A Framework for Corporate Sustainability Investment, Resource Efficiency and Profitability of Companies listed in FTSE/JSE Responsible Investment Index

by

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[redacted]

THESIS

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DEDICATION

I dedicate this thesis to my late mother, LV Nakeng; my brother, PV Nakeng; my daughter, Kgotlelelo Nakeng, and her father; and my father, Mr. SF Nakeng. Finally, this thesis is dedicated to the late Professor MB Fakoya.

DECLARATION

I declare that "**A FRAMEWORK FOR CORPORATE SUSTAINABILITY INVESTMENT, RESOURCE EFFICIENCY AND PROFITABILITY OF COMPANIES LISTED IN FTSE/JSE RESPONSIBLE INVESTMENT INDEX**" thesis for the degree of Doctor of Commerce submitted at the University of Limpopo has never been previously submitted to any other university by me. I attest that this is my original work both in design and execution and that all references included have been properly cited.

Mancheleng Vanessa Nakeng Date: 11 February 2025

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ABSTRACT

Corporate sustainability rank among leading factors in the agenda for many companies, given that they are compelled to report on it. Thus, companies make investments in activities that concern corporate sustainability to enforce compliance but make profits. Therefore, this study evaluated the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return) of companies listed in the FTSE/JSE Responsible Investment Index. The study adopted quantitative and qualitative methods to generate primary data and secondary data. The primary data was collected through questionnaires while the secondary data was collected from annual integrated reports of participant companies. The secondary data was analysed through multiple regression statistics, and primary data was analysed through thematic analysis. Findings from this study indicate that environmental sustainability investment (renewable energy investment, water investment and recycling investment) negatively affected resource efficiency (water consumption and energy consumption). Also, there existed a positive relationship between corporate social investment and resource efficiency, a positive impact of corporate environmental investment on profitability, and a positive influence of corporate social investment on profitability. Moreover, corporate profitability and eco-efficiency motivated investment in sustainability. Based on these findings, the study contributes to knowledge by developing a new framework of corporate sustainability investment, resource efficiency and profitability. The study recommends that companies should intensify their investment in corporate sustainability to assist in environmental resource conservation and increase in profitability. Furthermore, this study recommend that other research apply the developed framework in wider research across other industries.

Keywords: *Environmental sustainability investment, corporate social investment, profitability, water consumption, energy consumption*

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LIST OF ACRONYMS

BBBEE - Broad-Based Black Economic Empowerment

CEO’s - Chief Executive Officers

CRSA - Code of Responsible Investing in South Africa

CSD - Cross-Sectional Dependence

JSE - Johannesburg Stock Exchange

NFSD - National Framework for Sustainable Development in South Africa

NSSD - National Strategy for Sustainable Development

SDGs - Sustainable Development Goals

CHAPTER 1- INTRODUCTION OF THE STUDY

1.1 INTRODUCTION

Markets around the world are becoming progressively competitive and as a result, they are under pressure to not only flourish but achieve success that is sustainable (Hengst, Jarzabkowski, Hoegl & Muethel, 2020; Pedol, Biffi & Melzi, 2021). Success that is sustainable in the corporate environment is referred to as corporate sustainability investment which is driven by environmental and social investment (Jin, 2022).

Corporate sustainability investment is crucial given that it assist companies mitigate risks and create new opportunities whilst responding to environmental and social issues by being resource efficient (Esty, 2020). Resource efficiency presents opportunities for businesses to use limited resources while minimising environmental impacts resulting from business activities (Schilirò, 2019). This constitutes a driving force for companies to limit and monitor their environmental activities, as highlighted in the Paris Agreement signed in 2016 (Tanaka, Boucher, Ciais, Johansson & Morfeldt, 2021). Growing global concerns in corporate sustainability investment have led to constant review and investigation of business sustainability proxies such as environmental sustainability investment. This study examined how corporate sustainability investment affects resource efficiency and profitability. Given that sustainability is fast becoming a competitive advantage, there is a growing need for corporate sustainability investment models; hence, among other contributions, this study proposed a model for corporate sustainability investment, resource efficiency, and profitability. Research has shown that companies that implement and adopt targets of the Agenda 2030 Sustainable Development Goals (SDGs) are becoming sustainable and exhibit improvement in aspects of corporate sustainability such as environmental and social investments (Yu, Sial, Tran, Badulescu, Thu & Sehleanu, 2020).

Corporate sustainability refers to the corporate long-term implementation of economic sustainability, environmental sustainability, social sustainability and corporate governance (Saunila, Nasiri, Ukko & Rantala, 2019). The interrelationship between

environmental sustainability, social sustainability, and corporate governance is integral to corporate sustainability. Corporate sustainability investment involves investments in water and energy as well as community initiatives and despite being non-financial yield earnings, they attract more stakeholders and improve profitability (Kotze & Ferreira, 2020). Corporate sustainability helps businesses be efficient in cost and resources over the long-term thereby avoiding equity problems while improving profitability (Schilirò, 2019). While cost efficiency concern how companies save money by changing their operations, resource efficiency involves the usage of natural resources in a manner that is sustainable and resourceful (Schilirò, 2019; Parker, 2020). In other words, resource efficiency is the viable consumption of natural resources such as energy and water. When companies maintain cost efficiency and resource efficiency, they are likely to achieve better profitability. Profitability refers to the measurement of efficiency and the earnings that companies receive from investment (Kotze & Ferreira, 2020). In this study, the concept of profitability concern asset return and net profit.

Published literatures have assessed whether there exist a link between corporate sustainability and profitability. One such study is by Drempetic, Klein and Zwergel (2019) who determined the influence of corporate sustainability performance on corporate financial performance as measured by greenhouse emission intensity, corporate social responsibility committee members, number of employees, as well as company size. Results showed a significant relationship between corporate financial performance and corporate sustainability performance. In another study, Ketprapakorn (2019) developed a framework for corporate sustainability and revealed that it is not only environmental, social, and economic factors that enhance the profitability of companies. Xie, Nozawa, Yagi, Fujii and Managi (2019) investigated the relationship between profitability and corporate sustainability. Their results revealed that some choices of corporate social responsibility improve corporate sustainability. Taliento, Favino and Netti (2019) determined the impact of corporate sustainability and companies' economic performance as measured by return on assets and market value. They found that all sustainability proxies are important for the performance of a company and for going concern purposes. Another study assessed industry 4.0 and reported that technology could be a proxy given its impact on sustainability as well as the profitability of companies (Bai, Dallasega, Orzes & Sarkis, 2020).

Of published studies that evaluated sustainability investment, Atz, Van Holt, Douglas and Whelan (2021) examined its effect on the financial benefits of companies; Cancela, Neves, Rodrigues and Dias (2020) determined the relationship between corporate sustainability and corporate governance; while Silvola and Landau (2021) observed how aspects of corporate sustainability affect the profitability of companies. This study add to existing research through evaluating the effect of corporate sustainability investment on resource efficiency and profitability. In addition, the study developed a framework for corporate sustainability investment, resource efficiency, and profitability by determining the influence of environmental and social investment on resource efficiency and profitability.

1.2 PROBLEM STATEMENT

Research has shown that corporates make a significant contribution to emissions and pollution through the manufacture of resources such as energy as well as consumption of water (Meuer, Koelbel & Hoffmann, 2020). There is an urgent need to decrease and/or reverse the negative impacts associated with some practices on poor corporate sustainability, a motivating factor for businesses to focus on increasing investments towards addressing sustainability challenges (Sharma, Mangla, Patil & Liu, 2019). Hesitancy by companies to channel significant financial resources towards enforcing good sustainable practices has rarely solved the deteriorating environmental quality (Tura, Keränen & Patala, 2019). Published information has shown evidence of this. For instance, Yavorska and Piatka (2020) found that while investment on environmental sustainability by companies involved in manufacturing has increased, it has not had a significant effects on the environment or the proliferation in natural resource potential. Failure to observe corporate sustainability investment by companies may lead to a lack of transparency and advancement of sustainable practices (Oh, Park & Ma, 2020). Given the perpetuation of challenges attributed to lack of or poor investment on sustainability, it is unclear if increasing corporate sustainability investment might promote energy efficiency and profitability in companies.

Researchers such as Sultana, Zulkifli and Zainal (2018) as well as Elsenhuber and Skenderasi (2020) focused on corporate sustainability investment and profitability;

while Yuan, Cassman, Huang, Peng and Grassini (2019), Özbuğday, Fındık, Özcan and Başçı (2020) and Rahman, Rodríguez-Serrano and Lambkin (2020) focused on resource efficiency and profitability. However, most studies on sustainability focused on sustainability performance compared to few that show information on sustainability investment.

Based on published research, so far, there is scarcity of studies conducted in South Africa with focus on the effect of a combined environmental and social investment activity on corporate resource efficiency and profitability. Therefore, this research intended to contribute knowledge by developing an original framework for the relationship between corporate sustainability investment, resource efficiency, and profitability.

1.2.1 Motivation of the study

The dearth of information especially reports written by companies on sustainability necessitated the researcher to embark on this study. In fact, the researcher was concerned with scarcity of information on corporate sustainability investment of companies since most studies investigate the sustainability performance. This served as a motivation to add value towards the gap on knowledge pertaining to corporate sustainability investment, resource efficiency, and profitability.

1.3 AIM OF RESEARCH

This study aimed to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return). Also, it aimed to contribute knowledge by developing a framework based on the above relationship.

1.4 RESEARCH OBJECTIVES

In stating the objectives of this research, the researcher envisaged that corporate sustainability investment (proxied by environmental investment and social investment) can affect resource efficiency and profitability. Therefore, the objectives of this research study were:

i. To determine the relationship between corporate environmental investment and resource efficiency.
ii. To analyse the effect of corporate social investment on resource efficiency.
iii. To evaluate the impact of corporate environmental investment on profitability.
iv. To analyse the influence of corporate social investment on profitability.
v. To determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment.
vi. To contribute to knowledge by developing a framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa.

1.5 RESEARCH QUESTIONS

From the research problem stated above, the following research questions became important:

i. What is the relationship between corporate environmental investment and resource efficiency?
ii. What effect does corporate social investment have on resource efficiency?
iii. What is the impact of corporate environmental investment on profitability?
iv. What is the influence of corporate social investment on profitability?
v. To what extent does corporate eco-efficiency and profitability attract improved sustainability investment?
vi. What new framework can be developed for corporate sustainability investment, resource efficiency and profitability?

