firm-level financial environment is a significant necessary condition for circular economy practices. This suggests that the waste management firms' overall readiness and capacity to make strategic investments, particularly in circular

economy projects and technologies, is a key precursor to their adoption of circular economy practices. Firms with a higher level of investment preparedness are better positioned to channel resources towards circular initiatives.

Interestingly, the study found that these internal financial level environments are not necessarily linearly related to circular economy practices. The Necessary Condition Analysis (NCA) highlighted specific levels of financial readiness, firm-level financial environment, and investment preparedness that are required as necessary conditions to achieve different target levels of circular economy practices. These findings offer important implications for managers and policymakers seeking to foster the transition towards a more circular economy in the waste management sector. The findings highlight the need for these waste management firms to address internal financial factors as part of a strategy to practice a circular economy.

In contrast, the study found that external factors, such as circular economy finance and investment supply, country-level financial environment, and international-level financial environment, were not significant determinants of circular economy practices in this context. This suggests that the internal capabilities and financial conditions of waste management firms are the more critical factors shaping their engagement in the circular economy. As suggested by Cai and Zhou (2014), circular economy practices are predicted by firm-specific factors, such as investments in green finance and having competitive pricing strategies that represent support for green business. To support this, De Jesus and Menonca (2018) explained that institutional and regulatory factors are determinants of circular economy practices. Financial readiness in identifying and mitigating financial and business risks, sourcing for potential funding concerning sustainable business practices, having insurance coverage, and engaging in financial planning as a waste management

firm contributes to circular economy practices. As the results indicate, being financially ready by considering these measures puts you in the category of a circular economy firm.

4.5 Chapter Summary

This chapter assessed the precursors of circular economy practices in the integrated waste management space. Using a cross-sectional research method, data was analysed using a two-stage collaborative technique: a PLS-SEM and a Necessary Condition Analysis. The results show that the business environment, investment, and finance are precursors of the circular economy among waste management organisations. The paper observed that adequate and right investment supply, adequate finance, and the appropriate business environment are conditions for circular economy practices. The outcome of this inquiry guides policy formulation in the design and implementation of regulations for circular economy practices within the integrated waste management sector.

CHAPTER FIVE

IMPLICATIONS OF CIRCULAR ECONOMY PRACTICES FOR FIRMS IN THE INTEGRATED WASTE SECTOR

5.1 Introduction

The Regional and National Sustainable Development Agendas are guided by the Sustainable Development Goals (SDGs) or Agenda 2030. For instance, Agenda 2063 was introduced by the African Union (AU) in 2015 (AUC, 2015). The growth strategy closely resembles the United Nations' Agenda 2030. The SDGs urge everyone to ensure the availability and sustainable use of resources. Ghana's medium- and long-term goals reaffirm these international and local objectives. For instance, around 70% of the SDGs and Agenda 2063 are included in Ghana's Medium-Term National Development Policy Framework (2014–2021) (National Development Planning Commission, 2021). These policies include elements of environmental management, circular economy-inspired green business practices, and sustainable consumption and production.

These objectives are made at a time when the globe, including nations like Ghana, is dealing with issues like deforestation, pollution, and climate change because of economic and resource shortages (Terragni, 2014; Kapur, 2016; World Resource Institute, 2017, Schwartz & Popovich, 2019). According to statistics, Ghana's annual rate of deforestation between 2013 and 2015 was 794,214 hectares (Ghana Forestry Commission, 2017). Furthermore, between 1950 and the turn of the century, the nation is reported to have lost 60% of its forest cover (FAO, 2010; Forestry Commission, 2017). Illegal logging and surface mining are the main reasons for deforestation (popularly known as Galamsey). Galamsey is to blame for degraded surface and groundwater

quality as well as diminished soil fertility (Antabe et al., 2017; Aboka, Cobbina & Doke, 2018). In addition, landfills, sewers, and open spaces in almost every nation are now completely covered with plastic debris.

Some sustainability projects have been seen in Ghana to address the issues listed above. These include passing new legislation and amending existing ones to consider the needs of sustainable development. Additionally, efforts have been made to include sustainable development in national development plans within the framework of the circular economy. Resources are kept in use through the circular economy method, which involves recycling, reclaiming, regeneration, and reinvestment to benefit society (Stahel, 2016, Jorgensen & Pedersen, 2018, Agyapong, 2020). It is anticipated that businesses that adopt circular economy principles will experience cost savings by recycling their garbage.

It is crucial to comprehend how such activities affect economic agents, including corporations, as countries try to achieve sustainable development goals. Furthermore, as the nation transitions to a circular economy, it is important to determine how well-prepared businesses are for investment. The integrated waste management sector has limited data on the relationship between corporate performance and the circular economy. Previous research on this phenomenon in Ghana has not been done. Secondly, a systemic waste management issue affects emerging nations like Ghana (Ayeleru, 2020; Loukil & Rouached, 2020). Waste is a crucial source of raw materials for companies (Awasthi et al., 2019; Qiu et al., 2020). However, it is still a significant issue for governments (Gbadamassi et al., 2020). It is important to emphasise the advantages of circular economy practices for businesses to adopt them. On this subject, Ghana has scanty empirical data.

As a result, the study examines how circular economy principles may affect Ghana's integrated waste management industry's performance.

5.2 Empirical Methodology

The empirical methodology discusses the data and methods including the research design, approach, population, sample, and sampling technique. It also has the measures and the measurement of variables.

5.2.1 Data and Methods

The study used a cross-sectional design and a quantitative research method. The target populations were the owners/managers of integrated waste management firms in the Environmental Service Providers Association of Ghana (ESPA) database. In all, there were 7,190 registered members of ESPA spread across the sixteen regions (16) of Ghana. Three hundred and sixty-seven (367) firms were selected using Bartlett, Kotrlik and Higgins's (2001) Sample Size Determination formula. However, the sampling size is the minimum required based on assumptions of continuous data characteristics, a 5 percent margin of error, and a significance level of 5%. However, an oversampling strategy was used to account for a high non-response rate that characterises primary data-based surveys, especially those involving actors in the waste management sector. This resulted in 524 responses obtained from the participants in the study. The objective of oversampling was to help better estimate the attributes of the firms. It was also to help inch closer to precision despite the delays and costs encountered (Vaughan, 2017).

Data was collected from integrated waste management firms using a questionnaire consisting of a ten-point Likert-like scale with closed-ended questions. The scale ranged from zero (0), the lowest to ten (10) the highest. The questions focused on investment preparedness, financial readiness,

circular economy finance, investment supply, and the financial environment. The aim was to assess the determinants of circular economy finance and investment supply among integrated waste management firms in Ghana.

5.2.2 Sampling Procedure

The study used a simple random sampling (SRS) technique. This technique is appropriate for populations that are homogeneous and permit uniform selection (Etikan & Bala 2017) as in the case of the firms in the ESPA database. Furthermore, the approach offered every firm an equal chance of being included in the study (Noor, Tajik & Golzar, 2022; Berndt, 2020). Therefore, this approach has the benefit of producing an unbiased and representative sample (Stratton, 2021). To obtain the list of participants, the computerised randomisation method in Microsoft Excel was used. This was done by importing the list of the integrated waste management firms in the sampling frame into Microsoft Excel. The list of waste management firms was coded (1, 2, 3….7190) before being imported. Then the RAND function was used to generate the list of participants for the data collection.

5.2.3 Operationalisation of Variables

Additionally, the framework depicts other reflective measurements of the individual variables including. The measurement of variables is presented in Table 5.1.

Table 5.1. Measurement of Variables

Variables	Measurement
Upcycling	Upcycling focuses on enhancing the value of materials that can be reintegrated into the system, not just as recycled or recovered entities, but also through the creation of advanced materials. It was measured using the following constructs: re-manufacturing, re-investment in circular economy activities, and recycling (Mahabir *et al*., 2021; Horodytska *et al.*, 2020).
Waste recovery	Waste recovery refers to the process of collecting, processing, and converting waste materials into usable resources or energy. It was measured using the following constructs: waste collection and separation, material recovery and re-gift of suitable waste products (Shahrashoub, & Bakhtiari, 2021; Liao & Wang, 2020)
Firm performance	The proxies for measuring firm performance with the circular economy framework, include social performance, economic performance, environmental performance and Governance performance (Thacker *et al.,* 2019; Scarpellini *et al*., 2020)
Investment preparedness	The constructs for investment preparedness followed the elements in Mason and Kwok (2010), including equity aversion (dilution of control and ownership), investability (knowledge of the sector), presentational failings, functioning products and services, good corporate governance, the experience of managers, quality of the board, NPD potential and assets quality.
Financial Readiness	This is measured by composite indicators including the understanding of the firm's risks, business survival potential, employee retention strategy of key personnel, understanding and mitigating costs, identifying other sources of potential funding, assessing liquidity needs, presence of loss response team and assessing insurance coverage (Melton, 2017)

5.2.4 Analytical Procedures

The data were analysed using pairwise Markov random field (PMRF; Costantini et al. 2015a, van Borkulo et al. 2014) and partial least squares structural equation modelling (PLS-SEM) approaches. To corroborate the linear correlations proposed in the PLS-SEM model, further checks had to be made because numerous associations were being estimated. PLS-SEM is very useful for exploratory research because it maximises the explained variance of a group of endogenous

constructs in a model. Evidence from published works shows that PLS integrates factor analysis and route analysis into significantly more rigorous statistical processes (Kaplan, 2009; Hair et al., 2006). Latent variables were extracted to gather changes in the real endogenous variable (Mateos-Aparicio, 2011). Additionally, the correlation between the exogenous and endogenous variables is used to estimate the regression parameters to maximise the variance of the endogenous variable. It is appropriate for performing measurement and prediction tasks, as well as evaluating sophisticated models.

Making the measurement model is the first step in conducting data analysis using PLS-SEM. According to the reflective theory, the relationship between variables should be examined, considering how the measures reflect (or manifest) a construct. Before being included in the path model, the reflective measurement model estimate method includes a test of construct validity and reliability. Four reliability and validity tests—internal consistency, indicator, convergent, and discriminant reliability—were carried out. These tests examined the proportion of the indicator variables the latent variable accounted for as a diagnostic test using PLS-SEM. The idea was to eliminate indicators with loadings of less than 0.4 in the PLS model from the measurement model, as proposed by Hulland (1999). An evaluation of convergent validity was done in addition to the indicator reliability test. The degree to which one indicator positively connects with other indicators of the same construct was examined in this test. The indicators' outer loadings and the average variance retrieved were looked at during this process.

5.4 Results and Discussions

The results of the hypotheses tested were presented with various diagnostic checks including validity, reliability and multicollinearity. The section also discussed the results and the implications of the findings.

5.4.1 Assessment of Measurement Model

The measurement model shows the connections between the constructs and the indicators. By reducing the residual variances of the endogenous constructs, the partial least squares-structural equation modelling (PLS-SEM) analytical approach combines factor analysis with multiple regression (Hair et al., 2011). The PLSSEM is a useful technique for estimating complex models, including higher-order construct modelling, because the studies that follow use latent variable scores. An assessment of the measurement model is suggested as the first step before the structural model may be further examined to verify that the hypothesised relationships between structural models are accurately interpreted and presented (Hair et al., 2018). Before estimating the coefficients of the structural model, the PLS-SEM algorithm first optimises the measurement model's parameters. The suggested techniques appropriate for the assessment of measurement model quality, include indicator reliability, internal consistency reliability, and convergent and discriminant validity. Table 5.2 displays indicator dependability and internal consistency dependability.

Table 5.2. Reliability and Validity Assessment

Code	Latent constructs	Factor Loadings	rho_A	Composite Reliability	AVE
Economic Performance			**0.968**	**0.968**	**0.769**
PfP 1	We have experienced increasing economic value-added	**0.847**			
PfP 2	Our return on equity has been improving	**0.887**			
PfP 3	The Firm's net income/revenue is increasing steadily	**0.891**			
PfP 4	Return on investment helps retain our investors	**0.874**			
PfP 5	We have experienced increasing earnings before tax	**0.865**			
PfP 6	Our management is efficient at using its assets to generate earnings	**0.889**			
PfP 7	Profit margins in this sector are often very high	**0.882**			
PfP 8	The firm has experienced growth in profit over time.	**0.906**			
PfP 9	We have low operating costs that improve our profit	**0.851**			
Environment Performance			**0.960**	**0.958**	**0.698**
EP1	We have projects to improve/recover the environment	**0.708**			
EP10	Businesses and banks make a profit	**0.897**			
EP2	The firm has a low level of energy intensity (lower cost to convert energy)	**0.849**			
EP3	We use recyclable materials	**0.795**			
EP4	We reuse our residuals	**0.843**			
EP5	We monitor the volume of energy consumption	**0.879**			
EP6	The firm has not experienced any lawsuits due to its practices	**0.833**			

EP7	We use lesser water in our operations	**0.872**			
EP8	We have met all the environmental performance goals we set for the business.	**0.872**			
EP9	Businesses and banks make a profit	**0.793**			
Financial Readiness			**0.954**	**0.953**	**0.669**
FR1	The firm has a high financial survival potential	0.884			
FR2	The firm has a strategy for retaining key personnel in the business.	**0.894**			
FR3	There is a strategy for identifying and mitigating financial and business risks	**0.832**			
FR4	The firm has other sources of potential funding	**0.862**			
FR5	The firm can determine its liquidity and financing needs	**0.824**			
FR6	There is the presence of a loss response team	**0.737**			
FR7	The firm has insurance coverage for projects it finances	**0.798**			
FR8	The firm has financed its projects previously from equity.	**0.810**			
FR9	Debt financing has been the means for financing the firm's projects	**0.743**			
FR10	Integrated waste management firms often engage in financial planning	**0.778**			
Governance Performance			**0.927**	**0.924**	**0.671**
CGP1	Our Board Size is comparable to that of similar firms	**0.864**			
CGP2	Our Board is free from any form of interference	**0.877**			