1.6 SIGNIFICANCE OF THE STUDY

Users of financial statements need information that can assist them in their decision-making (Jin, 2022). In addition to conventional information available to these users, this study intend to provide users with additional research-based information that show whether there is a link between sustainability, resource efficiency, and profitability. It also intend to provide users with a guide on how to maintain proper corporate sustainability investments and enhance the corporates' participation towards sustainability. That way, findings of this study would add to the current literature on

business sustainability investments, resource efficiency, and probability as well as benefit other shareholders with a better understanding on the concepts. In addition, the study adds new knowledge in that it developed a framework that can improve our understanding of the practical and theoretical relationship among corporate sustainability investment, resource efficiency, and profitability. Additionally, the framework developed from this study can guide companies on how investments in corporate sustainability may achieve a dual purpose of resource efficiency and profitability. Furthermore, companies not listed in the FTSE/JSE Responsible Investment Index can get an insight on what corporate sustainability investment is as well as acquire knowledge on the effect of corporate sustainability investment, resource efficiency, and profitability. Such could help their companies to engage in corporate sustainability initiatives that aim to main resource efficiency while maximising profitability. The framework developed in this study can guide researchers on environmental sustainability accounting.

1.7 DEFINITION OF CONCEPTS

Sustainability investment

Sustainability investment refers to the amount of money put into the aspects of the environment and social investment (Odrowaz-Coates, 2021).

Corporate Sustainability Investment

Corporate sustainability investment refers to the rounded umbrella concept relating to pillars of economic, social and environmental investments, while others include dimensions of values such as corporate governance (Schrippe & Ribeiro, 2019; Atz, Van Holt, Douglas & Whelan, 2021).

Environmental Investment

Environment investment is the commitment of funds that are saved to assist with environmental factors, to implement environmentally sustainable projects, and to unite the financial and environmental systems that contribute to a company's profitability, mostly through the consumption of renewable energy and eco-living (Gu, Ho, Yan & Gozgor, 2021; Yu, Dong, Fei, Li, Guan & Jiang, 2022).

Social investment

Social investment is the savings of funds that assist with strengthening the skills and capabilities of the society and employees and provides funding to build 'companies' long-term capability to accomplish their social goals (Goijaerts, van der Zwan & Bussemaker, 2022). Social investments are funds used for significant improvements in society such as skills development programmes and the health and safety of employees (Zhu, Chen, Lu & Chang, 2022).

Resource Efficiency

Resource efficiency refers to the usage of natural resources such as water and energy in the perspective of oil and coal, efficiently and sustainably to gain benefits. It is how minimum resources are used to produce or to deliver more value (Whalen, 2019; Willskytt & Tillman, 2019; Steblyanskaya, Wang, Martynov, Mingye, Artykhov, Wang, Bocharnikov & Kiselik, 2021).

Profitability

Profitability is the usage of resources to create revenues from excess expenses and is a means of making profit or returns by companies from their activities (Marjanović & Popović, 2020; Ali, Khurram & Jiang, 2021). Profitability is a proportion that shows a company's capability to generate profits measured by its achievement and the capability of the usage of its assets effectively (Suwasono, 2021).

Sustainability

Sustainability is a broad concept that incorporates social, environmental, economic, and governance ability to create long-term and current values while making them sustainable for the future (Ramakrishna & Jose, 2021; Sanchez-Planelles, Segarra-Oña & Peiro-Signes, 2021).

Community initiatives

Community initiatives are the engagement of most companies to assist the communities in which they operate by reducing their social problems such as pollution

around them. Community initiatives improve health and welfare by reaching out to the concerned community members through awareness campaigns arranged by the companies (Polishchuk, Rubin & Shagalov, 2021).

Water conservation

Water conservation is the proper and wise usage of water even if it is limited. The usage of water is measured through quantity and quality. In addition, water conservation is the reduction of unnecessary usage of water for the future by limiting its quantity to avoid depletion (Novara, Cerda, Barone & Gristina, 2021).

Energy conservation

Energy conservation is the careful and wise usage of energy through proper quantity and quality as needed by companies. Energy conservation can also be seen as the reduction of wastage of consumption of energy to avoid depletion (Marton, Kaneko, Kovalik, Yasui, Nishiyama, Kitada & Titze, 2021).

1.9 STRUCTURE OF THE RESEARCH

Chapter 1 - Introduction of the study

Chapter one introduce the study by stating the background to the research problem to allow the audience to relate to the origin of the problem. The chapter also outline the aim and significance of the study.

Chapter 2 - Theoretical framework

Chapter two outline the theoretical framework of the study. It present the following theoretical frameworks: the stakeholder theory, reinforcement theory, and the agency theory.

Chapter 3 - Literature review (African literature)

This chapter review literature, largely that on studies conducted in Africa and on the relationship among corporate sustainability investment, resource efficiency, and profitability.

Chapter 4 - Literature review (International literature)

This chapter review on studies conducted outside Africa with focus on the relationship among corporate sustainability investment, resource efficiency, and profitability.

Chapter 5 – Research Methodology

This chapter present the research methodology where the research paradigm, research method, research design, study area, research population, sample, sampling method, sample size, and data collection are discussed.

Chapter 6 - Quantitative data analysis

This chapter present the quantitative analysis and discussions for the first level of analysis, which was the regression analysis. The analysis employed the statistical data based on research objectives 1-4 of the study.

Chapter 7 - Qualitative data analysis and development of framework

This chapter present the qualitative analysis and discussions for the second level of analysis, which was questionnaire analysis. The analysis employed the non-statistical data of the study based on research objective 5 of the study. In addition, the chapter presented the development of the framework, which entailed a combination of findings from quantitative and qualitative analysis.

Chapter 8 - Conclusion and recommendations

This chapter present the summary based on the research objectives of the study. It also present the limitations and contributions of the study and the future research.

1.10 SUMMARY OF THE CHAPTER

The chapter provide the background of the research, the introduction of the study and the research problem. It further outline the research's aim, objectives, and questions. The chapter conclude by discussing the significance of the research, defining the key concepts and outlining the organisation of the thesis. The next chapter presents the

theoretical framework of this study, and the proceeding chapter discusses the literature related to the study.

CHAPTER 2-THEORETICAL FRAMEWORK

2.1 INTRODUCTION

The preceding chapter show an overview of the study's background, discuss the research problem, state the aim of the research, research objectives, and research questions, as well as the significance of the study and define concepts outlined the thesis' structure. This chapter presents the theoretical framework of the study, which outlines the theories that are linked to the study.

2.2 THEORETICAL FOUNDATION

This research used three theories namely, stakeholder theory, agency theory, and reinforcement theory. The stakeholder theory highlights corporate environmental and social interest, agency theory shows the interest of the agent and principal, and reinforcement theory deals with sustainability investment reaction of managers because of earlier sustainability investment.

2.2.1 Stakeholder Theory

The stakeholder theory is considered suitable for use in research on sustainability (Freeman, Phillips & Sisodia, 2020). Stakeholders are people who can affect companies' decisions and investments and can be categorised as internal and external stakeholders (Valentinov, Roth & Will, 2019). For instance, internal stakeholders include employees, the board of directors, and shareholders, while external stakeholders include customers, suppliers, creditors, the local community, society and the government (Hiswåls, Hamrin, Vidman & Macassa, 2020: Chebbi, Yahiaoui, Sellami, Papasolomou & Melanthiou, 2020). There is a direct and indirect way in which stakeholders influence companies, whether they are internal or external stakeholders. For example, employees whose main influence is to contribute positively towards the operations and success of companies are stakeholders. The main stakeholders of companies are society, considered by the stakeholder theory, and influencers of various decisions, policies, and business operations (Sari, 2021). The emphasis on the need by companies to create some relationships by the stakeholder theory has enhanced investments in many companies (How, Lee & Brown, 2019). The

stakeholder theory asserts that the purposes of corporations include shareholder wealth, profit maximisation and value creation, such as a cleaner environment and higher corporate sustainability investments (How, Lee & Brown 2019; Shah, Sarfraz & Ivascu, 2021). Wojewnik-Filipkowska, Dziadkiewicz, Dryl, Dryl and Bęben (2019) state that the crucial objective of the stakeholder theory is for corporates to meet their needs, whether economic, environmental or social, in addition to profit maximisation. The theory asserts that companies are social institutions with a fiduciary responsibility to its stakeholders, including maintaining the environment (Waheed & Zhang, 2020; Bischoff, 2021). Additionally, meeting the economic expectations of stakeholders is mostly anchored through corporate environmental and social responsibilities (Boakye, Tingbani, Ahinful & Nsor-Ambala, 2021). The influence of the stakeholder leads to the maximisation of profit and assists with sustainability while keeping the environment friendly. The embracement of a range of information and a value-based decision-making approach is designed to tackle the complex and dynamic nature of sustainability-related challenges confronting companies (Schaltegger, Hörisch & Freeman, 2019). Corporates pay attention to stakeholders' interests both socially and the nearby environment in the hope of providing welfare to communities (Suwasono, 2021). Erawati, Hariadi and Saraswati (2021) indicate that there is a need for stakeholders to network for the achievement of meeting the interests of companies. Moreover, in most companies, stakeholder engagement has enhanced corporate sustainability investments that satisfy the different needs of stakeholders.

Studies have shown that pressure from various stakeholders has had an effect on the various facets of sustainability, including sustainability practices (Woo & Suresh, 2022). Failure to meet the needs of stakeholders including the production of stakeholder value, which tends to have an impact on resource efficiency, is influenced by social or environmental needs (Jan, Lai, Draz, Tahir, Ali, Zahid & Shad, 2021). Companies that interact with society must follow specific sustainability principles to retain higher profitability and be able to efficiently manage resources.

The participation of companies in corporate sustainability particular than on the environment creates the necessary mechanisms for resource efficiency. Despite pressure from stakeholders, companies may nevertheless run afoul of society when

they participate in environmental initiatives that push them to maintain high resource efficiency while maximising profit (Woo & Suresh, 2022).

When stakeholders in companies that practice sustainability have an extensive understanding of social and environmental sustainability, there tend to be a balance between maximising profitability and maintaining resource efficiency (Yang, Miao, Zhang & Xie, 2022). As a result, companies are forced to compete and advance sustainability while meeting the needs of all stakeholders. However, when stakeholders spend physical and financial capital in companies to maximise profitability, their involvement in those companies carries a risk for them.

In the study of Bătae, Dragomir and Feleagă (2021), it was revealed that there is a positive relationship between environmental sustainability and stakeholder theory. Additionally, there is a positive relationship between social sustainability and stakeholder theory. However, Daugaard and Ding (2022) argue that when companies attend to more social issues through social sustainability investment, it attracts more stakeholders and it can affect their profitability while enhancing their stakeholder value. Incorporating stakeholders into issues of corporate environmental protection and production efficiency, or how resources are used, lead to achievement of sustainable development.