CGP3	We have directors who monitor executives to act in the interest of owners.	**0.825**			
CGP4	Managers have high share ownership	**0.831**			
CGP5	There is gender diversity on the Board	**0.715**			
CGP10	Customers purchase products in large volumes	**0.792**			
Investment Preparedness			**0.959**	**0.958**	**0.697**
IP1	The business is open to large scale of investment.	**0.854**			
IP2	The firm is willing to dilute its ownership and control	**0.798**			
IP3	The firm has managers who have knowledge of the sector and its dynamics	**0.788**			
IP4	The business has well-functioning products and services	**0.855**			
IP5	There are good corporate governance practices in the firm	**0.891**			
IP6	There are experienced managers in the firm	**0.861**			
IP7	The firm has a diverse board.	**0.779**			
IP8	There is new product development potential for the firm	**0.765**			
IP9	The firm boosts quality assets for its operations	**0.878**			
IP10	The firm has a good reputation in the industry	**0.869**			
Social Performance			**0.955**	**0.953**	**0.670**
SP1	We employ more people from minority groups	**0.702**			
SP2	We have a number of social and cultural projects	**0.715**			
SP3	Our firm have not experienced any lawsuits	**0.877**			

SP4	We meet regulatory agencies' requirement	**0.854**			
SP5	We engage in fair trade	**0.864**			
SP6	We work to reduce vulnerability in our community	**0.868**			
SP7	The business has good relations with the community	**0.837**			
SP8	Our operations do not affect the people	**0.864**			
SP9	We are a diverse business	**0.715**			
SP10	Society Need trees	**0.829**			
Upcycling			**0.886**	**0.884**	**0.718**
REM	The firm undertakes re-manufacturing.	**0.874**			
REC	Waste recycling is an integral part of the firm's activities	**0.876**			
REF	The firm re-invest in circular economy activities.	**0.788**			
Waste recovery			**0.874**	**0.873**	**0.696**
WC	The firm engages in waste collection and separation	**0.804**			
WR1	The firm undertakes material recovery as part of waste management	**0.831**			
WR2	The firm engages in re-gift of suitable waste products	**0.866**			

The results in Table 5.2 show recommended techniques such as AVE, composite reliability, factor loadings, etc, for assessing the model's convergent validity and reliability, as well as the reliability of the items (factor loadings). To analyse the reliability of indicators, factor loadings—where elements with loadings above 0.7 were retained—were employed. Factor loadings show how well something captures the conceptual space of a construct. Because factor loadings above 0.7 are advised, items with low factor loadings (0.60) were excluded from the measurement model (Becker et al., 2018). Internal consistency quantifies the degree to which test items measure the underlying constructs. It highlights a test's capacity to generate reliable results by employing a range of objects to gauge a range of constructs. The study evaluates internal consistency and dependability using two diagnostic methods (Cronbach's alpha and composite reliability).

In addition to the Cronbach alpha, composite reliability—which is a more accurate measure of reliability in a PLS-SEM setting—was reported as an additional check on construct dependability (Hair et al., 2018). The total scale score variance is contrasted with the true score variance (Brunner & SÜ, 2005). It assesses the shared variance among the observed variables and acts as a latent construct indicator (Fornell & Larcker, 1981). The composite reliability score (C.R.) must be more than 0.708 to pass this test. If the C.R. is 0.60–0.70, exploratory research may be considered appropriate.

5.4.2 Test for Convergent and Discriminant Validity

The percentage of the indicator variables that the latent variable could explain was examined by the indicator reliability test. Although writers of flexible criteria propose factor loadings over 0.6, Hulland (1999) highlighted that the standard practice was to eliminate reflected indicators with loadings of less than 0.708 from the measurement model. The latent variable must account for at

least 50% of the variance in the indicators. It was anticipated that the outer loading would be greater than 0.708, or 0.5 squared. The concept of convergent validity shows how to scale items for the same construct about scale items of a similar nature. The final score of the average variance derived is influenced by the factor loadings' dependability (AVE).

The measuring criteria were cross-loading, Fornell-Larcker criterion (FLC), and Heterotrait-Monotrait Correlation Ratio (see Table 7.8, 7.9 and 7.10 in Appendix) (HTMT). Henseler et al. (2014) claim that the cross-loading approach to discriminant validity is established by a construct indicator's low connection with all other constructs other than the one to which it is theoretically related. The PLS algorithm technique is used to generate cross-loadings (See Table 7.8 in Appendix), which may then be tested for discriminant validity. The results show that indicators leaned more heavily on their parent components than on other constructs. A construct is regarded as discriminant valid by the Fornell-Larcker criterion if its square root of the AVE is higher than its correlations with other indicators (Fornell & Larcker, 1981). Values in bold indicate the AVE's squared root (See Table 7.9 in Appendix). A list of correlations between the latent constructs is shown below the square root of the AVE. Any construct that demonstrates discriminant validity, which is indicated by having a squared root of the AVE higher than the construct with the highest correlation to other components, is valid.

The Heterotrait-Monotrait ratio of correlations (HTMT) (See Table 7.10 in Appendix) is described as a more trustworthy way for assessing discriminant validity in variance-based SEM in comparison to cross-loadings and the FornellLarcker criterion (Henseler et al., 2014). The HTMT's ultimate result near one, which is more credible, denotes a lack of discriminant validity.

Discriminant validity is present if latent ratios are smaller than the threshold value of 0.85 (Kline, 2011) or 0.9. (Gold, Malhotra & Segars, 2001). According to HTMT, which again demonstrates that indicators significantly perform well in differentiating between unrelated constructs and loading highly on the parent constructs. After the measurement model's quality has been established, the structural model is further evaluated based on collinearity diagnostics, significance tests of hypothesised correlations, and the model's explanatory and predictive power.

5.4.3 Assessment of the Structural Model

Additional structural model fit concerns were resolved throughout the structural model analysis. Collinearity, relevance, and significance of structural models, effect size, the cumulative effect of the exogenous factors, and the predictive utility of the route model were some of these concerns. Before estimating the path model, collinearity should be tested as a fundamental step. The structural model's path coefficient is based on OLS regressions of each endogenous latent indicator on the constructs it preceded.

A VIF score of 5 or above with a tolerance of 0.2 or below denotes a collinearity issue, according to Hair et al. (2017, 2019). Next, based on the study's theoretical and empirical foundations, the structural model relationship (path coefficients) or hypothesised link was determined. When estimating the path coefficient, the significance test was also calculated for the relationships in the structural model. Using the t-values and p-values, the significance level of the path coefficient connections was calculated. The coefficient of determination (R^2), the effect size (f^2), and the predictive relevance (Q^2) were used to further assess the structural model and its results. The amount of variance in the dependent variable that the independent variables could account for was assessed by the coefficient of determination (R^2) between zero (0) and one (1) for R^2 (1).

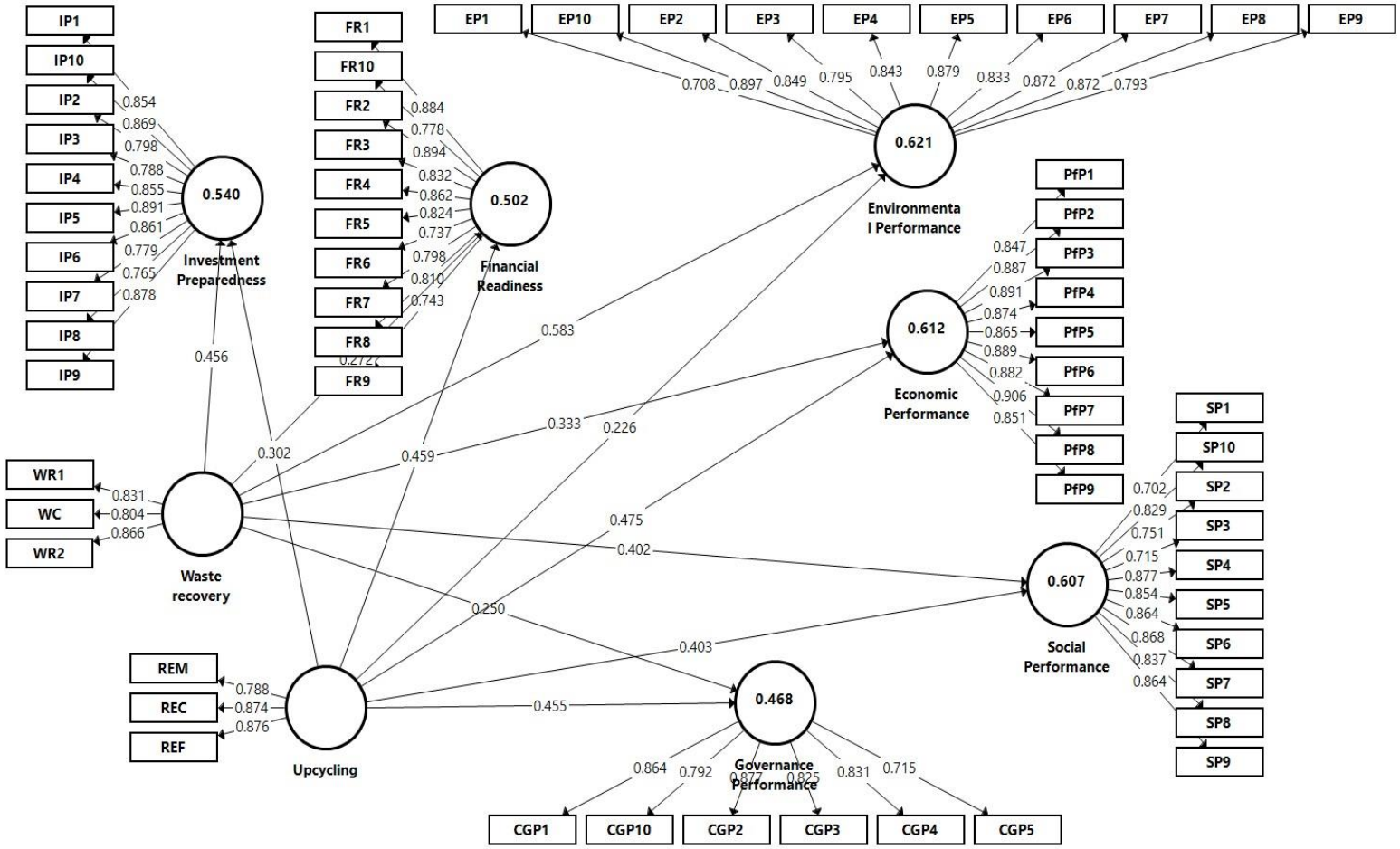


Figure 5.1. Structural Model

Table 5.3. Report the explanatory power indices: R square, F square

	Adj. R^2	*Upcycling* f^2	*Waste recovery* f^2
Economic Performance	0.611	0.139	0.068
Environmental Performance	0.620	0.032	0.214
Financial Readiness	0.500	0.101	0.035
Governance Performance	0.466	0.093	0.028
Investment Preparedness	0.538	0.047	0.108
Social Performance	0.606	0.099	0.098
Upcycling	0.611		
Waste recovery	0.620		

Source: Field data (2024)

The two statistical methods (f^2) for assessing a model's predictive power are R^2 and effect size. According to Cohen (1988), the general guideline for calculating the f^2 Small, medium, and big were designated by values of 0.20, 0.15, and 0.35, respectively. The predictive power and combined significance of a model are measured by the coefficient of determination (R^2). It displays the amount of variation in the endogenous construct that can be explained by all conceptually significant external factors. The range of R^2 values is 0 to 1, with higher values indicating more precise predictions. Adjusted R^2 is advised because it considers model complexity and facilitates model comparison because R^2 values rise with the number of predictors.

Table 5.4. Coefficients

	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	95% B.C.I 2.5%	97.5%
Upcycling -> Economic Performance	0.475	0.106	4.495	**0.000**	0.258	0.675
Upcycling -> Environmental Performance	0.226	0.130	1.736	**0.083**	-0.041	0.461
Upcycling -> Financial Readiness	0.459	0.122	3.755	**0.000**	0.208	0.691
Upcycling -> Governance Performance	0.455	0.124	3.670	**0.000**	0.202	0.694
Upcycling -> Investment Preparedness	0.302	0.127	2.388	**0.017**	0.030	0.533
Upcycling -> Social Performance	0.403	0.129	3.132	**0.002**	0.140	0.646
Waste recovery -> Economic Performance	0.333	0.105	3.183	**0.001**	0.130	0.547
Waste recovery -> Environmental Performance	0.583	0.126	4.641	**0.000**	0.352	0.835
Waste recovery -> Financial Readiness	0.272	0.123	2.212	**0.027**	0.031	0.516
Waste recovery -> Governance Performance	0.250	0.123	2.024	**0.043**	0.010	0.496
Waste recovery -> Investment Preparedness	0.456	0.126	3.624	**0.000**	0.229	0.717
Waste recovery -> Social Performance	0.402	0.127	3.157	**0.002**	0.161	0.664

Source: Field data (2024)

The results of the hypotheses test are displayed in Table 5.4. Two key circular activities of firms in the waste management sector were examined based on the theoretical and empirical evidence supporting them. Environmental, social, economic, and governance performance indicators were used to model waste recovery and upcycling. Additionally, the effect of upcycling and waste recovery on financial readiness and investment preparedness was tested.

For hypothesis H_{1a} it was found that upcycling had a positive and significant effect on economic performance ($\beta = 0.475$, $t=4.495$, $p = 0.000$). Increased upcycling activities may lead to better economic performance for waste management firms. Upcycling activities may include recycling, which enables firms to find new uses for waste. Therefore, increasing their access to cheaper raw materials and consequently reducing their cost of operation may lead to better economic performance (Mahabir et al., 2021; Horodytska et al., 2020). The findings also implied that waste management companies are better positioned to compete for investments and finance if they engage in circular economy practices like upcycling. That is the engagement in upcycling by waste management firms may attract socially responsible investors. According to the findings of Atan et al. (2018), upcycling has a considerable impact on waste management firms' ability to secure funding and investments, especially from socially responsible investors. This will lead to an increase in capital for their operations.

Furthermore, it was observed that upcycling had a positive and significant effect on social performance ($\beta = 0.403$, $t=3.132$, $p = 0.002$). Upcycling activities may lead to better social performance. This implies that once these firms engage in better waste management practices (e.g. re-manufacturing), they receive higher social acceptance as they may not experience lawsuits and

social resistance (Dalal & Thaker, 2019; Scarpellini et al., 2020). This would impact their social activities within the community.

Also, upcycling had a positive and significant effect on governance performance ($\beta = 0.455$, $t=3.670$, $p = 0.000$). This implies that an increase in upcycling activities by waste management firms would enhance their governance performance. When firms engage in upcycling activities (e.g. recycling and remanufacturing), it enables them to improve their operations (Scarpellini *et al.*, 2020). This would enable the firm to attract better management and investors. This is because these individuals would want to receive a better return on investment and be associated with the success story of such firms (Dalal & Thaker, 2019).

However, the effect of upcycling on environmental performance was positive but not significant ($\beta = 0.226$, $t=1.736$, $p = 0.083$). For upcycling to be attractive to waste management firms, they need to collect large volumes of appropriate waste before recycling or further processing. Meanwhile, low levels of waste segregation among households and other waste generators make it difficult for waste management firms to collect or obtain large quantities of segregated waste for their operations (Ofori et al., 2021). Therefore, the few firms that engage in upcycling, given the increasing levels of waste generated, are not able to make a significant impact on the environment.

Regarding hypothesis H_{1b} waste recovery had a positive and significant effect on economic performance ($\beta = 0.333$, $t=3.183$, $p = 0.001$). This implies that when waste management firms can collect and separate more material waste, it would lead to improved economic performance.

Effective waste recovery processes lead to more efficient use of resources. By recovering materials that would otherwise be discarded, firms reduce their reliance on raw materials, lowering costs associated with material procurement (Atan et al., 2018). Also, recovered materials can be sold or repurposed, creating new revenue streams. For example, recycled metals, plastics, or glass can be sold to manufacturers, while organic waste can be converted into compost or bioenergy, generating additional income for these waste management firms. Firms that demonstrate commitment to sustainability through waste recovery can enhance their brand value and reputation. This can attract environmentally conscious customers and investors, providing a competitive edge (Scarpellini et al., 2020). Engaging in waste recovery can stimulate innovation, leading to the development of new products or services. This not only diversifies the business but also opens new markets.

Also, from the results, it was found that waste recovery had a positive and significant effect on environmental performance ($\beta = 0.583$, $t=4.641$, $p = 0.001$). This outcome suggests that effective waste recovery practices enhance environmental performance among waste management firms. By effectively recovering, firms can reduce landfilling, thereby mitigating harmful emissions and environmental degradation (Shahrashoub & Bakhtiari, 2021; Liao & Wang, 2020). Also, the recovery of waste materials contributes to the conservation of natural resources, further reinforcing environmental benefits. The findings also suggest that for waste management firms, investment in and focus on waste recovery processes are not merely regulatory compliance or corporate social responsibility initiatives but are indeed integral to their core mission of enhancing environmental performance (Favi et al., 2016; Yazdani, Gonzalez & Chatterjee, 2019). The result

affirms that waste recovery is an important aspect of sustainable waste management, contributing significantly to improved environmental outcomes.

It was found that waste recovery had a positive and significant effect on governance performance ($\beta = 0.250$, $t=2.024$, $p = 0.048$). This finding indicates that adopting waste recovery practices enhances governance within waste management firms. The significance of this relationship can be attributed to several factors. First, effective waste recovery practices require robust management and operational systems, which in turn foster better organisational governance. This includes transparent decision-making processes, accountability, and adherence to regulatory standards, all of which are crucial aspects of governance (Dubey et al., 2019; Shahbazi et al., 2016; Bressanelli, Perona & Saccani, 2018). All these could be achieved by implementing monitoring and reporting mechanisms to improve data accuracy and transparency, an essential feature of strong governance. Second, the environmental responsibility demonstrated through effective waste recovery can enhance a waste management firm's compliance with environmental regulations and policies, which is a key component of good governance. It reflects a waste management firm's commitment to legal standards and ethical practices.

It was also found that waste recovery had a positive and significant effect on social performance ($\beta = 0.402$, $t= 3.157$, $p = 0.000$). This result indicates that waste recovery among integrated waste management firms promotes social welfare. Effective waste recovery initiatives often lead to reduced environmental hazards, promoting healthier and safer communities (Raimonda et al., 2020; OECD, 2019). By reducing waste and its associated negative impacts, firms are actively participating in the betterment of the living conditions in the areas they operate in. Additionally,

waste recovery processes can create job opportunities, particularly in recycling and processing activities. This not only contributes to economic well-being but also fosters community engagement and development (Liao & Wang, 2020). Moreover, firms that actively engage in waste recovery are often viewed positively by the public, enhancing their social image and standing. This can lead to better community relations and corporate social responsibility, thereby improving their social performance (Shahrashoub, & Bakhtiari, 2021).

For hypothesis H_{2a} upcycling had a positive and significant effect on the financial readiness (β = 0.459, t= 3.755, p = 0.000) of waste management firms in Ghana. This finding implies that upcycling enhances the financial readiness of these waste management firms. This suggests that upcycling, as a strategic initiative, goes beyond mere waste reduction; it strengthens the cashflows of waste management firms (Khan & Haleem, 2020; Bag et al., 2019). This is because upcycling adds value to waste materials, thereby creating new revenue streams and reducing costs associated with waste processing and disposal (Govindan & Hasanagic, 2018). The transformation of waste into higher-value products through upcycling not only contributes to environmental sustainability but also aligns with economic gains, underpinning the financial viability of these waste management firms.

Also, upcycling had a positive and significant effect on investment preparedness (β = 0.302, t= 2.388, p = 0.017) of waste management firms in Ghana. This finding implies that upcycling enhances the investment preparedness of these waste management firms. First, upcycling can lead to the development of innovative products and processes, which in turn can open up new markets and revenue streams (De Angelis, Howard & Miemczyk, 2018; Luthra & Mangla, 2018). This

diversification strengthens the financial stability of firms, making them more appealing to potential investors and lenders. Second, engaging in upcycling can improve these firms' reputations in the market, given current consumers' and investors' interest in sustainable business practices. This enhanced reputation can make it easier for waste management firms to attract appropriate investment. Furthermore, upcycling demonstrates a firm's strategic approach to resource innovation, an essential quality for investors.

Convening hypothesis H_{2b} waste recovery had a positive and significant effect on the financial readiness ($\beta = 0.272$, $t= 2.212$, $p = 0.027$) of waste management firms in Ghana. This means that waste recovery promotes financial readiness among waste management firms. This implies that waste recovery, as a component of sustainable practices, contributes not only to environmental stewardship but also to the economic health of waste management firms. These findings suggest that the more efficient a firm is at recovering waste, the better equipped it is financially (Genovese et al., 2017). This is because waste recovery can lead to more efficient use of resources, reducing costs associated with raw material procurement and waste disposal. Recovered materials can be sold or repurposed, creating additional streams of income (Maqbool et al., 2020). This enhances the financial capacity of the firm to invest in other areas or cushion against financial uncertainties.

Moreover, it was observed that waste recovery had a positive and significant effect on investment preparedness ($\beta = 0.456$, $t = 3.624$, $p = 0.000$) of waste management firms in Ghana. This finding implies that waste recovery enhances the investment preparedness of these waste management firms. The result suggests that as these firms enhance their capacity to recover and process waste, they increase their preparedness to undertake new investment initiatives. Efficient waste recovery

enables optimal utilization of resources, leading to cost savings. These savings can be reallocated to investment opportunities, thereby enhancing these firms' growth. Firms' efficiency in waste recovery demonstrates a commitment to sustainable practices, which is increasingly valued in the market (Granz, Henn & Lutz, 2020; Capizzi, Croce & Tenca, 2022). This reduces perceived investment risks and makes the firms more attractive to potential investors. Effective waste recovery positions firms favourably within the market, potentially leading to increased business opportunities and the ability to investment avenues.

5.4.4 Partial Correlation

When numerous variables interact with one another, it may be important to assess the true relationship between these variables without taking another factor into account. It was evaluated whether there is a partial association between circular economy practices, financial readiness, investment preparedness, and performance indicators. Pairwise Markov Random Fields (PMRF; Costantini et al., 2015a; van Borkulo et al., 2014) are a well-liked network model for predicting psychological networks that were applied in this investigation. Psychological networks are made up of nodes that represent the observed variables and edges that represent the statistical correlations between the nodes. An estimated parameter in psychological networks is the degree of connectivity between two nodes. The parameters are approximated more precisely with a larger sample size (close to the true value). Typically, a network structure is created to explain how the nodes, or variables, are related to one another. The network structure is shown in Figures 5.2 and 5.3, and the post-hoc stability analysis and tests for substantial differences**.**

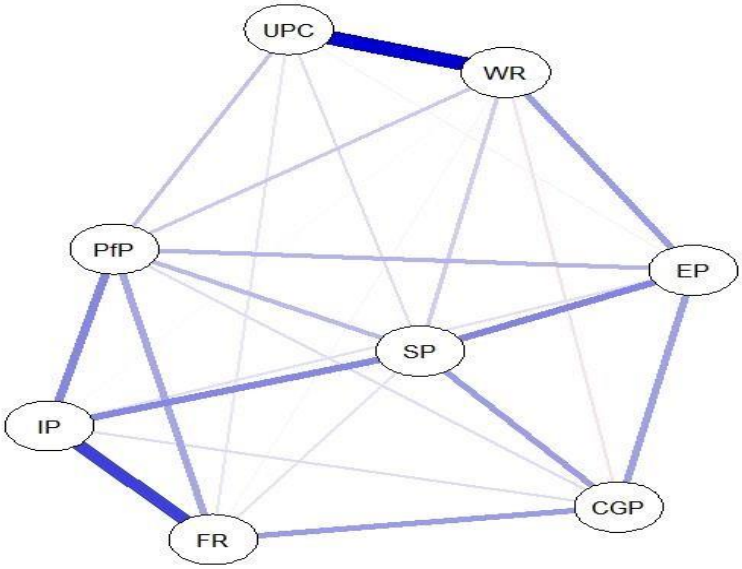


Figure 5.2 Estimated network structure

UPC: Upcycling, WR: Waste recovery, EP: Environmental performance, SP: Social Performance, PfP: Economic performance, CGP: Corporate Governance Performance, IP: Investment preparedness, FR: Financial readiness.

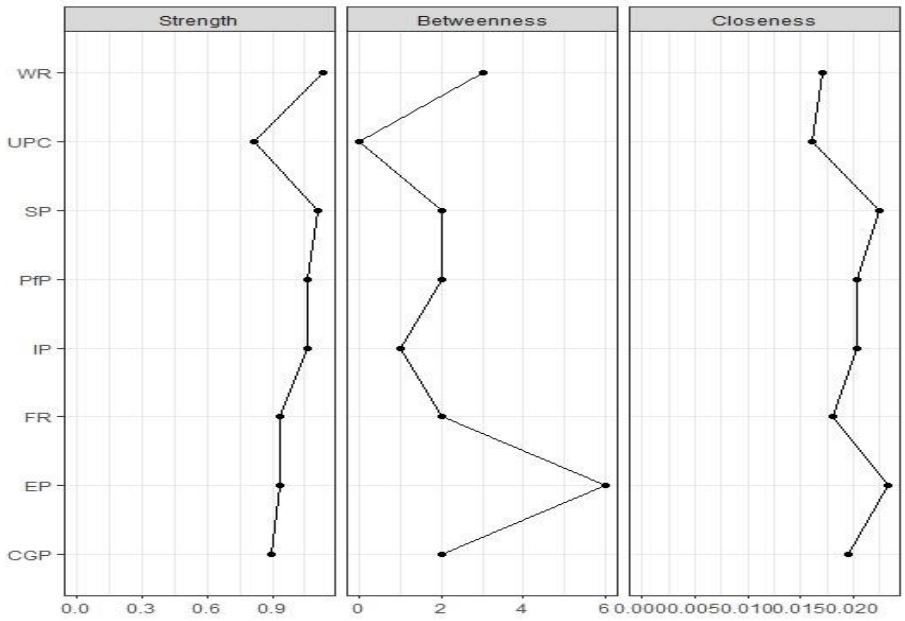


Figure 5.3. Centrality indices

UPC: Upcycling, WR: Waste recovery, EP: Environmental performance, SP: Social Performance, PfP: Economic performance, CGP: Corporate Governance Performance, IP: Investment preparedness, FR: Financial readiness.

Figure 5.2 displays the connections (regularized partial correlations) between network nodes (for all connections, p .003). Shorter, thicker lines with positive links shown in green and negative associations in red represent the strength of the connections between the nodes. The network topology shows strong ties between UPC (upcycling), WR (waste recovery), FR (financial readiness), and IP (positive in blue colour) (Investment preparedness). The marginal links between IP (Investment preparedness) and PfP (economic performance), IP (Investment preparedness) and SP (social performance), SP (social performance) and EP (environmental performance), CGP, and others may be shown in addition to the strong linkages. Additionally, there were weak linkages between several concepts, such as EP, WR, and UPC (upcycling) (environmental performance). Upcycling activities and waste recovery were strongly correlated, as shown by the strongest relationship between UPC (upcycling) and WR (waste recovery). Upcycling entails cyclic processes like inventive repair and reuse techniques.