Additionally, it is important for stakeholders to be eco-innovative in order to be competitive, to have economic growth, and to achieve sustainability. Being environmentally conscious allows for the development of novel, resource-efficient, and environmentally-friendly industrial techniques (Adomako, Simms, Vazquez-Brust & Nguyen, 2023). Using environmentally-friendly innovative techniques encourages resource recycling while enhancing the success of a company. It is asserted that it is challenging for companies to evaluate potential investments that are connected to upholding the relationship between stakeholders and companies' success (Woo & Suresh, 2022). Companies seem to have shifted their attention away from just economic factors to social and environmental considerations. While it is argued that stakeholders' expectations towards the environment are evolving, some companies have started developing strategies for sustainable management practices. Therefore, neglecting the interests of any stakeholder may harm a company's standing with the

public, which would have a detrimental effect on its sustainability and financial objectives.

Companies are required to respond to the needs of stakeholders although the needs be positive or negative. Whatever the case, a company must fully consider the interests of all its shareholders to reap the benefits of favourable society views and advantages (Yahaya & Alkasim, 2021). The stakeholder theory argues that it is important for companies to have robust relationships with its stakeholders to sustain and improve the corporate sustainability and profitability of companies. It is believed that corporate environmental and social sustainability has become a tool used to approach the needs of some stakeholders and it enhances long-term corporate growth, great operations efficiency, and profitability of companies. In addition, it is argued that stakeholders of companies are those that have relationships with the companies through their engagement with companies (Daugaard & Ding, 2022).

In contrast, the stakeholder theory places a strong emphasis on generating value for all stakeholders while supporting corporate sustainability investment. Corporate social and environmental activities, which also boost worker productivity and win the support of other key stakeholders, help a company's operational risk exposure to adverse market occurrences. Corporate involvement in social and environmental activities assumes that companies develop projects that are aimed at customers, employees and the community to improve and maintain profitability. Additionally, it is argued that investment in corporate sustainability contributes toward the efficient use of natural resources, improvement of profitability, and stakeholder management (Dandaro & Lima, 2022). Studies have revealed that stakeholder theory is used widely in studies on corporate sustainability since it covers the corporate environment and social sustainability aspects of corporate sustainability, which allows interactions with stakeholders (Daugaard & Ding, 2022).

It is argued that companies consider the interests of stakeholders through corporate environmental sustainability investments to reduce resource consumption as well as to improve resource efficiency and profitability. By recognising and applying the stakeholder theory, companies perform better, promoting interrelations between stakeholders. The justification for adopting the stakeholder theory is that companies

have the responsibility to satisfy the needs of all their stakeholders and resource efficiency, that is, minimising the use of water and energy is one avenue of exercising this responsibility. As a result, the ability of companies to keep the use of water and energy at minimal enhances profitability. Among expectations from findings of this study is, the engagements of sustainability investments satisfy the needs of the stakeholders while improving the profitability of companies since stakeholder theory informs the importance of investments this would help maintain resource efficiency.

2.2.2 Agency Theory

The agency theory posits that stakeholders of companies should align themselves with the strategies of corporate boards (Bătae, Dragomir & Feleagă, 2021). Stakeholder expectations should balance the strategy of companies for the sake of corporation growth (Dionisio & de Vargas, 2022). Companies with good corporate boards allow for investments that enhance profitability and reduce agency issues (Aksar, Hassan, Kayani, Khan & Ahmed, 2022). Additionally, the reduction of agency problems can be brought by the alignment of corporate value and corporate governance (Dong, Xiang, Zhang, Zhao & Tang, 2022).

There is a synergy between corporate strategy and stakeholder aspirations to prevent failure in the engagement of society and companies (Jan *et al.,* 2021). Companies' management in some ways serves as an intermediary between the company and its stakeholders, and if they are successful in doing so, it would help to maximise profit. Most companies rely on relationships with their shareholders to gain access to resources that help managers meet stakeholders' needs, maximise profit, and utilise resources effectively. Stakeholder pressure, however, may cause companies to not completely adhere to social or environmental standards, which may prevent them from being resource efficient (Adomako, Simms, Vazquez-Brust & Nguyen, 2023).

In the study of Bătae, Dragomir and Feleagă, (2021) it was revealed that there is negative relationship between agency theory and social sustainability. It is argued that the pressure from stakeholders may cause companies to change their priorities, allowing them to overlook their obligations to serve society and protect the environment (Glambosky, Jory & Ngo, 2023). Additionally, this brings about some conflicts between companies and stakeholders, which are resolved by the adoption of

corporate sustainability practices that guide on corporate sustainability investment and can benefit both the resource efficiency and profitability of companies (Glambosky, Jory & Ngo, 2023). The monitoring of profitability and the use of natural resources by stakeholders is an important tool for shareholders and ensures that the stakeholders' interests are met through the activities from corporate sustainability of companies.

Agency theory is often related to corporate sustainability investments through their involvement in corporate sustainability activities and it enhances their profitability. Adopting and applying the agency theory is likely to assist companies with stakeholders, which in return benefits companies. The adoption of the agency theory assists with internal controls such as good relationships among employees. Management in companies should do what is best for companies while maintaining good relations with other stakeholders to monitor companies' profitability and efficiency. It is not known whether the agency theory motivate CEOs of companies to work hard and achieve profitability and informs the investments that companies engage in to yield more profits.

2.2.3 Reinforcement Theory

The reinforcement theory deals with the behaviour and reactions of individuals as a function of consequences (Hardiyanti, 2022). Individuals prefer to engage in activities or behaviours that they are rewarded for. For example, as investors who invest in companies to get greater rewards (Hardiyanti, 2022). There are two main types of reinforcements, positive and negative reinforcements, the former is regarded as the desired behaviour with desirable rewards such as natural, social, tangible and token reinforcers. Negative reinforcement is the increase in the desired behaviour by removing undesirable rewards (Tan, Kasiveloo & Abdullah, 2022).

Rewards are important in the reinforcement theory and in investments. Most individuals are attracted to invest in companies due to the rewards that they are likely to get from risk taking (Durall, 2022). The desire by most individuals to invest in companies is due to the companies' involvement in sustainability in either society or the environment and the profitability state of such companies (Tan, Kasiveloo & Abdullah, 2022). Companies make investments in their environmental and social initiatives if they want to be resource-efficient and profitable. The commitment may

come from company stakeholders who need to feel happy to increase their investment and reap the benefits of profitability. To be rewarded with strong profitability and resource efficiency, businesses ought to be strategic with their sustainability investments by integrating their values (Durall, 2022). Companies' dedication to corporate sustainability investments may result in benefits that help them keep their profitability. The focus of reinforcement theory is on the environmental elements that influence behaviour (Nwachukwu & Worlu, 2023). Good corporate behaviour by companies attract investors through their outcomes on profitability, which is the reward they get (Daugaard & Ding, 2022).

Together, stimuli, responses, and behaviour are the three components that make up reinforcement and help companies make sustainable investment decisions (Odira, 2022). Stimuli include the sustainability investments that companies make, responses include whether they are being resourceful or whether their profitability is increasing, and behaviour includes the rewards that investors receive after making such investments, including whether they can make a profit or not (Asgari & Khasteh, 2022).

Reinforcement may be neutral, negative, or positive and the latter concern rewarding a person for acting in a certain way (Odira, 2022). Sustainability investments compel businesses to retain healthy profits and respond effectively to social and environmental issues (Durall, 2022). A negative reinforcement deters some behaviour by penalising the offending party accordingly. A neutral reinforcer is one that does not do anything to encourage or dissuade repeating the behaviour in question (Odira, 2022). By matching plans and values with returns and stakeholders, firms are likely to benefit from adopting and using the reinforcement theory. Adopting the reinforcement theory can help businesses invest in sustainability initiatives that can improve their use of resources and financial success. The expectations of the results in relation to the reinforcement theory would indicate that companies that invest in sustainability would maintain resource efficiency and maximise profitability.

2.2.4 Preliminary research conceptual framework

Figure 2.1 below illustrates the preliminary research conceptual framework, which indicates that the stakeholder theory involves the environment and society; and the agency theory involves the maximisation of profit and resource efficiency.

Furthermore, according to the reinforcement theory, the researcher anticipates that the achievement of resource efficiency and profitability would reinforce improved sustainability. Therefore, stakeholder theory (stakeholder interest), agency theory (agency interest) and reinforcement theory are represented in this research and in figure 2.1 below by:

- Stakeholder theory (stakeholder interest) represented by environmental investment and social investment.
- Agency theory (agency interest) represented by resource efficiency and profitability.
- Reinforcement theory represented by improved sustainability investment.

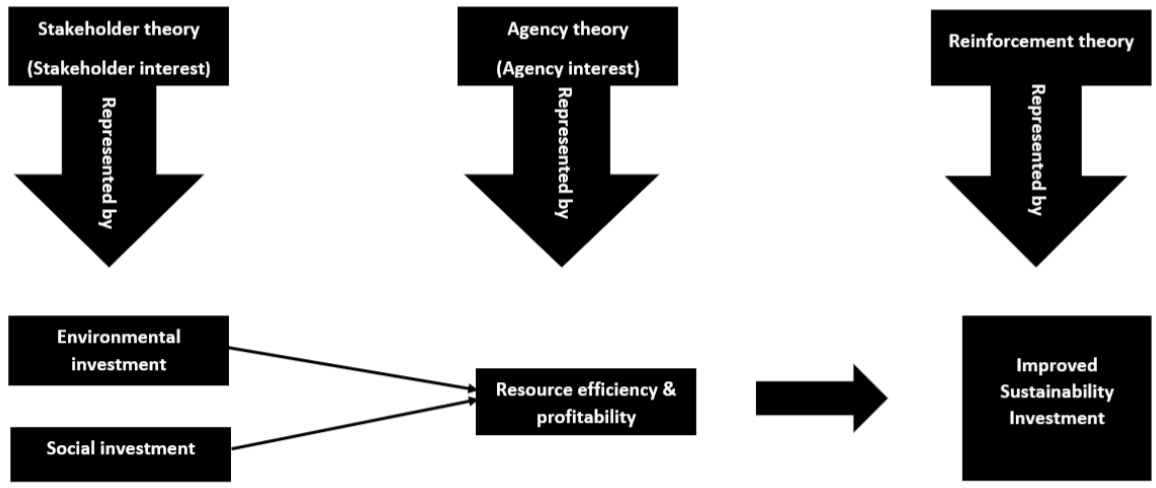

Figure 2.1. Preliminary Research Concept

Source: Researcher

The next section discusses the related regulatory and legal frameworks governing sustainability to further understand sustainability in the context of South Africa.

2.3 Regulatory and legal frameworks governing sustainability in South Africa

This section discusses the South African regulatory and legal frameworks. The challenges associated with global warming gave rise to legal frameworks being put in place to regulate how the environment has to be maintained. The regulatory laws,

policies, and strategic plans that are demonstrated in the figure below are pertinent and should be discussed in this study.

Figure 2.2 Regulatory and legal frameworks.

Source: Researcher

Constitution of the Republic of South Africa (CRSA) (ACT 108 of 1996)

The 1996 South African Constitution establishes the Bill of Rights, and an organisation's structure, and endorses statutory laws. One of the chapters of the Constitution clearly stipulates the Bill of Rights as the foundation of South Africa's constitutional framework. It helps to safeguard South Africa's founding principles of liberty, fairness, and respect for humanity, where environment is one of the rights and the objective of the environment is outlined in section 24 of the CRSA as follows:

Everyone has the right to:

- to an environment that is secure for their health and well-being and

- to safeguard the environment for the benefit of current and future generations by enacting appropriate laws and other measures that,
    - prevent the deterioration of the environment and pollution;
    - encourage the preservation and,
    - ensure the use of natural resources ecologically and sustainably while supporting legitimate social and economic development.

As stated in the Constitution, environment must be kept in such a way that it will be sustainable for the future and one way of doing that is through investing in it, to maintain resource efficiency for humanity. Through sustainability investments and efficient use of resources, the environment can be sustainable.

National Environmental Management Act

The National Environmental Management Act was established for the decision-making related to the environment and to foster and implement processes for coordinating environmental functions. Only the National Environmental Management Act, which addresses environmental conservation by offering guidance on sustainable environmental decision-making while effectively addressing global warming, has an important influence on the study. The other Acts presented in the study do not have an impact on the study. This Act's objectives are to promote sustainable development and to prohibit pollution. For companies, this would be done through environmental sustainability investments.

National Strategy for Sustainable Development (NSSD)

The NSSD states the strategic actions that are needed to realise the country's sustainable development goal and its objectives are to:

- optimise integrated planning and execution systems.
- conserve the natural resources and maintaining our ecosystems.
- head for a green economy.
- implement efficient climate change responses and creating sustainable communities.

The NSSD is in support of corporate sustainability since it aims to maintain the environment and society while saving for the future.

King IV Report on Corporate Governance for South Africa

A set of guidelines utilised for corporate governance stipulates the way through which companies ought to operate. The management of companies should adhere to these principles to foster efficient and ethical operations. King IV views sustainability as a crucial ethical and commercial requirement that should be integrated into any company's value-creation process and sustainable development is regarded as main requirement for finance and ethics. It advocates that companies must implement responsible investment practices when approaching sustainability investments such as environmental sustainability investment and social sustainability investments when making investment decisions to mitigate risks and generate sustainable long-term returns. As per principle 17 King IV, the stakeholders must be responsible when making investment decisions. Therefore, the principle was suitable to this study since it advocates better relationships between stakeholders and good approaches to investments.

Additionally, the Johannesburg Stock Exchange (JSE) Listings Requirements require public companies with shares listed thereto, to apply King IV and report in their annually integrated reports whether or not they comply with the suggestions and principles of King IV. Since this study focused on the annual integrated reports of the 30 FTSE/JSE Responsible Investment Index companies, the King IV as adhered to by companies, was used.

Code of Responsible Investing in South Africa (CRISA)

The code was first launched in 2011 and amended in 2022 to encourage companies to incorporate environmental sustainability, social sustainability, and governance when making investments decisions. The objectives of the code are as follows:

- the promotion of implementation and the development of green and sustainability-oriented investments.

- the cultivation of integrated thinking and understanding of context of society, economy, and environment within which companies operate.
- The creation of a context within which the investment environment can evolve towards positive outcomes to address South Africa's unique environmental and social challenges.

From the stated objectives above, this code encourages sound investment decisions for companies and promotes investment activities on environmental sustainability investments and social sustainability investments together with how they influence performance of companies.

National Framework for Sustainable Development in South Africa (NFSD)

A global effort on the sustainable development goals created the development of the NFSD in South Africa and planning for sustainable development since it is greatly influenced by global trends. Its first draft was in 2005, intended to outline the nation's objective for sustainable development in South Africa and indicate strategic options to change the nation's development direction. This framework supports the idea of environmental sustainability investment and social sustainability investment as this would help with mitigating risks posed to the use of natural resources and assist with generating sustainable returns.

2.4 SUMMARY OF THE CHAPTER

The chapter discussed the theoretical framework of the study, which encapsulated the stakeholder theory, agency theory and reinforcement theory. Stakeholder theory encourages engagements among stakeholders for the maximisation of profitability with a minimal usage of resources through sustainability investments. On the other hand, agency theory advocates better relations among stakeholders for the benefit of the companies. Furthermore, the reinforcement theory boosts the profitability of companies through its corporate sustainability investments. The chapter conclude with the regulatory and legal frameworks that govern sustainability in South Africa, where there was a discussion about the Constitution of the Republic of South Africa, the NFSD in South Africa, the NSSD, the King IV Report on Corporate Governance for South Africa and Code of Responsible Investing in South Africa.

The next chapter discusses African literature in relation to the objectives of the study.

CHAPTER 3-LITERATURE REVIEW (AFRICAN LITERATURE)

3.1 INTRODUCTION

The previous chapter discussed the theoretical framework used in the study and presented a figure of the preliminary research conceptual framework. This chapter reviews published literature on studies conducted in the African continent on corporate sustainability investments on resource efficiency and profitability. Section 3.2 reviews the African perspective on the concept of corporate sustainability investment. Section 3.3 reviews the relevant literature on the effect of environmental investment on resource efficiency and profitability while section 3.4 reviews literature on the effect of social investment on resource efficiency and profitability, lastly, the cited literature focus on the attraction to corporate sustainability investment (resource efficiency and profitability).

3.2 African perspective on the concept of corporate sustainability investment

According to studies, corporate sustainability investments are largely reported in Africa due to the failure of companies to utilise mineral resources to the benefit of environmental prosperity (Ali, Anufriev & Amfo, 2021). Countries in Africa are working toward achieving the Sustainable Development Goals (SDGs), which have an impact through corporate sustainability investments (Denhere, 2022). Companies in Africa, primarily that in Sub-Saharan Africa (SSA), are actively engaged in bilateral trade through corporate investments in corporate environmental sustainability, which makes it challenging for companies to maintain the balance between their financial obligations and environmental health (Lema, Bhamidipati, Gregersen, Hansen & Kirchherr, 2021). Corporate sustainability investments are made by companies to support social sustainability and environmental sustainability efforts. Such investment assists companies with their technical and financial decisions on the uses of natural resources and the impacts on profitability, in most companies, corporate sustainability investments are seen as the competitive measures of sustainability projects or engagements that they get involved in.

There has been an increase in corporate sustainability investments made by companies in Africa due to the social sustainability, environmental sustainability, and

economic sustainability of their targets toward the SDGs in their different sectors (Ali, Anufriev & Amfo, 2021; Kong & Gao, 2024). Most companies involved in manufacturing in Africa, are over-dependent on water and energy resources (Amoah & Eweje, 2024). Corporate sustainability investment in companies is often driven by technological change in companies where there is an investment in sustainability where the amount is apportioned to social sustainability and environmental sustainability to assist with the consumption of resources and improvement of profitability.

The following section reviews published literature on studies that focussed on the African perspectives on environmental sustainability investment, with emphasis on investment in renewable energy, recycling investment and water investment.

African perspective on environmental sustainability investment

Environmental sustainability is defined as the funds which are put aside for the preservation of environmental activities. The funds are to maintain the natural state of the environment and to prevent any negative impacts that could result from the corporate environmental sustainability initiatives (Denhere, 2022). Corporate environmental sustainability initiatives concern companies fulfilling the environmental needs of society while protecting the environment and improving the wellbeing of the companies and profitability. The more companies extract and utilise energy sources, the more the quality of the environment is affected badly (Lema *et al.,* 2021). Normally, this trend is synonymous with the companies whose activities require consumption of energy largely to grow the economy or profits while they lack environmental quality. The corporate environmental sustainability investment includes, among others, investment in renewable energy, recycling investment, and water investment. Environmental sustainability investment helps with the reduction of carbon emissions, efficient energy costs, and access to water over reasonable costs while producing products that increase profitability (Lema *et al.,* 2021).

Most countries in Africa make the largest environmental sustainability investments in the mining sectors, and this helps to assist with the performance of such companies. However, due to the emergence of green energy, there has been a need for green investments, therefore, environmental sustainability investment no longer focus on

one sector, but all sectors now engage in environmental sustainability through energy resources.

African perspective on the investment in renewable energy

There is a rapid increase in investment in renewable energy made by companies in Africa. As a result of the release of carbon emissions and the high pollution associated with their activities, energy resources pose a threat to the environment including in Africa, making investments in renewable energy essential (Amoah & Eweje, 2024). By increasing resource efficiency, corporate investments in renewable energy have a significant environmental impact. Additionally, investing in renewable energy is essential to reducing the risks associated with carbon emissions through environmental technologies that consume fewer energy resources, which results in a decrease in costs associated with carbon emissions and allows businesses to maximise their profits (Kong & Gao, 2024). Investment in renewable energy is the greatest method to satisfy company profitability and environmental quality goals while using resources efficiently (Lema *et al.,* 2021). Indeed, embarking on projects that focus on renewable energy is important since this is a type of energy considered crucial and sustainable for the future; therefore, investment in renewable energy improves a company's profitability (Denhere, 2022). Additionally, renewable energy assists with the development of technological skills and capabilities for growing profitability.

In Africa, such investments ensure compliance with environmental regulations aligned with companies' strategies that improve profitability (Kong & Gao, 2024). It is believed that investment in renewable energy bring about innovations in technology which create environmental awareness, mitigate effects of greenhouse and global warming, as well as improve environmental quality in the long run while being resource efficient and maintaining good profitability while providing energy security (Lema *et al.,* 2021). Energy use in African countries is alarming and the rate of investment in renewable energy is showing in companies over the amounts that are invested for renewable energy (Ali, Anufriev & Amfo, 2021). In order to meet SDG 7, there is focus on cheaper, affordable, and cleaner energy, brought about by investment in renewable energy.

Such approach is used as one of the tools that can contribute to a reduction in energy usage making energy efficient and improving profitability.

African perspective on the social sustainability investment

Social sustainability investment in most companies that operate in Africa involve skills development focused on technology, which is linked to environmental investment and improves profitability. Social sustainability investment in African countries is related to positively improving the lives of the society by generating healthy and liveable for the upcoming generations (Amoah & Eweje, 2024). Investment in social sustainability has a significant impact on companies since it increases societal contributions through initiatives. The initiatives that are done through social sustainability investments serve the long-term viability of the societies rather than the purpose of companies however they contribute towards maximising profit (Mhlanga, 2022).

The following section reviews the African literature on the effect of environmental investment on resource efficiency and profitability.