Figure 5.3 (right panel) shows how the nodes differ in terms of their estimates for centrality indices. The most statistically significant connections to other nodes in the network are made by a central node. Strength, betweenness, and closeness are the three primary centrality estimations produced throughout the estimation process (Epskamp et al., 2012). A node's strength describes how well it is directly coupled to other nodes. The total of the absolute weights (regularised partial correlations) connecting that node to other nodes is calculated (Di Cerbo & Taylor, 2021). A node's relevance in the typical path connecting two other nodes is indicated by its betweenness.

Also, how crucial a specific node is to linking other nodes. A node's closeness to other nodes in the network is determined by how well they are directly or indirectly connected to them. Using the R package bootnet, which examines variations in node strength, node centrality tests—i.e., statistical tests to assess whether any nodes in the network are considerably more central than other nodes— were carried out (Epskamp et al., 2016). The correlation of the stability coefficient, another bootnet calculation, was used to assess the accuracy of the strength values for the nodes and their links or edges (Epskamp et al., 2018).

We see a significant variation in the nodes' centrality indices (betweenness, strength, and closeness). The node with the greatest strength is WR (Waste Recovery), whereas EP (Environmental Performance) indicated the greatest betweenness and proximity. These findings indicate the value of WR (Waste Recovery) and its bearing on EP (Environmental performance). Every node, including UPC, EP, SP, PfP, CGP, IP, and FR, is directly connected to WR. However, EP is also the variable that is connected to all other variables most tangentially (closeness). In the average path between two other variables, it is the most significant variable (betweenness).

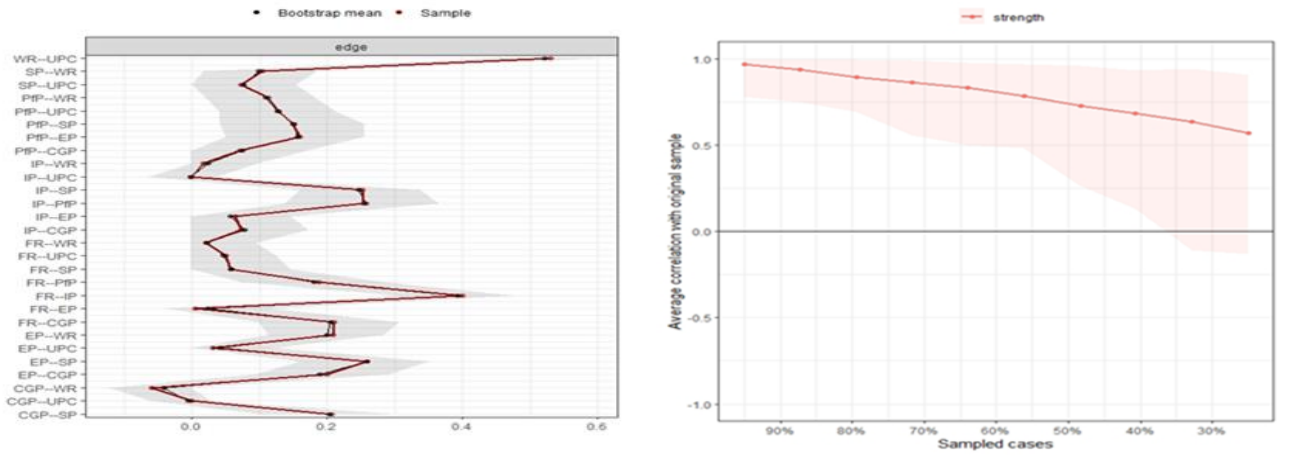


Figure 5.4. Bootstrapped confidence intervals of estimated edge weights for the estimated network

5.5 Discussions

The study's goals were to evaluate the effects of upcycling activities on waste management firms' performance, evaluate the effects of waste recovery on waste management firms' performance, examine the effects of upcycling on firms' financial readiness and investment preparedness, and finally examine the significant effects of waste recovery on these firms' financial readiness and investment preparedness. Results showed that upcycling has a substantial impact on economic performance, governance performance, and social performance (p-values of 0.000, 0.475, t=4.497, 0.455, t=3.670, and 0.403, t=3.132). The environmental performance of waste management companies, however, was unaffected by upcycling (= 0.226, t=1.736, p = 0.083). This suggests that a company's capacity to upcycle into circular activities has a significant impact on its economic, social, and governance performance.

No impact of upcycling on environmental performance. Focusing on the garment industry, Long and Gui (2022) noted that the environmental impact of quick upcycling depends on how eager these businesses are to engage in such operations. However, there hasn't been enough research done in the literature on upcycling decisions. There is a wide range in how fashion labels respond to opportunities for upcycling provided by upcycling enterprises. Some take advantage of the opportunity; for example, the fashion industry giant LVMH launched the resale website Nona Source to make its deadstock fabric available to other designers (Fortune, 2021). Others have admitted to being hesitant to sell their deadstock fabric out of concern that doing so could lower demand for their products (Fashionista, 2018), particularly given the fact that upcycled products usually have a similar premium vibe. at more reasonable costs. Results showed that waste recovery

strongly influences social, economic, and environmental performance (= 0.333, t=43.183, p = 0.000; = 0.583, t=4.641, p = 0.000; = 0.250, t=2.024, p = 0.043; = 0.402, t=3.157, p = 0.002).

According to the findings, upcycling and waste recovery prospects are crucial for the success of circular economy strategies. If not, encouraging circular behaviours like recycling and upcycling could aggravate waste production, boost resource consumption, and raise pollution. All stakeholders must cooperate to create a better environment, according to the stakeholder theory. According to Dalal and Thaker (2019), businesses with good corporate governance, environmental, and social practices do better overall. Atan et al. (2018), on the other hand, had a different viewpoint. According to the findings, upcycling has a considerable impact on waste management's ability to secure funding and make investments (p values of 0.457, t=3.755, and 0.000, respectively; and 0.302, t=2.388, and 0.0017, respectively). On the other side, research revealed that waste recovery had a substantial impact on waste management companies' financial readiness and investment readiness, respectively (p = 0.027; t=2.212; p = 0.000; p = 0.4563.624).

The findings show that waste management companies are better positioned to compete for investments and finance if they engage in circular economy practices like upcycling and trash recovery. According to Schoenmaker (2019), financial institutions are starting to include social and environmental factors in their stakeholder models. By investing in sustainable companies, it is anticipated that they will be able to shift from avoiding risk to seizing possibilities for sustainability. This implies that they would put more of an emphasis on sustainable development initiatives like funding health care, green buildings, wind turbines, electric vehicle manufacturers, upcycling, waste recovery initiatives, and land reuse projects. This is because research by

Scarpellini et al. (2020) discovered a favourable correlation between corporate social responsibility, environmental accounting procedures used by businesses, and circular economy strategies including upcycling and trash recovery.

Therefore, it is crucial to recognize material sustainability challenges, which can vary between businesses and industries (Khan et al., 2016). The evidence also establishes a "business case" for the possibility that incorporating sustainability considerations into investment decisions may increase financial returns (UNEP FI & Mercer, 2007; Cadman, 2011). These incentives, therefore, lead to a greater emphasis on ESG indicators' criteria by traditional corporate governance frameworks, such as shareholder "impact on activism" and fiduciary duty, while making investment decisions (Waygood, 2011; Hachigan & McGill, 2012). Investments are drawn by the nature of business operations. SRI has expanded because of the focus on sustainable development. Investors make investment decisions depending on a company's environmental policies.

5.6 Conclusions and policy prescriptions

This study concentrated on the effects of circular economy practices on the integrated waste management industry, drawing on the stakeholder theory. First, the study looked at how Ghanaian waste management companies' performance was impacted by circular economy strategies, particularly upcycling and trash recovery. The results of this aim demonstrated that upcycling has a favourable and considerable impact on the economic, social, and governance performance of firms. Environmental performance is unaffected by upcycling and has a negligible impact on it. The SEM and partial correlation data show that there is little correlation between upcycling and environmental performance. Furthermore, trash recovery improved the performance of waste

management companies in terms of the performance parameters, specifically the economic, environmental, social, and governance indices.

The result is that waste management companies who excel at completing circular economy activities like remanufacturing, trash recycling, and refurbishment are more likely to draw clients who favour eco-friendly pursuits in addition to their current clients. Additionally, these actions increase efficiency, which lowers operational expenses. Once more, improving governance-related concerns includes management training on these procedures and implementation of policies in compliance with the law. If adopted, a circular economy would stop a company's operations from having an impact on the neighbourhood. The consequences make it clear that circular economy techniques have a significant impact on how well waste management companies operate in terms of social economics and governance. From the findings, it may be inferred that the circular economy has little to no environmental impact. This might be the case since waste recovery and upcycling have little impact on reducing pollution, achieving environmental goals, consuming less water, and operating low-energy consumables. It is advised that companies keep establishing objectives for themselves to attain environmental performance. The results' partial connection indicated that social performance and environmental performance are significantly correlated in some way. It would be advisable to treat environmental performance as vital regardless of the outcomes.

The following goal examined the impact of waste management companies' financial and investment readiness. The results showed that circular economy practices have a significant impact on the firm's financial and investment readiness. This suggests that businesses, like the waste

management company, have techniques to detect and reduce the financial risk involved with adopting circular economy policies. They are also financially prepared because they have a source of possible funding, the ability to assess their liquidity and financial requirements, and insurance coverage for these kinds of activities. Additionally, it exhorts people to make quality asset investments to practice the circular economy. Additionally, it puts them in a position to appoint qualified management, as seen by the board of directors' background. This encapsulates their level of readiness to make investments in a circular economy. Businesses will always attract investors who are interested in investing in them. It is advised that businesses interested in participating in the circular economy seriously analyse its finance and investment aspects. They can manage the activities effectively as a result. They will be able to receive investment as well due to their financial readiness. The estimated network topology from the partial correlation analyses demonstrates this.

5.7 Chapter Summary

This chapter explores the effects of circular economy practices on the performance of Ghana's integrated waste management sector, focusing on stakeholder theory. It finds that while upcycling positively influences economic and governance performance, its impact on environmental performance is minimal. In contrast, waste recovery enhances all performance dimensions, including economic, environmental, social, and governance indices. Companies excelling in circular economy activities attract eco-conscious clients and improve efficiency while addressing governance issues through training and policy compliance. The study also indicates that circular economy practices significantly enhance financial and investment readiness, urging firms to set clear environmental objectives and consider the financial aspects of their strategies to effectively manage circular economy initiatives and attract investors.

CHAPTER SIX

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

6.1 Introduction

This final chapter contains a summary of the study, its conclusions, and its recommendations. The chapter begins with a summary and overview of the major conclusions before moving on to the knowledge contributions and investment and policy recommendations that could be drawn from this research. The chapter's conclusion makes recommendations for additional research.

6.2 Summary of Key Findings

The summary of key findings was presented for each of the standalone chapters (objectives).

6.2.1 Antecedents of circular economy financing and investments supply: the moderating role of the financial environment

The findings from the first hypothesis revealed that financial readiness has a positive and significant effect on circular economy finance and investment supply. The findings suggest that firms in integrated waste management believe that financial readiness enables businesses to have easy access to funding because such businesses are strategically positioned to leverage the necessary resources to implement circular economy initiatives effectively.

The findings from the second hypothesis showed firm-level financial environment had a negative moderating effect on the relationship between financial readiness and circular economy financing and investment. However, the relationship was not significant. Also, the moderating role of country-level environment and circular economy finance and investment

supply was positive and significant. The moderating role of the international level financial environment in the relationship between financial readiness and circular economy finance and investment supply was negative and significant. The results imply that within the context of firm-level financial environment, the effect of financial readiness on circular economy finance and investment supply is weak and nonsignificant. Countries with favourable financial conditions are more conducive to promoting circular economy finance and investment. This connotes that in attracting circular economy finance and investment supply, the firm's ability to position itself financially to be ready to be invested in is significantly influenced by the broader economic and financial conditions prevailing within the country.

In addition, firms should consider the country-level environment when assessing their investment readiness and seeking circular economy financing. This involves staying updated on local policies, regulations, and incentives, understanding how they impact circular economy projects, and aligning their investment strategies with the country's sustainability goals and priorities. Finally, international-level financial environment contains complex factors that are usually beyond the control of waste management firms in Ghana, which makes it more difficult for these firms to translate their financial readiness into actual circular economy investments. Factors like exchange rate volatility, capital controls, or geopolitical tensions in the international environment could undermine the ability of financially ready firms to deploy capital towards circular economy initiatives.

The findings for the third hypothesis revealed that the moderating effect of firm-level financial environment in the relationship between investment preparedness and circular economy finance

and investment supply was negative and significant. The findings suggest that even though investment preparedness (e.g., availability of capital, financial capabilities) would normally have a positive influence on the supply of circular economy finance and investment supply, this positive relationship is dampened when the firm-level financial environment is taken into account. The firm-level financial environment may introduce constraints, risks or competing priorities that prevent financially prepared firms from channelling resources towards circular economy initiatives, despite their investment readiness. On the other hand, the moderating role of country level financial environment was positive and significant in the relationship between investment preparedness, circular economy finance, and investment supply. This means that as the country-level financial environment becomes more favourable or supportive, it strengthens or enhances the positive relationship between investment preparedness, circular economy finance, and investment supply among waste management firms in Ghana.