3.3 The effect of environmental investment on resource efficiency and profitability

The concept of sustainability environmental investment is relatively new to most companies however, it is expanding as interest in it grows. To align environmental investments with responsible resource use and profitability maximisation, some sustainable strategies must be identified (Kong & Gao, 2024). Africa's abundant natural resources are difficult to preserve, but they can be maintained with the use of sustainable practices.

For instance, Yahaya and Alkasim (2021) found a negative and significant relationship between environmental investment sustainability and profitability. By contrast, Adams, Adams, Attah-Boakye, Ullah, Rodgers and Kimani, (2022) revealed that there is a positive relationship between environmental sustainability investment and profitability. These studies agree that there is a relationship, even though they cannot agree on how environmental investment and profitability should be directed. Yahaya and Alkasim (2021) sampled 26 insurance companies listed on the Nigerian Stock

Exchange companies from 2010-2019 using regression analysis while Adams, Adams, Attah-Boakye, Ullah, Rodgers and Kimani (2022) sampled 52 companies that extracted oil in 20 countries in Africa, between the years 2003 and 2017 using regression analysis. The variations in the direction of environmental investment on profitability could be attributed to variations in the sample size and research analysis.

While Zhao and Rasoulinezhad (2023) found a negative relationship between environmental investment and resource efficiency, Zhang, Liu, Zhang, and Ma, (2023) showed a positive relationship between environmental investment and resource efficiency. Although the studies revealed no agreement on how environmental investment and profitability should be directed, they concur that there exist a relationship. Zhao and Rasoulinezhad, (2023) used regression analysis with African countries and period of 2000 to 2020. While Zhang, Liu, Zhang and Ma, (2023) used regression analysis with 25 African countries and the period of 2010 to 2021. Variances in the sample size and research analysis may be the cause of the variances in the direction of environmental investment on resource efficiency.

Prokopenko, Kurbatova, Khalilova, Zerkal, Prause, Binda, Berdiyorov, Klapkiv, Sanetra-Półgrabi and Komarnitskyi (2023) revealed a positive relationship between renewable investment and net income. The study sampled 10 of VARVAR in 2020 companies engaged in developing and implementing renewable energy technologies. Additionally, Shabbir and Wisdom (2020) revealed that there is a positive relationship between environmental investment and return on assets (profitability). The study sampled manufacturing companies in the Nigerian stock exchange.

3.4 The effect of social investment on resource efficiency and profitability

For instance, Yahaya and Alkasim (2021) and Bahta, Yun, Islam, and Ashfaq (2021) revealed a positive and significant interaction between social investment and profitability. Moreover, Adams *et al.* (2022) found a positive relationship between social sustainability investment and profitability. The latter study show that social investment has an impact on profitability as well as the direction in which social investment affects profitability. The study by Yahaya and Alkasim (2021) involved collecting data from 26 insurance companies listed on the Nigerian Stock Exchange

companies from 2010-2019 using regression analysis. Bahta, Yun, Islam and Ashfaq (2021) distributed questionnaires to Eitrean firms and used partial least squares structural equation modelling, direct and mediating effects. On the other hand, a study by Adams *et al.* (2022) involved sampling 52 companies from 20 oil African countries from 2003 to 2017 using regression analysis. Even though the authors used different samples and methods, their findings agree on the direction of social investment on profitability.

Shabbir and Wisdom (2020) revealed that there is a positive relationship between donations and employee benefits (social value) and return on assets (profitability). The study sampled manufacturing companies in the Nigerian stock exchange. Amahalu and Okudo (2023) revealed a positive significant relationship between donations and return on asset and net profit margin. Their study used seven (7) oil and gas companies quoted on the floor of Nigeria Stock Exchange as the sample size from 2009 to 2021.

An insignificant relationship between BBBEE and profit was shown in a study conducted on all firms listed in South Africa between 2004 and 2019 (Busse, Kupzig & Vogel, 2023). Dreyer, Viviers and Mans-Kemp (2021) revealed no significant relationship between BBBEE and return on asset. The data was collected from financial health data for 379 companies.

3.5 Attraction to corporate sustainability investment (resource efficiency and profitability)

Among significant threats that the globe is faced with to date is ensuring stability between the health of especially humans and the economy. The imbalance is caused by the depletion of natural resources, needed by human, which has a direct negative effect on the environment. There has been a great initiative in the support of environmental preservation and systems that strengthen regulations of the environment while allowing for funding of research on technological advances in energy efficiency. In Africa, the geographical location of companies is part of the great reasons for the investment in corporate sustainability. In their study, Ali, Anufriev and Amfo, (2021) found that environmental conditions matter since many countries in

Africa are rich in natural resources. The study used qualitative research methods and situational analysis and it revealed that there is potential with respect to sustainability investment through a green economy. For instance, Buda and Ricz (2023) found that there is a positive relationship between environmental investment and resource efficiency with a potential of improving profitability. The study used a qualitative approach and they used online surveys based on Ugandan green industry policies.

The above discussion makes it evident that there are differing views regarding the relations between corporate sustainability investment, resource efficiency and profitability in the African perspective. Additionally, there is dearth evidence that much has not been done on sustainability investment. Therefore, the current research adds some knowledge for corporate sustainability investment.

3.6 SUMMARY OF THE CHAPTER

The chapter focus on a review of literature on studies conducted in Africa, one of the objectives of the study. It highlighted how corporate sustainability is approached in Africa and is mostly linked to environmental sustainability investment. Prior research has shown both positive and negative relationships between corporate sustainability investment and resource efficiency, as well as between corporate sustainability and profitability using various proxies. This displays contradictory results from many studies. The next chapter will discuss the international literature related to the study.

CHAPTER 4-LITERATURE REVIEW (INTERNATIONAL LITERATURE)

4.1 INTRODUCTION

The preceding chapter present a review of literatures, on studies related to this, but done in Africa. This chapter presents a brief review of the literature related to this study. Section 4.1 reviews scholarly studies on the effect of environmental investment on resource efficiency and profitability. Section 4.2 reviews the literature on the effect of social investment on resource efficiency and profitability. Section 4.3 reviews literature about the attraction to corporate sustainability investment (resource efficiency and profitability). Section 4.4 discusses the gap in the literature. Section 4.5 presents a table identifying variables. Lastly section 4.6 presents the expanded conceptual framework.

4.2 International perspective on the concept of corporate sustainability investment

International perspective on environmental sustainability investment

Across the world, the demand for energy has increased largely in response to the need for economic development. By contrast, the usage of energy resources is limited, a situation that lead to an increase in environmental sustainability investments since energy is causing some effects on the global warming. With an increase in the demand for energy, there is an increase in the consumption of energy, a trend that has led to most companies getting involved in promoting approaches through which energy could be saved, particular through their environmental sustainability and social sustainability engagements. In addition to factors associated with the environment, challenges attributed to changes in climate across the globe are some of the major reasons for the sudden surge in environmental investment and energy efficiency; hence, they promotion of energy efficiency in many companies.

International perspective on investment in renewable energy

Investment in renewable require technological innovations meant to prevent the increasing effects of global warming. In particular, investment in renewable energy by companies that operate in developing countries has great financial development and is considered efficient and effective for their growth and profitability. Countries with sustainable development foreknowledge embrace energy efficiency and investments in environment. Normally, companies that operate in such countries tend to put more emphasis on the maximisation of profit without considering the environmental consequences they may face. However, in other countries, companies are in a quest for profitability with energy efficiency. Additionally, countries with sustainable economic development sometimes succeed on renewable energy because their discoveries of sustained energy sources. It is argued that companies that do well in energy efficiency are that with a good record of good profitability. In contrast, companies in developed countries contribute much to energy efficiency through energy consumption than making good profitability.

In an attempt to meet SDG 7, which proffers the need for affordable and clean energy, green innovation was introduced through investment in renewable energy. Asia record the highest investment in renewable energy and most of their companies promote green energy and green economy. In fact, such companies are able to achieve energy efficiency through the implementation of technological innovation because it is environmentally-friendly and cheaper. However, renewable energy investments have increased significantly across the world due to an increase in the consumption of energy.

International perspective on social sustainability investment

Companies tend to believe that investment in social sustainability improves profitability since some of their engagements are educational to society (Abdel Megeid & Abd-Elmageed, 2021). However, Ferreira, Lopes, Gomes and Rammal (2023) argue that there is a need to explore social sustainability, which can expand the need for social sustainability investment. There is a need to have practices in place for social sustainability. Investment in social sustainability allows companies to promote healthy and productive living through social sustainability practices by addressing certain risks in areas that lack.

4.3 The effect of environmental investment on resource efficiency and profitability

The accomplishment of the Agenda 2030 SDGs involves efforts by companies and society to ensure environmental protection, to enhance technology, and to increase energy efficiency (Steblyanskaya, Wang, Martynov, Mingye, Artykhov, Wang, Bocharnikov & Kiselik, 2021). Awan, Arnold and Gölgeci (2021) revealed that knowledge of investment in the environment by many companies can assist in overcoming environmental challenges and can advance resource efficiency of companies and profitability. Some companies are working towards preventing pollution, thereby exploring new opportunities to promote sustainability practices and adopting new environmental solutions that enhance profitability.

For instance, Bătae, Dragomir and Feleagă (2021), Chang, Liang and Liu (2021) and Liu, Zhao, Zhang and Zhou (2022) found that environmental investment has an impact on resource efficiency and profitability. Bătae *et al.* (2021) reported a positive relationship between environmental innovation and environmental emissions (environmental investment) and water usage, energy usage, return on asset, and return on equity (resource efficiency and profitability). Liu *et al.* (2022) showed a positive relationship between profitability, green investment, carbon dioxide emissions (environmental investment), wastewater and net profit (resource efficiency and profitability). Conversely, Chang *et al.* (2021) revealed a negative relationship between renewable energy (environmental investment) and total assets (profitability); and between renewable energy (environmental investment) and use of energy (resource efficiency). While findings of some of the studies cited in this section differ on the direction of the impact of environmental investment on resource efficiency and profitability, there is agreement that environmental investment has an impact on resource efficiency and profitability. Bătae *et al.* (2021) sampled 104 companies and used the quantitative research approach, and Liu *et al.* (2022) sampled 113 companies and used the same research approach. Both Bătae *et al.* (2021) and Liu *et al.* (2022) used regression model analysis. Chang *et al.* (2021) sampled 145 companies, used a quantitative research approach and stochastic frontier analysis. Furthermore, the differences in the sample size and research analysis may have led to the differences in the direction of environmental investment on resource efficiency and profitability.