Lastly, the moderating effect of international level financial environment in the relationship between investment preparedness and circular economy finance and investment supply was positive but not significant. While this moderating effect was positive, the lack of statistical significance indicates that the international-level financial environment may not be a strong enough factor to significantly influence the relationship between investment preparedness and circular economy finance/investment.

6.2.2 Precursors of circular economy practices in the waste management sector

Regarding the first hypothesis, it was found that financial readiness was a significant and necessary condition for circular economy practices. This suggests that the overall financial capability, capacity, and preparedness of the waste management firms, in terms of access to capital, financial

management expertise, and financial stability, are crucial enablers of their engagement in circular economy practices. Firms with a stronger financial foundation appear to be better positioned to invest in and implement circular economy practices. Again, the firm-level financial environment as a measure of the internal environment of the waste management firm was found to be a significant and necessary condition for circular economy practices. This implies that the firm's internal financial landscape, such as access to capital, capital structure, liquidity, credit policies, investment decisions, risk management practices, and overall financial strategy, plays a vital role in facilitating their transition towards circular business models.

Also, investment preparedness as a measure of firm level financial environment is significant necessary condition for circular economy practices. This suggests that the waste management firms' overall readiness and capacity to make strategic investments, particularly in circular economy projects and technologies, is a key precursor to their adoption of circular economy practices. Firms with a higher level of investment preparedness are better positioned to channel resources towards circular initiatives.

Interestingly, the study found that these internal financial level environments are not necessarily linearly related to circular economy practices. The Necessary Condition Analysis (NCA) highlighted specific levels of financial readiness, firm-level financial environment, and investment preparedness that are required as necessary conditions to achieve different target levels of circular economy practices. In contrast, the study found that external factors, such as circular economy finance and investment supply, country-level financial environment, and international-level financial environment, were not significant determinants of circular economy practices in this

context. This suggests that the internal capabilities and financial conditions of waste management firms are the more critical factors shaping their engagement in the circular economy.

6.2.3 Implications of circular economy practices of firms in the integrated waste sector

The first hypothesis revealed that upcycling has a favourable and considerable impact on the economic, social, and governance performance of firms. Environmental performance is unaffected by upcycling and has a negligible impact on it. The SEM and partial correlation data show that there is little correlation between upcycling and environmental performance. Furthermore, trash recovery improved the performance of waste management companies in terms of the performance parameters, specifically the economic, environmental, social, and governance indices.

The second hypothesis showed that circular economy practices have a significant impact on the firms' financial and investment readiness. This suggests that businesses, like the waste management company, have techniques to detect and reduce the financial risk involved with adopting circular economy policies. They are also financially prepared because they have a source of possible funding, the ability to assess their liquidity and financial requirements, and insurance coverage for these kinds of activities.

6.3 Conclusions

6.3.1 Antecedents of circular economy financing and investments supply: the moderating role of the financial environment

This study concentrated on the antecedents of circular economy finance and investment supply in waste management firms in Ghana, drawing on the ecological finance theory and the on natural resources-based view theory. The study first analysed the impact of financial readiness and

investment readiness on circular economy finance and investment supply for waste management firms in Ghana. Results from the first hypothesis showed that circular economy finance and investment supply are highly influenced by the financial readiness and investment preparedness of waste management firms in Ghana.

The implication is that the ability of waste management firms to develop supportive internal finance and investment strategies will draw in outside financial support in terms of supply and availability of circular economy financing. The study demonstrates how the level of informalities regarding finance and investment of these waste management firms increases their risk to the lending institution and emphasises the value of formalisation. Companies in the waste management sector stand to gain if they can strategically and proactively identify financial risk, ascertain liquidity, enhance the quality of their assets, meet their financial needs, and incorporate waste management and other sustainable management practices into financial planning.

The second hypothesis examined how the financial environment affects the relationship between financial readiness and circular economy finance and investment supply among waste management firms. Results showed that the relationship between financial readiness, circular economy finance, and investment supply is influenced by the country-level financial environments. Based on this finding, it is prudent for the integrated waste management sector to join forces in a strategic partnership to develop a robust sector with a circular economy as its focal point. The financial environment at the country level that is tax policies, soft loans, favourable governance, and legal rules will sharpen the waste management industry's focus, supporting the circular economy and investment practices.

The third hypothesis examined the moderating effect of the financial environment on the relationship between investment preparedness and circular economy finance and investment supply for waste management firms. Findings showed that the country-level financial environment moderates the relationship between the investment preparedness of waste management firms and circular economy finance and investment supply to waste management firms in Ghana. Financial environments at the firm and international levels did not significantly act as moderators. To put it another way, even if a waste management firm is prepared to share ownership or has a solid reputation in the sector, it will be difficult to find circular economy finance and investment in unfavourable countries.

For instance, a worse ranking of a nation's economic performance will have a significant impact on the flow of foreign direct investment into projects and firms involved in the circular economy including waste management firms. The operations of integrated waste management companies are impacted by concerns regarding dividend policy, tax obligations, exchange rates, and interest rates. Unfavourable circumstances may indicate that investing in such nations is extremely dangerous, with the potential for the investor to lose both interest and the principle of the investment.

6.3.2 Precursors of circular economy practices in the waste management sector

The study focused on the internal and external financial environment of waste management firms as the precursor of its circular economy practices in Ghana. The findings show that the factors influencing the adoption of circular economy techniques by waste management companies in Ghana include the internal environment, firm-level financial environment, financial readiness,

and investment readiness. The findings also showed that a waste management firm could participate in circular economy activities when firm-level financial factors such as maximising stakeholder welfare, growth prospects, industry competition, and increased capital requirements are at play. It also suggests that the ability of the integrated waste management industry to provide supportive internal funding and investment greatly influences the conduct of circular economy activities.

The findings also demonstrate that in Ghana, the waste management company's circular economy practices are independent of the country-level financial environment, the global financial environment, and circular economy finance and investment supply. That is these factors have no bearing on the circular economy practices of the waste management firms in Ghana. Although the literature suggests that these elements aid the waste management firms in achieving their sustainable objectives, the main motivators for waste management firms in Ghana are internal. It is advised that waste management companies consider the benefits in considering other factors such as the country-level financial environment, the global financial environment, and circular economy finance and investment supply to guide their practices.

6.3.3 Implications of circular economy practices of firms in the integrated waste sector

This study concentrated on the effects of circular economy practices on the integrated waste management industry, drawing on the stakeholder theory. First, the study looked at how Ghanaian waste management companies' performance was impacted by circular economy strategies, particularly upcycling and trash recovery. The results of the study demonstrated that upcycling has a favourable and considerable impact on the economic, social, and governance performance of firms. Furthermore, trash recovery improved the performance of waste management companies

in terms of the performance parameters, specifically the economic, environmental, social, and governance indices.

The conclusion is that waste management companies who excel at undertaking circular economy activities like remanufacturing, trash recycling, and refurbishing are more likely to draw clients who want green activities in addition to their current clients. Additionally, these actions increase efficiency, which lowers operational expenses. They are also able to reduce waste in the system that may cause harm to the environment as well as the society in which they operate. Various degrees of relationship between the circular economy practices, investment preparedness, financial readiness, and sustainability performance criteria were evident in the partial correlation. While investment readiness and financial readiness have a strong correlation between them, waste recovery and upcycling followed a similar pattern.

Findings also showed that circular economy practices had a substantial impact on the financial readiness and investment preparedness of integrated waste management firms in Ghana. The integrated waste management sector's implications for MSMEs include developing internal competencies, resources, and strategies to recognize and reduce the related financial risk. They are also financially prepared because they have a source of possible funding, the ability to assess their liquidity and financial requirements, and insurance coverage for these kinds of activities.

Additionally, it exhorts people to make quality asset investments to practise the circular economy. Also, it enables them to select managers with relevant experience. The predicted network topology from the partial correlation analysis shows that integrated waste management firms in Ghana will

always attract investors who are interested in investing in them. It is advised that waste management firms take the funding and investment elements seriously. This will allow them to manage the events effectively. They will also be able to receive investment depending on their financial preparedness.

6.4 Recommendations for Policy and Practice

The recommendations were presented for each of the standalone chapters (objectives)

6.4.1 Antecedents of circular economy financing and investments supply: the moderating role of the financial environment

Recommendations were made about theory, policy, and practice.

Theory

From an ecological finance theory perspective, advancing research and innovation in sustainable finance is paramount. This includes exploring and developing new financing mechanisms that align with circular economy principles, such as green bonds, impact investing, and sustainable debt instruments. Emphasizing a long-term sustainability perspective in financial decision-making encourages investors and financial institutions to consider environmental and social impacts alongside financial returns. Promoting systemic change within financial systems to integrate ecological risks and opportunities fosters a holistic approach to sustainable finance, supporting the transition towards a more resilient and environmentally responsible economy.

Policy

To effectively leverage this relationship, policymakers can develop and implement comprehensive national strategies that prioritize circular economy financing. Such strategies should include targeted incentives for businesses and investors engaged in sustainable practices, as well as regulatory frameworks that support and encourage circular economy investments. By integrating circular economy principles into economic policies, governments can foster an environment conducive to sustainable development and long-term environmental stewardship.

Practice

Fostering public-private partnerships is essential for mobilizing capital towards circular economy projects. These collaborations can harness the expertise and resources of both governmental bodies and private sector entities to scale up investments in sustainable initiatives. Innovative financing mechanisms, such as green bonds and impact investment funds, should be promoted to attract diverse sources of capital towards circular economy ventures. Sector-specific initiatives tailored to areas like renewable energy, waste management, and sustainable agriculture can address unique financing challenges and maximize the impact of financial interventions in these critical sectors.

6.4.2 Precursors of circular economy practices in the waste management sector

Recommendations were made concerning theory, policy, and practice.

Theory

From a resource-based view theory perspective, investments should focus on building organizational capabilities that optimize resource use and efficiency. Waste management organizations can leverage their internal competencies by investing in advanced technologies for

waste segregation, recycling processes, and resource recovery. Managing waste streams as strategic assets involves adopting innovative approaches such as waste-to-energy solutions and closed-loop systems, aligning with the resource-based view's emphasis on leveraging unique and valuable resources for competitive advantage. Continuous innovation in waste management practices ensures organizations remain adaptive to new technologies and market opportunities, reinforcing their commitment to sustainable development and circular economy principles.

Policy

Governments should prioritize the establishment of supportive regulatory frameworks tailored to incentivize circular economy practices in waste management. This includes implementing extended producer responsibility (EPR) laws, imposing landfill taxes, and promoting policies that encourage product stewardship. Such regulations create an enabling environment where waste management organizations are motivated to adopt sustainable practices, thereby driving the transition towards circular economy principles.

Practice

Capacity building and technical assistance are crucial for empowering waste management organizations to implement circular economy strategies effectively. Governments and industry bodies should provide training programs and support for adopting technologies that enhance waste reduction, recycling efficiency, and eco-design principles. Collaboration among stakeholders, including research institutions and industry associations, is essential for sharing knowledge, best practices, and innovative solutions. This collaborative approach accelerates the adoption of

circular economy practices and fosters a culture of continuous improvement within the waste management sector.

6.4.3 Implications of circular economy practices of firms in the integrated waste sector

Theory

From a stakeholder theory perspective, organizations should recognize the importance of engaging with stakeholders across their ecosystem. This includes dialogue with local communities impacted by waste management practices, investors interested in sustainable business practices, and regulatory authorities shaping environmental policies. Transparent communication about waste recovery efforts and their positive impacts on economic, social, and environmental outcomes builds trust and credibility among stakeholders. Embracing stakeholder interests and expectations helps align business strategies with broader societal goals, fostering long-term resilience and competitive advantage sustainably.

Policy

Governments should prioritize regulatory frameworks that support and incentivize waste recovery and upcycling initiatives. This involves establishing clear targets and standards for waste diversion from landfills, implementing extended producer responsibility (EPR) laws to hold manufacturers accountable for their products' end-of-life management, and offering financial incentives such as tax credits or subsidies to businesses adopting circular economy practices. Comprehensive circular economy policies are essential, integrating waste recovery as a fundamental strategy alongside promoting sustainable resource management practices and fostering market demand for recycled materials and upcycled products.

Practice

Businesses should be encouraged to invest in robust infrastructure and advanced technologies for waste recovery. This includes facilities for efficient sorting, recycling, and processing of materials to maximize resource recovery and minimize environmental impact. Collaborative efforts across value chains are crucial, involving partnerships with suppliers, customers, and waste management companies to streamline operations and optimize material flows. Emphasizing lifecycle thinking and eco-design principles can further enhance product durability and recyclability, thereby supporting circular economy goals and enhancing firm performance across various dimensions.

6.5 Suggestions for Further Research

Conducting a qualitative study to gather perspectives from significant stakeholders in waste management firms would significantly enhance the depth and breadth of understanding obtained from the research. Qualitative methods allow for exploration of nuanced viewpoints, motivations, and challenges faced by stakeholders involved in waste recovery and upcycling initiatives. By interviewing key players such as waste management executives, policymakers, environmental activists, and community representatives, researchers can capture diverse perspectives on barriers to implementing circular economy practices, potential solutions, and the broader impacts of these initiatives on various stakeholders. This approach would enrich the study by providing insights that quantitative data alone may not fully capture, thereby offering a more comprehensive view of the complexities involved in promoting sustainable waste management practices.

Additional research on industries such as finance and investing would complement existing studies by offering insights into how financial environments influence circular economy finance and investment opportunities. Understanding the role of financial institutions, investment criteria, and

risk perceptions related to circular economy projects can provide valuable insights for policymakers, businesses, and investors aiming to promote sustainable practices. By exploring these dynamics through empirical research, researchers can identify barriers, incentives, and best practices that facilitate greater investment in circular economy initiatives. This research could contribute to developing tailored financial instruments, policies, and partnerships that accelerate the transition towards a circular economy, benefiting both economic development and environmental sustainability.