Additionally, in their research, Wang, Li and Zhang (2021) and Zhang and Xie (2022) propose that investment in greenness has a role on the consumption of natural resources such as energy and water and profitability. Wang, Li and Zhang (2021) indicated a positive relationship between investment in greenness (environmental investment) on energy usage (resource efficiency) and return on assets and total asset turnover (profitability). Zhang and Xie (2022) found a negative relationship between investment in greenness on energy consumption (resource efficiency) and gross profit (profitability). The authors differ on the direction of the impact of investment greenness on energy efficiency and profitability yet, they agree that investment greenness has an impact on energy efficiency and profitability. Wang, Li and Zhang (2021) sampled 38 companies from three industries in one country for five years on regression model. Zhang and Xie (2022) sampled 25 companies in one industry from 5930 countries for one year using the regression model. Even though there are different directions between environmental investment, resource efficiency and profitability, there may be a need for substantial investment in environmental protection initiatives that promote resource efficiency and profitability.

Additionally, Khalid, Naveed, Nawaz, Sun, Wu and Ye (2023) showed a positive relationship between corporate environmental investment and profitability were China's A-share listed companies were sampled from 2010-2019. Regional development and return on assets were used as the variables for corporate environmental investment and profitability. Least square dummy variable panel regression was used on quantitative variables. Furthermore, Aldieri, Makkonen and Vinci (2022) found a positive relationship between environmental sustainability investment and resource efficiency. They used regression model and from European countries from 2002 to 2017.

A significant positive relationship between environmental investment and profitability measured in return on assets, based on Chinese listed firms from 2009 to 2016 was reported by Akbar, Jiang, Qureshi and Akbar (2021). Furthermore, Jin and Xu (2020) suggest a relationship between return on asset and environmental investment by revealing a positive relationship between the variables where data was collected from Chinese companies from 2012-2016.

Anderson, Liu, Cruz and Wang (2020) allude that research help firms to understand the impacts of environmentally and socially responsible activities on the financial performance of firms before and after the 2008 recession at different stages of the supply chain that includes four industries: Retail, Wholesale, Manufacturing, and Transportation. These findings suggest that manufacturing companies, transportation companies and wholesalers' environmental activities (environmental investment on recycling and environmental prevention, and pollution) have a negative relationship to return on asset. For retail companies, it revealed a positive relationship to return on assets.

Khalid, and Naveed (2022), Garcés-Ayerbe, Rivera-Torres, Murillo-Luna and Suárez-Gálvez (2022) and Hana and Astuti (2023) reveal that environmental investment has an influence on profitability. Khalid, and Naveed (2022) revealed a positive relationship between environmentally responsible investment (environment investment) and profitability (return on asset). Garcés-Ayerbe *et al.* (2022) revealed that there is a positive relationship between environmental investment and financial performance (return on asset). Hana and Astuti (2023) recorded a negative and insignificant relation between green accounting (recycling costs and environmental research and development costs) and profitability (return on assets). Whilst findings of the studies reviewed in this paragraph disagree on the exact direction of the relationship between environmental investment and profitability, they agree that there is connection. Khalid, and Naveed (2022) sampled an unbalanced sample of 2290 firm-year observations of China's A-share listed firms for the period 2010–2019. Garcés-Ayerbe *et al.* (2022) sampled 2936 Spanish manufacturing firms, covering the period 2009–2016. Hana and Astuti (2023) sampled 24 manufacturing companies listed on the Indonesian stock exchange from 2019-2021. More importantly, variations in the direction of environmental investment on profitability could have resulted from variations in the sample size and research analysis.

4.4 The effect of social investment on resource efficiency and profitability

Social investments are becoming top priorities towards the sustainable operations of companies to reach a two-fold goal of maximising profit and resource efficiency.

Cordini, Boczy and Cefalo (2021) and Dionisio and de Vargas (2022) argue that social investment solves societal issues such as protecting society; and social needs such as promoting skills in the communities through community initiatives that improve the profitability of companies.

Ajayi and Akinsomi (2022), Saeed, Noreen, Azam and Tahir (2021) and Suwasono (2021) found that social investment satisfies stakeholder needs and leads to a competitive advantage as well as higher efficiency that improves profitability. Ajayi and Akinsomi (2022) found a positive relationship between BBBEE investment (social investment) and return on assets (profitability). Studies by Saeed *et al.* (2021) and Suwasono (2021) showed a negative relationship between corporate social investment (social investments) and return on assets (profitability). Ajayi and Akinsomi (2022), Saeed, Noreen, Azam and Tahir (2021) and Suwasono (2021) agree that social investment has an impact on profitability, yet they differ on the direction of the impact of social investment on profitability. Ajayi and Akinsomi (2022) used a quantitative approach with a sample of 152 companies, and ordinary squares models were used. Saeed *et al.* (2021) used a quantitative approach with a sample from energy sector companies and regression model analysis. Suwasono (2021) sampled 33 companies, and the data analysis used multiple regression analysis. Furthermore, the differences in sample size and research analysis may have led to differences in the direction of social investment on profitability.

Joshi, Agrawal and Welegedara (2022) and Gachie (2021) allude to the fact that social investment impacts resource efficiency and profitability. Gachie (2021) revealed a negative relationship between training and education, donations (corporate social investment), BBBEE investment, energy usage (resource efficiency) and net profit (profitability). Joshi, Agrawal and Welegedara (2022) found that there is a positive relationship between community donations and education (corporate social investment), energy usage (resource efficiency) and net profit margin (profitability). Gachie (2021) used a case study with a sample of two companies through qualitative and quantitative research approaches. Joshi, Agrawal and Welegedara (2022) used a case study method on a sample of 21 communities through a quantitative research approach. Furthermore, the differences in the sample size and research analysis may

have led to the differences in the direction of social investment on resource efficiency and profitability. Social investment influences the social improvement of companies and promotes innovation of company stakeholders, which influences profitability. Companies strive for profit by refocusing their attention on investing in societies and resolving social issues such as educating communities on social sustainability investment, which improves profitability and makes them sustainable.

Social sustainability such as corporate social responsibility strive to be resource efficient by meeting the social needs of communities. This indicate that investment is directly related to corporate sustainability and fulfil the corporate social strategy of companies. In fact, some results revealed a negative moderate between resource efficiency and while there is marginal positive relationship between the social sustainability investment and profitability (Woo & Suresh, 2022). The study used a sample of corporate companies in South Korea and social investment was measured by corporate social investments, resource efficiency by inventory and production while profitability by return on assets.

On the other hand, a study in Pakistan by Rahman, Shafi and Saad (2021) revealed a positive relationship between social sustainability investment and profitability. It involved a sample of 23 companies with record of having been involved in the banking sector for 7 years, and they used ordinary least square.

According to Anderson, Liu, Cruz and Wang (2020), research helped guide businesses comprehend how socially and environmentally conscious operations affect their financial performance especially before and after the 2008 recession at various points in the supply chain, which spans four industries: manufacturing, transportation, retail, and wholesale. Findings for transportation companies and retailer companies revealed that there is a positive relationship between social activities (corporate social investment and community initiatives) and return on assets. While for retail companies and manufacturing companies revealed a negative relationship between social activities (corporate social investment and community initiatives) and return on assets.

4.5 Attraction to corporate sustainability investment (resource efficiency and profitability)

The engagement of companies in corporate sustainability increases the attraction of stakeholders' attention since it has an immediate effect on the profitability of companies. Companies that engage in corporate sustainability investment have a protection tool for communities, customers, and employees since it incorporates environmental sustainability, social sustainability, and corporate governance that attract stakeholders' attention. These companies pursue improved profitability while their resources get used efficiently (Qiu, Jiang, Liu, Chen & Yuan, 2021).

For instance, Ibrahim, El Frargy and Hussainey (2021), Lo and Liao (2021) and Ellili (2022) revealed an influence of corporate sustainability investment on resource efficiency and profitability. Ibrahim *et al.* (2021) reported a positive and significant relationship between corporate sustainability investment and both resource efficiency and profitability. Lo and Liao (2021) found a positive and insignificant relationship between corporate sustainability investment and profitability and a negative and significant relationship between corporate sustainability investment and resource efficiency. In contrast to the findings of the other studies cited in this paragraph, Ellili (2022) found a negative relationship between corporate sustainability investment and profitability and a negative relationship between corporate sustainability investment and resource efficiency. Overall, the literature cited here differ on the direction of the impact of corporate sustainability investment on resource efficiency and profitability, yet they have a joint agreement that corporate sustainability investment has an impact on resource efficiency and profitability. Ibrahim, El Frargy and Hussainey (2021) sampled 12 companies and used a quantitative research approach and regression analysis. Lo and Liao (2021) sampled 3587 companies and used a quantitative research approach and regression analysis. Ellili (2022) sampled 30 companies and used a quantitative research approach and used regression analysis. Furthermore, the differences in sample sizes may have led to differences in the direction of corporate sustainability investment on resource efficiency and profitability.

4.6 Gap in the literature

From the literature reviewed so far, related literature exists on the phenomenon being studied. However, as indicated in Table 4.1 below, the literature has not focused exactly on the combined effect of environmental and social investment on corporate resource efficiency and profitability. Therefore, this research study intended to close the existing literature gap and contribute to knowledge by developing a framework for corporate sustainability investment, resource efficiency and profitability. The following are the identified gaps:

-Most of the literature reviewed focused on sustainability performance.

-Most of the literature reviewed has not focused exactly on the combined effect of environmental and social investment on corporate resource efficiency and profitability

4.7 Variables from the Literature for Expanding the Research Framework (figure 4.1 below) and the Construction the Analysis model in Section 5.3.6.1.

Table 4.1 present key variables used in previous empirical research in environmental investment, social investment, resource efficiency, and profitability. The research adopts these variables to expand the Research Framework and construct the Analysis Model in 5.3.6.1. Also, the Table display an extract of the literature reviewed and it indicates some variables that were identified in the literature done.

Table 4.1: Key variables used in related previous empirical research

Author and year	**Independent variables**	**Dependent variables**
Bătae, Dragomir and Feleagă (2021)	Waste reduction Emissions Environmental innovation Investment in recycling	Asset return Net profit Energy consumption Water consumption
Liu, Zhao, Zhang and Zhou (2022)	Green investment (water investment, renewable energy investment)	Net profit Water consumption
Chang, Liang and Liu (2021)	Investment in renewable energy	Asset return Energy consumption

Wang, Li and Zhang (2021)	Investment in greenness (water investment, renewable energy investment, recycling investment)	Asset return Energy consumption
Zhang and Xie (2022)	Investment in greenness (water investment, renewable energy investment, recycling investment)	Net profit Energy consumption Water consumption
Saeed, Noreen, Azam and Tahir (2021)	Corporate social investment (investment in skills development and community education)	Asset return
Suwasono (2021)	Corporate social investment	Asset return
Joshi, Agrawal and Welegedara (2022)	Corporate social investment (community donations and education)	Net profit Energy consumption
Gachie (2021)	Corporate social investment BBBEE investment	Net profit Energy consumption Water consumption
Ajayi and Akinsomi (2022)	BBBEE investment	Asset return

4.8 Conceptual framework

Figure 4.1 below presents the main research conceptual framework, which is a combination of the preliminary framework (Figure 4.1) and insights from empirical literature. The variables that are presented on Figure 4.1 are: investment in renewable energy, water investment, as well as recycling investments. All these are independent variables that represent corporate environmental investment, while corporate social investment variables are represented by corporate social investment and BBBEE investment as independent variables and market capitalisation is the control variable. Of noteworthy, asset return and net profit are representatives of dependent variables for profitability. Furthermore, energy consumption and water consumption are dependent variables representatives for resource efficiency.