Investigating the non-financial environment's influence on finance and investment opportunities for circular economy initiatives represents a critical area for further study. Factors such as regulatory frameworks, market demand for sustainable products, technological readiness, and societal attitudes towards environmental stewardship can significantly impact the feasibility and attractiveness of circular economy investments. Research in this area could involve comparative analyses across different countries or regions to identify regulatory best practices, cultural factors influencing consumer behaviour towards sustainable products, and policy interventions that effectively support circular economy goals. Such insights would inform policymakers and businesses on how to create an enabling environment that encourages sustainable investment and fosters innovation in waste management and resource utilization.

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APPENDICES

Table 7.1. Cross loadings

	Circular Economy Finance and Investment Supply	Country-level Environment	Financial Readiness	Firm-level Environment	International-level Environment	Investment Preparedness
CEF1	**0.806**	0.572	0.447	0.413	0.524	0.318
CEF10	**0.816**	0.658	0.380	0.394	0.539	0.248
CEF2	**0.770**	0.672	0.291	0.400	0.502	0.170
CEF3	**0.806**	0.662	0.352	0.387	0.526	0.264
CEF4	**0.856**	0.705	0.365	0.441	0.560	0.237
CEF5	**0.807**	0.651	0.352	0.370	0.546	0.280
CEF6	**0.866**	0.698	0.358	0.455	0.591	0.227
CEF7	**0.909**	0.708	0.441	0.412	0.612	0.327
CEF8	**0.721**	0.549	0.352	0.294	0.517	0.270
CEF9	**0.790**	0.640	0.332	0.378	0.533	0.263
FR10	0.376	0.382	**0.800**	0.586	0.550	0.721
FR3	0.311	0.336	**0.766**	0.611	0.511	0.705
FR4	0.374	0.432	**0.863**	0.713	0.587	0.715
FR5	0.308	0.320	**0.751**	0.568	0.502	0.721
FR6	0.333	0.386	**0.766**	0.567	0.554	0.666
FR7	0.377	0.450	**0.842**	0.637	0.586	0.717
FR8	0.417	0.475	**0.841**	0.642	0.599	0.661
FR9	0.397	0.422	**0.804**	0.622	0.536	0.675
IP6	0.229	0.281	0.714	0.537	0.452	**0.779**
IP8	0.291	0.347	0.714	0.596	0.520	**0.848**
IP9	0.285	0.379	0.762	0.632	0.547	**0.898**
MA1	0.615	**0.794**	0.412	0.498	0.515	0.346
MA5	0.567	**0.778**	0.439	0.489	0.510	0.360
MA6	0.689	**0.834**	0.385	0.500	0.568	0.321
MA7	0.639	**0.829**	0.409	0.500	0.594	0.326

MA8	0.677	**0.786**	0.366	0.425	0.566	0.255
MA9	0.637	**0.758**	0.378	0.412	0.510	0.305
ME1	0.290	0.399	0.693	**0.807**	0.534	0.611
ME2	0.340	0.438	0.743	**0.885**	0.539	0.717
ME4	0.314	0.435	0.595	**0.753**	0.462	0.576
MI3	0.373	0.432	0.473	**0.668**	0.448	0.428
MI6	0.460	0.514	0.513	**0.733**	0.478	0.417
MI8	0.454	0.495	0.516	**0.743**	0.492	0.452
MI9	0.383	0.461	0.540	**0.736**	0.483	0.494
MT1	0.562	0.546	0.584	0.525	**0.831**	0.512
MT10	0.471	0.534	0.610	0.508	**0.804**	0.521
MT2	0.556	0.588	0.508	0.527	**0.799**	0.441
MT3	0.611	0.595	0.534	0.557	**0.840**	0.459
MT4	0.558	0.574	0.562	0.518	**0.814**	0.456
MT5	0.613	0.604	0.497	0.572	**0.822**	0.405
MT6	0.502	0.504	0.569	0.475	**0.778**	0.510
MT8	0.411	0.437	0.565	0.451	**0.737**	0.578

Table 7.2. Fornell-Larcker criterion

	Circular Economy Finance and Investment Supply	Country-level Environment	Financial Readiness	Firm-level Environment	International-level Environment	Investment Preparedness
Circular Economy Finance and Investment Supply	**0.816**					
Country-level Environment	0.800	**0.797**				
Financial Readiness	0.451	0.499	**0.805**			
Firm-level Environment	0.485	0.591	0.770	**0.763**		
International-level Environment	0.669	0.683	0.688	0.644	**0.804**	
Investment Preparedness	0.319	0.400	0.865	0.699	0.602	**0.843**

Table 7.3. HTMT

	Circular Economy Finance and Investment Supply	Country-level Environment	Financial Readiness	Firm-level Environment	International-level Environment
Circular Economy Finance and Investment Supply					
Country-level Environment	**0.800**				
Financial Readiness	**0.449**	**0.498**			
Firm-level Environment	**0.487**	**0.593**	**0.759**		
International-level Environment	**0.667**	**0.682**	**0.689**	**0.641**	
Investment Preparedness	**0.318**	**0.398**	0.866	**0.688**	**0.603**

Table 7.4. VIF

	Circular Economy Finance and Investment Supply	Country-level Environment	Financial Readiness	Investment Preparedness
Circular Economy Finance and Investment Supply				
Country-level Environment	**2.101**		**2.024**	**2.024**
Financial Readiness	**5.515**			
Firm-level Environment	**2.918**		**1.844**	**1.844**
International-level Environment	**2.703**		**2.251**	**2.251**
Investment Preparedness	4.103			

Table 7.5. Coefficients

	Path coefficient	**Standard Deviation (STDEV)**	***t-values***	***p-values***	**95% C.I Biased Corrected**
Country-level Environment -> Circular Economy Finance and Investment Supply	0.664	0.060	11.076	**0.000**	[0.538, 0.775]
Firm-level Environment -> Circular Economy Finance and Investment Supply	-0.069	0.047	1.452	**0.147**	[-0.159, 0.027]
International-level Environment -> Circular Economy Finance and Investment Supply	0.259	0.058	4.478	**0.000**	[0.150, 0.379]
Investment Preparedness -> Circular Economy Finance and Investment Supply	-0.284	0.128	2.222	**0.026**	[-0.563, -0.052]
Financial Readiness -> Circular Economy Finance and Investment Supply	0.703	0.122	5.766	**0.000**	[0.485, 0.968]

Table 7.6. F^2, $R^{2,}$ and Q^2

Constructs	**Adj. R^2**		***f^2***		***Q^2***	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Firm-level Environment (FE)			0.008*			
Country-level Environment (CE)			0.656***			
International-Level Environment (IE)			0.091*			
Financial Readiness (FR)				0.159**		
Investment Preparedness (IP)				0.026*		
Circular economy finance and investment supply (CEFS)	0.671	0.229			0.418	0.128

Model 1: FE, CE, and IE ▼ CEFS

Model 2: FR and IP ▼ CEFS

*$0.02 \leq Q^{2,} f^2 \leq 0.15$ is a weak effect, **$0.15 \leq Q^{2,} f^2 \leq 0.35$ is a moderate effect

*** $Q^{2,} f^2 \geq 0.35$ shows a large effect

Table 7.7. Significance tests of the moderation effect

Hypothesised relationships	**Path Coefficient**	**SD (STDEV)**	***t-value***	***p-values***
Financial Readiness -> Circular Economy Finance and Investment Supply	-0.042	0.045	0.94	0.347
Financial Readiness * Country-Level Environment -> Circular Economy Finance and Investment Supply	0.173	0.05	3.502	0.000
Financial Readiness * Firm-Level Environment -> Circular Economy Finance and Investment Supply	-0.047	0.037	1.292	0.196
Financial Readiness * International-Level Environment -> Circular Economy Finance and Investment Supply	-0.127	0.052	2.456	0.014