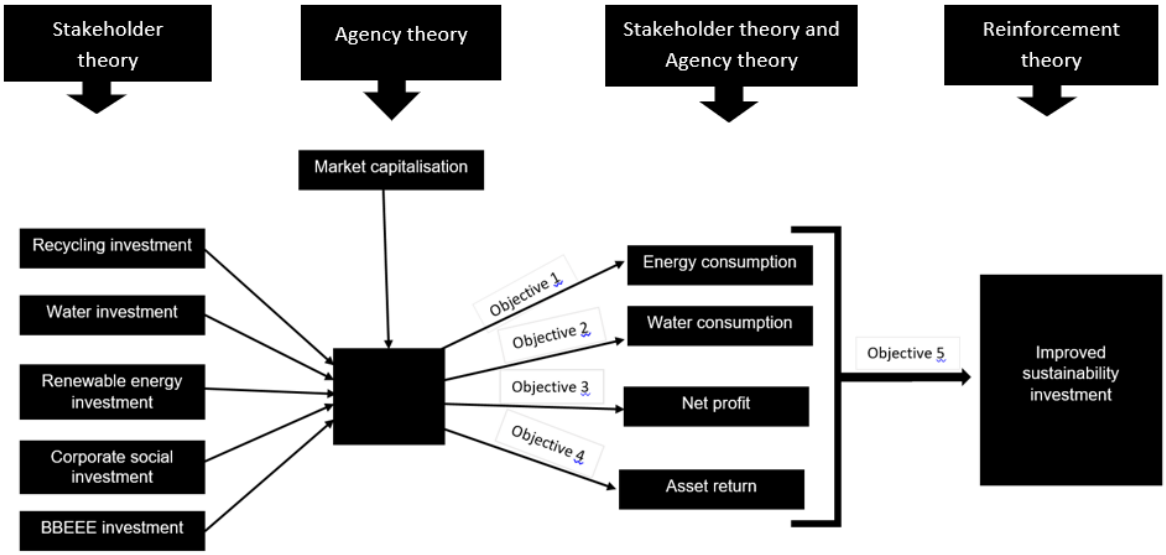

Figure 4.1. Main Research Conceptual Framework

Source: Researcher

4.9 SUMMARY OF THE CHAPTER

The chapter review literature on studies conducted outside the continent of Africa in relation to the objectives of the study. It highlight how corporate sustainability is approached internationally. This chapter indicate that there exist a gap, on sustainability investment. Therefore, this study make a great impact on the literature of sustainability investment. The researcher developed a preliminary conceptual framework which is presented in the chapter based on the literature of the international and African literature. The next chapter discusses the research methodology of the study.

CHAPTER 5-RESEARCH METHODOLOGY

5.1 INTRODUCTION

The previous reviewed published literature on studies conducted outside the African continent, an approach in line with objectives of this study. In Chapter three, focus was on literature published based on studies done in the African continent, in view of the objectives of this study and chapter two discussed the theories that underpinned the study.

The research methodology used for the thesis is discussed in this chapter. According to Lê and Schmid (2022), research methodology refers to procedures and strategies employed for identifying and examining the information related to a particular research topic. Frazier and Gonzales (2021) describe the concept of research methodology as a key element of the thesis that ensures consistency between the techniques, approaches, and underlying study used. The choice of research methodology in this study was carefully considered by ensuring that whoever is chosen, is aligned with the research objectives of the study. Therefore, it is important to restate the research objectives of this study as follows:

i. To determine the relationship between corporate environmental investment and resource efficiency.
ii. To analyse the effect of corporate social investment on resource efficiency.
iii. To evaluate the impact of corporate environmental investment on profitability.
iv. To analyse the influence of corporate social investment on profitability.
v. To determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment.
vi. To contribute to knowledge by developing a framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa.

In this chapter, a description of the methodology used to select different features during the research process is provided. The chapter is divided into sections: section

5.2 describes the research paradigm, section 5.3 focus on the research method, section 5.3.1 describes the research design, section 5.3.2 describes the study area, section 5.3.2 discussed research population; section 5.3.4 discussed the sample, sampling method and sample size. Furthermore, section 5.2.5 expounded the data collection process and section 5.3.6 explained the data analysis. The chapter ends with the discussion of the reliability and validity in section 5.4, ethical considerations in section 5.5, whereas section 5.6 discusses the research's limitations. Lastly, there is a presentation of the research onion, which summarises the research methodology of the thesis.

5.2 Research Paradigm

A research paradigm is a philosophy that a research study is based on. There are different paradigms namely positivist, anti-positivist, and interpretivism (Frazier & Gonzales, 2021; Nückles, 2021). A positivist research paradigm focuses on whether a relationship exists between variables, where variables are measured statistically because positivism believes that reality can be discovered through a scientific methodology (Kumatongo & Muzata, 2021; Nückles, 2021). An anti-positivist research paradigm applies the interpretation of variables and critical analysis to give different perspectives on the understanding of variables (Kumatongo & Muzata, 2021; Bonache, 2021). The interpretivism paradigm gives emphasis on the recognition of subject meanings by interpreting responses from surveys (Bonache, 2021).

Given the definitions above, this research study applied a mix of two paradigms: the positivist research paradigm and the interpretivist research paradigm. While objectives one to four were stated in quantitative and relational variables, objective number five was stated in qualitative variables. The positivist paradigm sought to respond to objectives one to four of the study since they evaluated the relationship between quantitative variables, which was measured statistically. The interpretivist research paradigm was applied to objective five since this objective was used to interpret responses gathered through a questionnaire survey.

5.3 Research method

Selecting a suitable research approach that aligns with the implemented methodology for a particular research is of the utmost importance when carrying out research. There are different research methods that exist in literature, such as quantitative, qualitative or mixed methods (Lê & Schmid, 2022). However, each research adopts a method that is suitable for the objectives and types of research data. The quantitative method is employed to analyse numerical data (Chang *et al.,* 2021; Lê & Schmid, 2022). Also, the quantitative method can be referred as the research method that focuses on demonstrating and emphasising the measuring of gathered and analysed data (Lê & Schmid, 2022). Saeed *et al.* (2021), Bătae *et al.* (2021) and Liu *et al.* (2022) used the quantitative method in a similar study involving numeric dependent and independent variables.

The qualitative method is a technique employed by researchers to analyse non-numerical data (Lê & Schmid, 2022). In line with this, Patel, Shah and Trivedi, (2022) describe the qualitative method as research approach that emphasises gathering information through dialogue and open-ended questions.

Vebrianto, Thahir, Putriani, Mahartika and Ilhami, (2020) refer to the mixed method as the use of the combination of quantitative research and qualitative research in a study. This study used a mix of quantitative and qualitative research methods for a number of reasons:

Figure 5.1 Research methods

Source: The Researcher

On the one hand, the quantitative method is suitable for objectives 1-4 because the dependent variables and independent variables in these objectives were measured in a numerical form and the research paradigm is positivist. On the other hand, the qualitative method was also suitable for this study because objective 5 sought to interpret and understand the meaning of variables; hence, interpretivism was used as the research paradigm for objective 5.

5.3.1 Research design (strategy)

Research design is a technique by which a researcher collects and analyses data to address the aim of the research (Stoecker & Avila, 2021). Given that this research used a mixed paradigm and a mixed method, it used a mixed design involving correlational and survey designs. The correlational research design is suitable because objectives one to four of the study determined the relationships between numerical variables (quantitative variables) using statistical analysis. The correlational research design is in alignment with the positivist paradigm because positivism measures relationships between quantitative variables. In addition, the researcher used a questionnaire survey to accommodate objective five because it (the objective) is stated in qualitative variables with the interpretivism paradigm since information (responses) gathered through the questionnaire survey from respondents were interpreted.

5.3.2 Study Area

A study area is the geographical location where a researcher will carry out the research (Chandra *et al.*, 2022; Guignard, 2022). This study was conducted in Johannesburg, in the Gauteng Province of South Africa, specifically, the Johannesburg Stock Exchange (JSE) because Responsible Investment Index companies are found there. It is mandatory that all companies that are listed by the JSE report on sustainability. This study made use of the information on sustainability from companies listed on the JSE because it offers efficient, safe primary and secondary capital markets for various securities, backed by regulatory and post-trade services. Moreover, this study area selected is where all the companies under study are listed on the FTSE/JSE, and they are subject to regulations and are required to report their earnings and most of their head offices are based in Johannesburg.

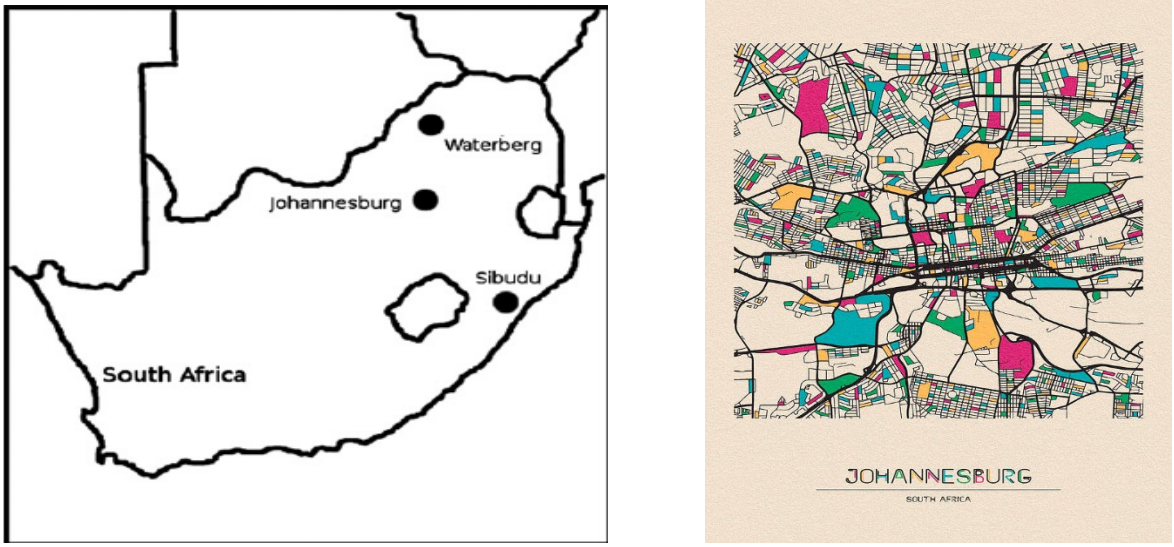

Figure 5.2 Johannesburg map

Source: Google Maps (2023)

5.3.3 Research population

A research population is a collection of subjects of the study from where a sample is selected (Marcus, 2022). This study's population comprised 60 FTSE/JSE Responsible Investment Index companies because they are officially recognised in the index as companies performing and reporting on environmental and social sustainability, which are the key variables for sustainability investment (Denhere, 2022).