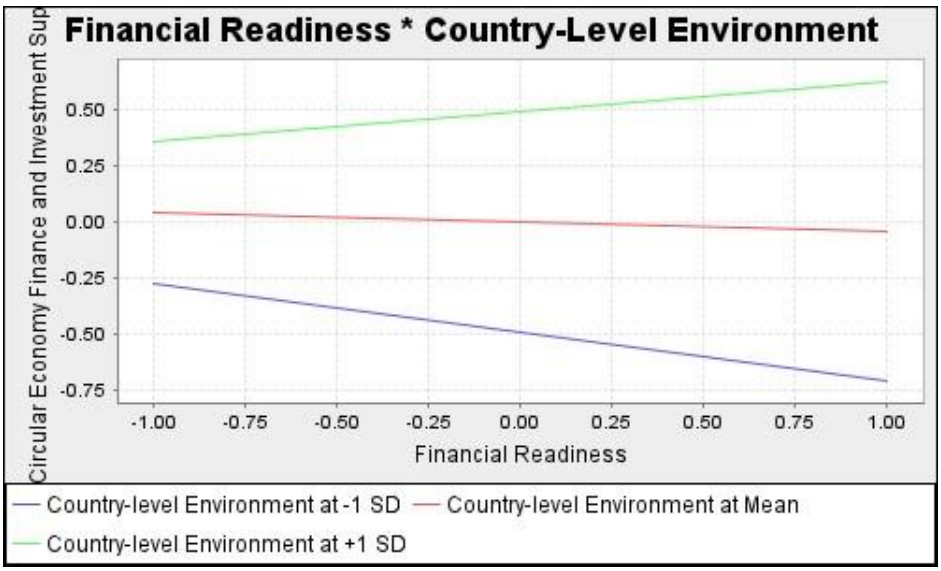


Figure 7.1. Financial readiness and country-level environment

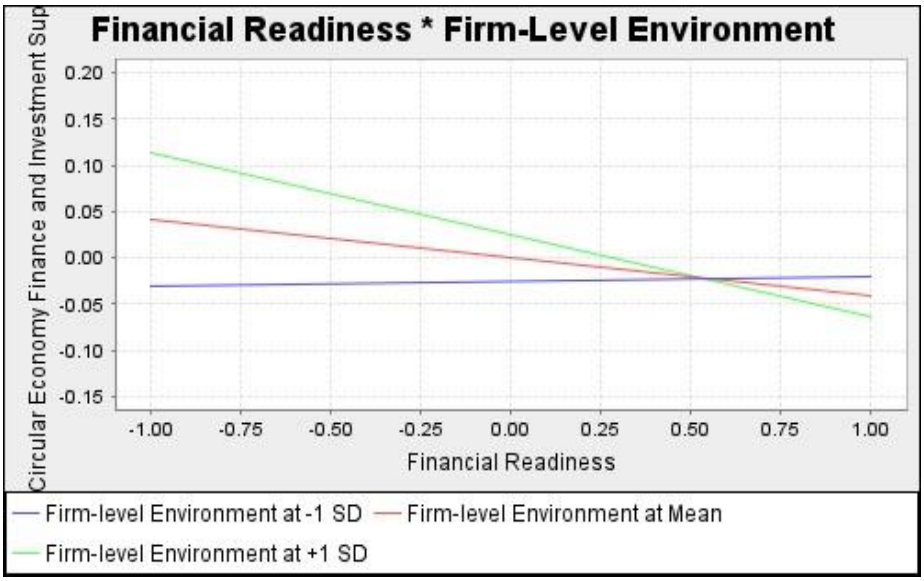


Figure 7.2. Financial readiness and firm-level environment

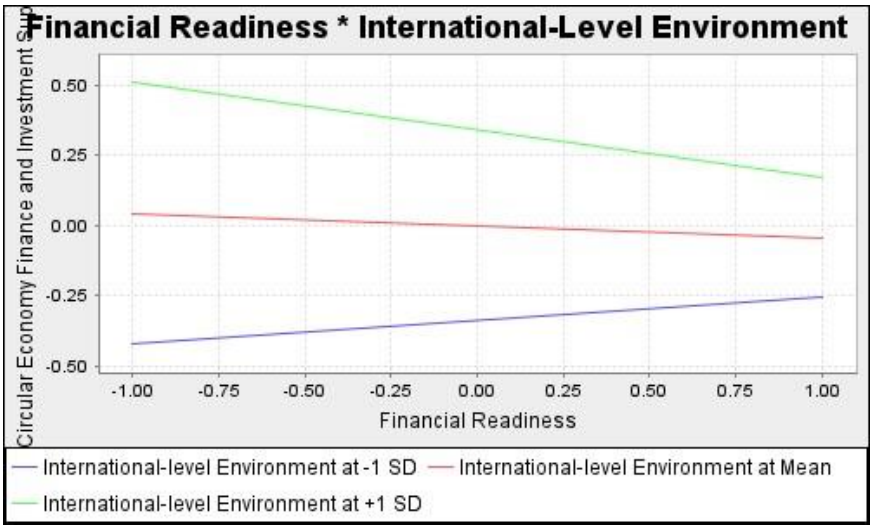


Figure 7.3. Financial readiness and international-level environment

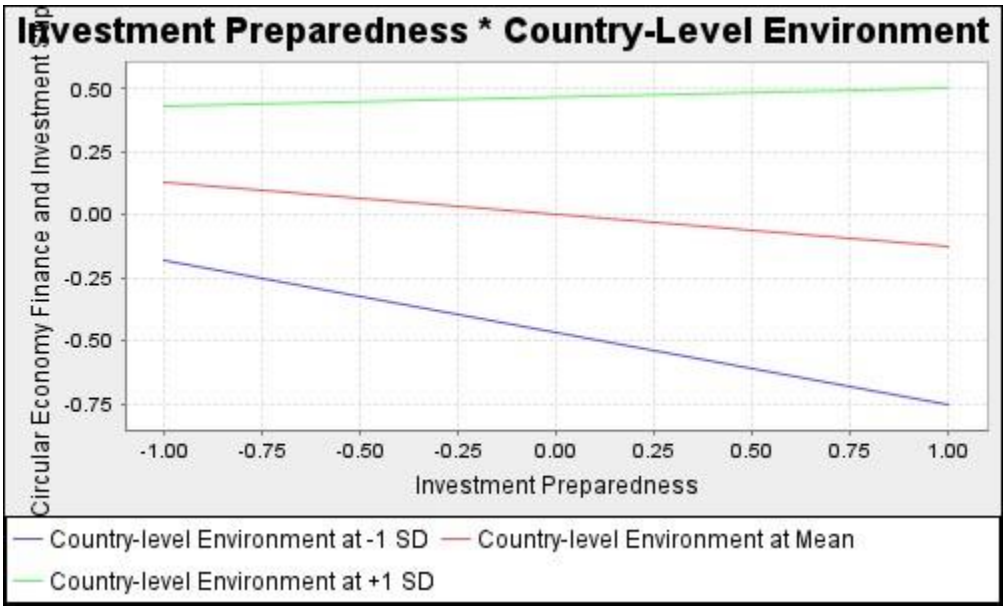


Figure 7.4. Investment preparedness and country-level environment

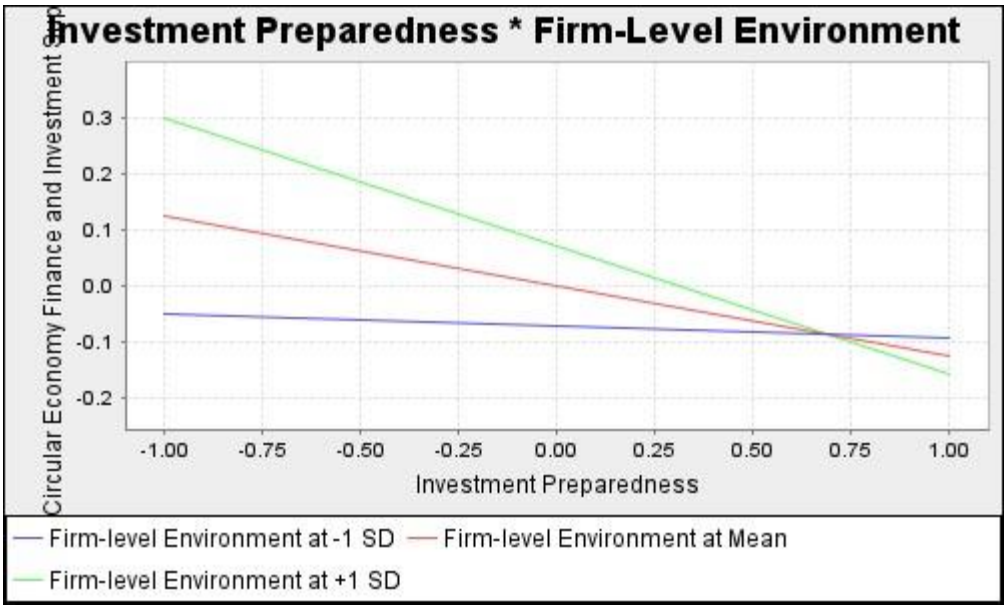


Figure 7.5. Investment preparedness and firm-level environment

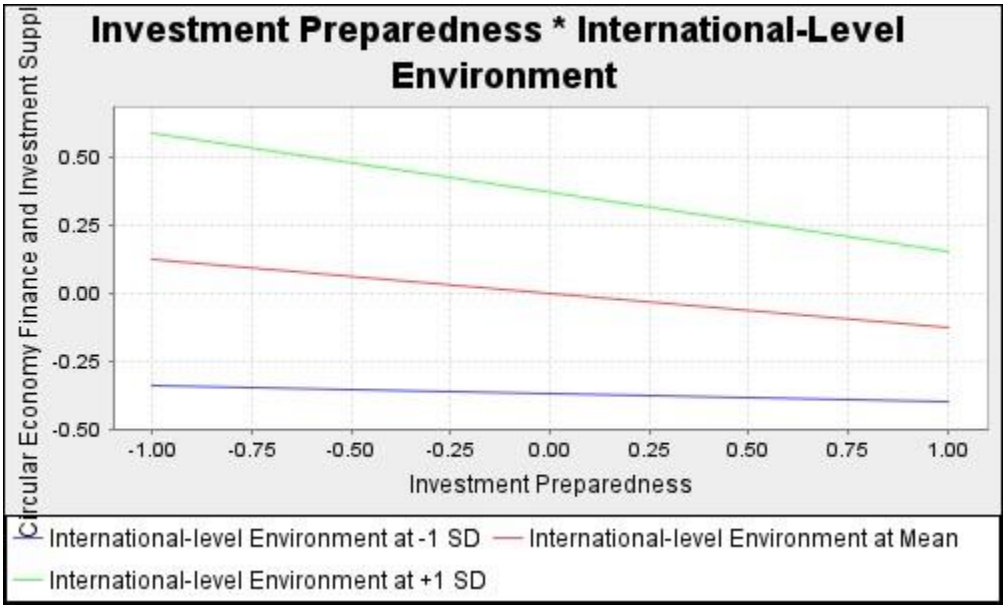


Figure 7.6. Investment preparedness and international-level environment

Table 7.8. Cross-Loadings

	Econ. Perf	Env Perf	Fin Read	Gov Perf	Invest Prep	Social Perf	Upcycling	Waste recovery
CGP1	0.696	0.701	0.695	0.864	0.682	0.688	0.586	0.556
CGP10	0.645	0.667	0.584	0.792	0.608	0.683	0.536	0.534
CGP2	0.716	0.698	0.702	0.877	0.702	0.716	0.564	0.573
CGP3	0.676	0.645	0.671	0.825	0.657	0.663	0.562	0.526
CGP4	0.675	0.683	0.650	0.831	0.634	0.688	0.579	0.562
CGP5	0.520	0.543	0.634	0.715	0.618	0.589	0.474	0.416
EP1	0.573	0.708	0.489	0.592	0.536	0.589	0.527	0.549
EP10	0.737	0.897	0.669	0.729	0.735	0.755	0.610	0.650
EP2	0.695	0.849	0.622	0.689	0.657	0.706	0.604	0.650
EP3	0.651	0.795	0.589	0.621	0.615	0.663	0.588	0.627
EP4	0.688	0.843	0.629	0.663	0.660	0.721	0.608	0.646
EP5	0.712	0.879	0.670	0.709	0.676	0.731	0.663	0.693
EP6	0.662	0.833	0.605	0.665	0.634	0.705	0.627	0.700
EP7	0.703	0.872	0.668	0.702	0.678	0.725	0.639	0.706
EP8	0.701	0.872	0.666	0.693	0.705	0.732	0.681	0.692
EP9	0.643	0.793	0.617	0.640	0.637	0.675	0.585	0.594
FR1	0.739	0.655	0.884	0.738	0.764	0.692	0.517	0.551
FR10	0.639	0.571	0.778	0.604	0.689	0.648	0.589	0.555
FR2	0.741	0.664	0.894	0.747	0.782	0.688	0.529	0.577
FR3	0.656	0.680	0.832	0.650	0.710	0.636	0.519	0.546
FR4	0.711	0.647	0.862	0.700	0.744	0.667	0.602	0.553
FR5	0.685	0.607	0.824	0.618	0.739	0.656	0.561	0.547
FR6	0.610	0.531	0.737	0.573	0.658	0.589	0.572	0.502
FR7	0.659	0.558	0.798	0.647	0.730	0.662	0.591	0.505
FR8	0.658	0.618	0.810	0.663	0.676	0.674	0.652	0.619
FR9	0.589	0.565	0.743	0.594	0.648	0.650	0.580	0.545
IP1	0.786	0.668	0.728	0.689	0.854	0.689	0.556	0.598

IP10	0.733	0.702	0.744	0.665	0.869	0.772	0.644	0.669
IP2	0.679	0.633	0.690	0.663	0.798	0.678	0.501	0.519
IP3	0.699	0.641	0.660	0.634	0.788	0.662	0.490	0.546
IP4	0.760	0.676	0.734	0.652	0.855	0.740	0.594	0.627
IP5	0.783	0.697	0.787	0.688	0.891	0.758	0.611	0.640
IP6	0.731	0.695	0.749	0.659	0.861	0.753	0.610	0.646
IP7	0.631	0.566	0.731	0.661	0.779	0.657	0.567	0.544
IP8	0.619	0.571	0.708	0.610	0.765	0.676	0.604	0.554
IP9	0.739	0.682	0.764	0.710	0.878	0.764	0.659	0.650
PfP1	0.847	0.684	0.691	0.675	0.756	0.696	0.618	0.623
PfP2	0.887	0.713	0.752	0.703	0.793	0.740	0.622	0.621
PfP3	0.891	0.709	0.756	0.700	0.799	0.738	0.636	0.610
PfP4	0.874	0.707	0.732	0.699	0.749	0.719	0.674	0.651
PfP5	0.865	0.690	0.704	0.711	0.739	0.705	0.701	0.632
PfP6	0.889	0.737	0.712	0.740	0.745	0.757	0.679	0.695
PfP7	0.882	0.734	0.707	0.716	0.728	0.747	0.712	0.700
PfP8	0.906	0.735	0.736	0.719	0.756	0.780	0.727	0.704
PfP9	0.851	0.694	0.676	0.671	0.720	0.737	0.674	0.662
REC	0.677	0.645	0.599	0.572	0.609	0.663	0.874	0.774
REF	0.673	0.624	0.625	0.597	0.629	0.681	0.876	0.728
REM	0.592	0.599	0.542	0.541	0.538	0.567	0.788	0.714
SP1	0.586	0.551	0.587	0.600	0.624	0.702	0.465	0.539
SP10	0.693	0.685	0.673	0.668	0.737	0.829	0.618	0.610
SP2	0.602	0.624	0.606	0.654	0.620	0.751	0.629	0.542
SP3	0.610	0.641	0.540	0.572	0.578	0.715	0.534	0.610
SP4	0.753	0.746	0.700	0.712	0.745	0.877	0.634	0.672
SP5	0.712	0.756	0.664	0.697	0.720	0.854	0.640	0.647
SP6	0.738	0.703	0.703	0.703	0.759	0.864	0.643	0.628
SP7	0.728	0.735	0.685	0.717	0.740	0.868	0.668	0.648
SP8	0.707	0.695	0.692	0.667	0.731	0.837	0.603	0.631
SP9	0.712	0.714	0.696	0.711	0.739	0.864	0.711	0.633
WC	0.606	0.634	0.550	0.498	0.595	0.616	0.675	0.804

WR1	0.610	0.658	0.545	0.542	0.578	0.616	0.762	0.831
WR2	0.653	0.660	0.586	0.578	0.627	0.654	0.744	0.866

Table 7.9. Fornell-Larcker criterion

	Econ. Perf	**Env Perf**	**Fin Read**	**Gov Perf**	**Invest Prep**	**Social Perf**	**Upcycling**	**Waste recovery**
Economic Performance	0.877							
Environmental Performance	0.811	0.836						
Financial Readiness	0.820	0.747	0.818					
Governance Performance	0.803	0.804	0.801	0.819				
Investment Preparedness	0.860	0.784	0.874	0.794	0.835			
Social Performance	0.839	0.840	0.802	0.821	0.857	0.818		
Upcycling	0.765	0.735	0.696	0.673	0.700	0.754	0.847	
Waste recovery	0.747	0.780	0.672	0.647	0.720	0.754	0.872	0.834

Table 7.10. Heterotrait-Monotrait ratio

	Econ. Perf	Env Perf	Fin Read	Gov Perf	Invest Prep	Social Perf	Upcycling	Waste recovery
Economic Performance								
Environmental Performance	0.810							
Financial Readiness	0.817	0.743						
Governance Performance	0.802	0.803	0.801					
Investment Preparedness	0.858	0.781	0.873	0.797				
Social Performance	0.839	0.839	0.803	0.824	0.857			
Upcycling	0.765	0.735	0.698	0.675	0.699	0.753		
Waste recovery	0.747	0.780	0.672	0.646	0.719	0.756	0.874	

Table 7.11. Socio Demographic Characteristics of the Firm

Variable	Frequency	Percentage
Sex of the Board Chairman or Advisor		
Male	491	93.7
Female	33	6.3
Total	**524**	**100**
Sex of the Owner/Managers Male		
	483	92.2
Female	41	7.8
Total	**524**	**100**
Legal Form of the Business		
Sole Trader	378	72.1
Partnership	90	17.2
Limited Liability Company	50	9.5
Total	**524**	**100**
Age of the Business (in years)		
<= 5	128	24.4
6 – 10	117	22.3
11 – 15	169	32.3
16 – 20	70	13.4
21 – 25	28	5.3
26 – 30	5	1.0
31 – 35	4	0.8
36 – 40	2	0.4
41+	1	0.2
Total	**524**	**100**
Nature of Waste Business Recycling		
	114	21.8
Collection	357	68.1
Research	53	10.1
Total	**524**	**100**
Location of the Business		
Metro Area	72	13.7
Municipal	397	75.8
District	55	10.5
Total	**524**	**100**

Source: Field data (2023)

Appendix 2. Questionnaire

Author's Contact:
Tel: +233 24 6168010/206168010
Email: dagyapong@ucc.edu.gh.

Sustainability Financing and Investment in integrated Waste Management: Implications for the Circular Economy in Ghana

Dear Participant

I am a PhD Student at the University of Witwatersrand in Johannesburg, South Africa. I invite you to take part in a survey as part of my thesis on sustainability financing and investments in Ghana. The survey is being conducted to solicit the views of owner/managers on sustainability financing and investments within the circular economy framework and the implications of such funding for firms in the integrated waste management sector. The outcome of the study would better inform managers, the appropriate strategies to attract funding and investments into their firm and the sector.

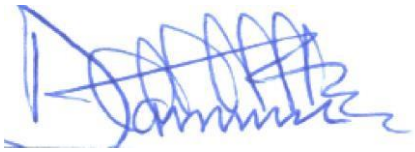
Please note that your response is private and confidential. Your organisation was carefully selected to be part of this survey due to its position in this industry. This is a self-administered questionnaire. Your identity and that of your organisation will not be disclosed in any data or report. Survey responses will not be linked with any personal or organisational records.

Participation in this survey is highly valued, but voluntary. You are free to withdraw consent at any time. We will protect your anonymity and the confidentiality of your response to the fullest possible extent within the limits of the law and ethics of research.

If you have any questions about this survey or would like further information, please contact me on 0206168010 or dagyapong@ucc.edu.gh.

The survey takes between 20 and 25 minutes to complete. Thank you for considering your involvement in this survey.

Yours sincerely



Daniel Agyapong
PRINCIPAL INVESTIGATOR

Section A: Financing and Investment Models /Schemes/Mechanisms

On a scale 0 (no agreement) to 10 (high agreement), please rate the level of agreement with the existence of the following financing and investment models /schemes/mechanisms for integrated waste management. Please tick {√} in response to the questions.

No.	**Financing and investment models /schemes/mechanisms**	0	1	2	3	4	5	6	7	8	9	10
FI 1	We have the National Green Fund											
FI 2	Green loans and eco-funds are available											
FI 3	There is green project finance and green venture capital											
FI 4	There are socially responsible investors in the country											
FI 5	One can source funds from the global green fund											
FI 6	There is the possibility of issuing green bond											
FI 7	There are faith-based funds											
FI 8	There is digital finance for sustainability											
FI 9	There are carbon finance and insurance											
FI 10	Grants for sustainability financing.											

Section B: Dimensions of Financial Environment

On a scale 0 (no agreement) to 10 (highest agreement), please rate the level of agreement with the following statements with respect to the financial environment in the waste sector. Please tick {√} in response to the questions.

No.	Dimensions of Financial Environment	0	1	2	3	4	5	6	7	8	9	10
Micro-level indicators												
MI1	The firm has a strategy for financing its circular economy projects and products.											
MI2	The firm budgets for sustainability											
MI3	The firm engages in environmental accounting- incorporating the use or depletion of natural resources in the accounting system.											
MI4	There is an internal circular economy financing expert in the firm.											
MI5	There is an internal sustainability financing procedure.											
MI6	The firm has investments in green financial products.											
MI7	The firm seeks to maximize the welfare of its stakeholders.											
MI8	The competitive pricing strategy of the firm reflects its supports for green business.											
MI9	The firm pre-finance suppliers to ensure their compliance with sustainable business practices											
MI10	To ensure continues flow of operations, the firm retains a substantial portion of its profit to reinvest it in the business.											
	Meso-level indicators											
ME1	The integrated waste management sector is among the attractive sectors for financial institutions' lending.											
ME2	Firms in the sector are among the high financial performing businesses in the country.											
ME3	Growth potential is high in this sector.											
ME4	There is strategic alliance of firms to finance joint projects.											

ME5	The industry attracts substantial investments over the years											
ME6	The industry has the best of operational infrastructure.											
ME7	The sector provides a good return on investment for investors.											
ME8	There are numerous business opportunities in the sector.											

ME9	Businesses in the sector requires a substantial initial capital to enter this sector.											
ME10	The level of competition is high among firms in the sector.											
	Macro-level indicators											
MA1	Lending institutions have separate rate of interests for firms within the circular economy (interest rate)											
MA2	Changes in the prices of currencies in relation to the local currency affect firms engaged in sustainable business practices (exchange rate)											
MA3	The fluctuations in pricing arising from changes in consumer prices equally affect firms in the circular economy (CPI)											
MA4	The Central Bank's eco monetary policy changes often increase in the cost of funding from the financial institutions.											
MA5	There is reduction in taxes for the import of organic products.											
MA6	There are tax breaks for firms engaged in sustainable business practices											
MA7	Lending institutions have separate credit appraisal requirements for firms within the circular economy.											
MA8	The country has a measure for sustainable gross domestic product (SGDP)											

MA9	There are well known legislations and policies on the circular economy in the country.											
MA10	Circular economy business practices have been identified as a strategy to create jobs in the society.											
	Meta-level indicators											
MT1	There is a regional policy on financing of sustainability within ECOWAS											
MT2	International development corporations are the main financiers of activities in the circular economy in the country											
MT3	The country and firms in the sector benefits from global circular economy financing schemes.											
MT4	There is a flow of foreign direct investment into the integrated waste sector in Ghana											
MT5	There is an increasing level of investments in the importation of different waste streams into the country											
MT6	Export of processed waste to the country's export destinations has increased in recent times											
MT7	Global investor interest in sustainable business is increasing											
MT8	There is a global move towards the mobilisation of private capital towards environmentally sustainable investments											
MT9	There is a global action towards integrating sustainability into financial policy framework to mobilise finance for sustainable growth											
MT10	The country has benefited from the Green Climate Fund for future climate action											

Section C: Dimensions of Financial Readiness and Investment Preparedness On a scale 0 (no agreement) to 10 (highest agreement), please rate the level of agreement with the following statements with respect to (1) financial readiness and (2) investment preparedness in the waste sector. Please tick {√} in response to the questions.

	Financial readiness	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
FR1	The firm has a high financial survival potential											
FR2	The firm has a strategy for retaining key personnel in the business.											
FR3	There is a strategy for identifying and mitigating financial and business risks											
FR4	The firm has other sources of potential funding											
FR5	The firm has the capacity determine its liquidity and financing needs											
FR6	There is the presence of loss response team											
FR7	The firm has insurance coverage for projects it finances											
FR8	The firm has financed its projects previously from equity.											
FR9	Debt financing has been the means for financing the firm's projects											
FR10	Integrated waste management firms often engage in financial planning											
	Investment preparedness											
IP1	The business is open to large scale of investment.											
IP2	The firm is willing to dilute its ownership and control											
IP3	The firm has managers who have knowledge of the sector and its dynamics											
IP4	The business has well-functioning products and services											
IP5	There are good corporate governance practices in the firm											

IP6	There are experience managers in the firm											
IP7	The firm has diverse board.											
IP8	There is new product development potential for the firm											
IP9	The firm boost of quality assets for its operations											
IP10	The firm has good reputation in the industry											

Section D: Dimensions of Circular Economy Financing, Investments Supply and Practices
On a scale 0 (no agreement) to 10 (highest agreement), please rate the level of agreement with the following statements with respect to circular economy financing and investments supply in the waste sector. Please tick {√} in response to the questions.

	Circular economy financing and investments supply	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CEF1	There are funds readily available for firms engaged in sustainable production activities (Availability).											
CEF2	Access to funds for circular economy activities (green businesses) is easy (Accessibility).											
CEF 3	The cost of credit for firms involved in circular economy activities is affordable (Affordability)											
CEF 4	The arrangement for obtaining and paying back credit obtained from financial institutions or other lenders is flexible (Flexibility)											
CEF 5	There are numerous alternatives of supply of funds for the circular economy activities in the country (Accommodation).											
CEF 6	It is perceived that there are sufficient funds available for circular economy activities (Adequacy).											
CEF 7	There is well-developed and functioning financial infrastructure for circular economy activities in the country (Appropriateness).											

CEF8	The system for credit appraisal for firms in the circular economy is the same as that of other sectors (Credit Appraisal).											
CEF9	Supply of funds for circular economy business activities in the country often comes from the international donors (External Funding)											
CEF10	There is provision of funds from the state to firms engaged in green businesses (Internal Funding).											
	Circular economy practices											
	Recycling											
CEP1	The firm engages in waste collection and separation											
CEP2	The firm undertakes material recovering as part of waste management											
CEP3	Waste reduction is part of the firm's business practices											
CEP4	The firm undertakes remanufacturing.											
CEP5	Waste recycling is an integral part of the firm's activities											
CEP6	The firm re-invest in the circular economy activities.											
CEP7	Refurbishment is part of the business activities.											
CEP8	The firm engages in re-gift of suitable waste products											
CEP9	The firm is involved in re-plant as part of its green business practices											
CEP10	The firm has a system for managing non-biodegradable materials.											

Section E: Firm Performance

On a scale 0 (no agreement) to 10 (high agreement), please rate the level of agreement with the issues raised with respect to the performance of your firm. Please tick {√} in response to the questions.

No.	**Firm Performance**	0	1	2	3	4	5	6	7	8	9	10
PfP	**Profitability Performance**											
PfP1	We have experienced increasing economic value added											
PfP2	Our return on equity has been improving											
PfP3	Firm's net income/revenue is increasing steadily											
PfP4	Return on investment helps retain our investors											
PfP5	We have experienced increasing earnings before tax											

PfP6	Our management is efficient at using its assets to generate earnings											
PfP5	Profit margins in this sector is often very high											
PfP6	The firm has experienced growth in profit over time.											

PfP7	We have low operating costs that improves our profit											
PfP8	Our gross profit has been growing											
PfP9	The profit margin in this sector is comparable to others											
PfP10	Green plants are not expensive											
MVP	**Market Value Performance**	0	1	2	3	4	5	6	7	8	9	10
MVP1	The firm is able to allocate portion of its profit to owners											
MVP2	The firm experienced appreciation in its worth											
MVP3	We are getting more cash back for each cedi invested											
MVP4	Market fluctuations have been favourable to firm											

MVP5	The firm is experiencing increasing product value											
MVP6	The firm is earning a rate higher than its replacement cost											

MVP7	Businesses in this sector are among high performing firms											
MVP8	We have experienced increased operational efficiency over time.											
MVP9	We enjoy a reasonable market share in the sector											
MUP10	Banks are careful and professional											
GP	**Growth Performance**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
GP1	The firm is experiencing a rising market-share growth											
GP2	Our firm has experienced asset growth over time											
GP3	We are experiencing net revenue growth											
GP4	There is net income growth appreciation.											
GP5	The number of our employees is growing											
GP6	The has experienced growth in capital employed											

GP7	The firm has multiplied its assets over time.											
GP8	Return on assets of the firm is increasing											

GP9	The firm do new things often											
GP10	Firms collaborate											
ES	**Employee Satisfaction**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
ES1	There is relatively lower turnover rate in our firm											
ES2	We invest in employee's development and training											
ES3	We have favourable wages and rewards policies											
ES4	The firm has career plans in place											
ES5	We have good organizational climate											
ES6	Our employees are generally satisfied											
ES7	Employees support our sustainable nature											
ES8	Employees often recommend the firm to others											
ES9	Employees love to help others complete their tasks											

ES10	Managers understand climate change											

CS	**Customer Satisfaction**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CS1	Our customers are satisfied with our mix of products /services											
CS2	We receive a smaller number of complaints											
CS3	Our products have high repurchased rate											
CS4	We have high new customer retention											
CS5	There is general customers satisfaction											
CS6	There are a number of new products/services launched											
CS7	Our customers frequently leave positive feedback											
CS8	Our appreciate our service verbally.											
CS9	Our customers follow us on social media											
CS10	Suppliers target managers.											
EP	**Environmental Performance**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
EP1	We have projects to improve / recover the environment											

EP2	The firm has low level of energy intensity (lower cost to convert energy)											
EP3	We use recyclable materials											
EP4	We reuse our residuals											
EP5	We monitor the volume of energy consumption											
EP6	The firm has not experienced any lawsuits due to its practices											
EP7	We use lesser water in our operations											
EP8	We have met all the environmental performance goals we set for the business.											
EP9	We have data to show that our contribution to pollution has reduced drastically											
EP10	Businesses and banks make profit											

CGP	**Corporate Governance**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

	Performance											

CGP1	Our Board Size is comparable to that of similar firms											
CGP2	Our Board is free from any form of interference											
CGP3	We have directors who monitor executives to act in the interest of owners.											
CGP4	Managers have high share ownership											
CGP5	There is gender diversity on the Board											
CGP6	We publish our reports periodically											
CGP7	There is accountability to, and engagement with stakeholders											
CGP8	There is manager training and board evaluations											
CGP9	We have policies in line with law and applicable regulations											
CGP10	Customers purchase products in large volumes											
SP	**Social Performance**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
SP1	We employ more people from minority groups											

SP2	We have a number of social and cultural projects											
SP3	Our firm have not experienced any lawsuits											
SP4	We meet regulatory agencies requirement											
SP5	We engage in fair trade											
SP6	We work to reduce vulnerability in our community											
SP7	The business has good relations with the community											
SP8	Our operations do not affect the people											
SP9	We are a diverse business											
SP10	Society Need trees											

Section F: Demographic Information of the Firm

1. Please indicate the sex of the Board Chairman or Advisor to the business:

   0. Male [ ] 1. Female [ ]

2. Please indicate the sex of the owner/Chief Executive Officer/ the Managing Director:
   0. Male [ ] 1. Female [ ]
   .
3. Please indicate your position in the firm:
   Top level [ ] Middle level [ ] lower level [ ] others, state……

4. Please state the legal form of the business:
   Sole Trader [ ] Partnership [ ] Limited Liability Company [ ] others, state……..……

5. Please state the age of your business (in years)……..

6. Please state the nature of waste business:
   Recycling [ ] Collection [ ] Research [ ] others, state……..…

7. Please indicate the location of the business:
   Metro area [ ] Municipal [ ] District [ ] others, state……..…

THANK YOU FOR PARTICIPATING