5.3.4 Sample, sampling method and sample size

The procedure used to select a group of elements from the categorised population is known as a sample (Gruijters & Peters, 2022). Probability and non-probability sampling are the two main sampling methods. A probability sampling method is a procedure for sampling where the elements in the population have the same prospect of being selected while a non-probability sampling is a method where the elements in the population have an unknown chance of being selected (Ghorbani, 2022). A variant of non-probability sampling is purposive sampling, which occurs when elements are chosen from the population for the sample based on the researcher's judgement (Beaumont & Rao, 2021; Pace, 2021; Ghorbani, 2022). Therefore, purposive sampling was used based on the number of companies that the JSE has classified as top

performing Responsible Investment Companies. Additionally, as purposive sampling is the process of choosing a specific sample for a particular purpose, it was employed since the aim of the researcher was to choose a sample that specifically address the research problem identified. There were 60 FTSE/JSE Responsible Investment Index companies at the time of the study and out of the 60 companies FTSE/JSE Responsible Investment Index companies, 30 were ranked as the top companies based on their sustainability transparency and the commitment towards sustainability (Denhere, 2022). Furthermore, by virtue of their environmental, social, and governance ratings, the top 30 firms were selected because they have a greater influence on the evolution of corporate sustainability policies and investor expectations. Due to incomplete year to year published data of 60 companies, the researcher used 24 performing FTSE/JSE Responsible Investment Index companies as indicated by JSE. The sectors in which companies listed on the FTSE/JSE Responsible Investment Index operate include manufacturing, banking, financial services, insurance, chemical and energy, mining and metal processing, communications, and retail sectors.

5.3.5 Data collection

Data collection is a process of obtaining information on certain variables and measuring the obtained information to answer the outcomes of a study based on identified research objectives (Mahalle, Shinde, Pise & Deshmukh, 2022). There are two types of data collection: primary data collection and secondary data collection. The former is the collection of new data (Li & Zhang, 2022), and the latter relates to the collection of data that was collected before (Morris, Conway, Becraft & Ferrucci 2022).

This study used both secondary data and primary data. The researcher used 30 FTSE/JSE Responsible Investment Index companies for secondary data collection from annual integrated reports which were available on their websites. However, there was no consistency of data from 6 FTSE/JSE Responsible Investment Index companies; therefore, the researcher only used 24 FTSE/JSE Responsible Investment Index companies. Primary data collection was considered in an attempt to do a follow-up on quantitative secondary analysis, to check companies' CEOs' and

environmental officers' views on how sustainability investment is attracted by corporate eco efficiency and profitability.

Secondary data collected in this study covered variables contained in objectives 1-4, which are an investment in renewable energy (in Rand amount); recycling investment (in Rand amount); and water investment (in Rand amount). In addition, the variables include Corporate Social Investment (in Rand amount) and investment in BBBEE (in Rand amount) for social investment variables. Furthermore, the variables collected for resource efficiency are water consumption (in cubic kilometres) and energy consumption (in kilowatt hour). Lastly, the variables collected are net profit (in Rand amount) and asset return (in percentage) for profitability variables and market capitalisation (in Rand amount) as a control variable. The data was collected for a period of five (5) years (2017-2021) and the reporting periods of companies were considered. This was arranged in panel data and gave a total of 120 observations (5 years x 24 companies= 120).

Primary data was collected qualitatively using a survey questionnaire, where the respondents answered questions designed to address research objective 5 regarding the attraction of companies to corporate sustainability investment. Questionnaires were issued to the environmental managers and chief executive officers (CEO's) companies, they were distributed to the respondents through email and the questionnaire was converted to google-form to make it easier for the respondents to respond to the questionnaire. Furthermore, to obtain a high degree of consistency and to facilitate response comparison, a structured questionnaire was employed, with each item predefined to guarantee that participants were asked similar questions in the same order. There are both closed-ended and open-ended questions on the survey. Respondents were only allowed to select answers from the pre-provided options when answering the multiple-choice, closed-ended questions. The respondents were able to provide free-form answers to the open-ended questions.

5.3.6 Data analysis

Data analysis is a process in which a researcher inspects information from data collected to conclude the outcomes of the study (Iye, Nurlatu, Susiati, Taufik, Harziko & Abida, 2022). This study used multiple linear regression analysis, a regression

model used to identify relationships between two or more explanatory variables statistically (Liu *et al*., 2022). The justification of using multiple linear regression analysis is that the study used quantitative variables and the positivist paradigm to measure relationships between variables. In addition, multiple linear regression was selected to describe both the nature and impact of the correlations between the independent and dependent variables in this study. Before the analysis, the data was arranged in a panel, and the analysis used the Stata software.

5.3.6.1 First level Analysis (variables for quantitative analysis for objectives 1-4)

Analysis Model

Table 5.1 below reveal the dependent and independent variables that the researcher used to prepare the analysis model. These variables were chosen from published studies including Bătae *et al*. (2021), Liu *et al*. (2022), Chang *et al*. (2021), Saeed *et al*. (2021), Suwasono (2021), Joshi *et al*. (2022), Gachie (2021) and Ajayi and Akinsomi (2022). See Table 4.1 under the international literature.

Table 5.1: First level Analysis (variables for quantitative analysis for objectives 1-4).

Objective	Independent variables	Dependent variable	Control variables	Model Number
Objective 1 To determine the relationship between environmental investment and resource efficiency	Renewable energy investment, Recycling investment and water investment.	Water consumption	Market capitalisation	Model 1
	Renewable energy investment, Recycling investment and water investment.	Energy consumption	Market capitalisation	Model 2
Objective 2 To analyse the relationship between social investment and resource efficiency.	Corporate Social investment and BBBEE investment	Water consumption	Market capitalisation	Model 3
	Corporate Social investment and BBBEE investment	Energy consumption	Market capitalisation	Model 4

Objective 3 To determine the relationship between environmental investment and profitability	Renewable energy investment, Recycling investment and water investment.	Net profit	Market capitalisation	Model 5
	Renewable energy investment, Recycling investment and water investment.	Asset returns	Market capitalisation	Model 6
Objective 4 To analyse the relationship between social investment and profitability.	Corporate Social investment and BBBEE investment	Net profit	Market capitalisation	Model 7
	Corporate Social investment and BBBEE investment	Asset returns	Market capitalisation	Model 8
Objective 5 was analysed qualitatively with responses from questionnaire survey (See section 10.8.2 below for details.)				

Based on the above explanations of sources of variables, the analysis model is presented below. Each research objective has two models:

Model for Objective 1:

$$WATECO_{it} = \alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots..(1)$$
$$ENERCO_{it} = \alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots..(2)$$

Model for Objective 2

$$WATECO_{it} = \alpha_i + \beta_1 \text{CSI}_{it} + \beta_2 \text{BBINV}_{it} + \beta_3 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$
$$ENERCO_{it} = \alpha_i + \beta_1 \text{CSI}_{it} + \beta_2 \text{BBINV}_{it} + \beta_3 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Model for Objective 3

$$NETPRO_{it} = \alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots..(5)$$
$$ASERER = \alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots(6)$$

Model for Objective 4

$$NETPRO_{it} = \alpha_i + \beta_1 \text{CSI}_{it} + \beta_2 \text{BBINV}_{it} + \beta_3 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(7)$$
$$ASERER_{it} = \alpha_i + \beta_1 \text{CSI}_{it} + \beta_2 \text{BBINV}_{it} + \beta_3 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

Where:

NETPRO=Net profit (Dependent variable)
ASERER=Asset return (Dependent variable)
WATECO=Water consumption (Dependent variable)
ENERCO= Energy consumption (Dependent variable)
INVIRE=Investment in renewable energy (Independent variable)
WATINV=Water investment (Independent variable)
RECINV=Recycling investment (Independent variable)
CSI=Corporate Social Investment (Independent variable)
BBINV=BBBEE investment (Independent variable)
MKTCAP=Market capitalisation (Control variable)
α =intercept
β =Beta representing coefficiency
ε = error
$_i$=represents the company
$_t$=represents the year

Table 5.2 indicates the different categories of variables and how they were measured and collected. This study aimed to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return).

Table 5.2: Operational measure of variables.

Independent variables	**Measurement**	**Sources**
Recycling investment	Amount of money invested in recycling for each company	From annual integrated reports for each company
Water investment	Amount of money invested in water for each company	From annual integrated reports for each company
Investment in renewable energy	Amount of money invested in renewable energy for each company	From annual integrated reports for each company
Corporate Social Investment	Amount of money invested in CSI for each company	From annual integrated reports for each company
BBBEE investment	Amount of money invested in BBBEE for each company	From companies annual integrated reports for each company
Dependent variables	**Measurement**	**Sources**
Net profit	Amount of money the company earns after deducting all expenses in a given time.	From annual integrated reports for each company
Asset return	The rate that is used to measure how much profit companies are generating	From annual integrated reports for each company
Water consumption	Volumes of water usage for each company	From annual integrated reports for each company
Energy consumption	Units of usage of energy fFor each company	From annual integrated reports for each company

Control variable	Measurement	Source
Market capitalisation	Total ordinary shares multiplied by current market value per share	From annual integrated reports for each company.

Source: Researcher

The following subsection discusses the operational definitions of variables of the study.

Operational definitions of variables

Dependent variables

Asset return is a component of financial success because it informs other stakeholders regarding the efficacy of the operations of the company and that of the management (Rahmawati, Sa'adah & Lutfiah, 2024).

Net profit is a reliable measure of the company's profitability since it is the sum of money the company makes during a specific reporting period after deducting all operating and tax expenses (Rahmawati, Sa'adah & Lutfiah, 2024).

Water consumption is the total part or volume of water utilised for drinking or other operations within the premises of the company and never be put back to its natural source (Pomoni, Koukou, Vrachopoulos & Vasiliadis, 2023).

Energy consumption is the total energy expressed in kilowatts per hour (kWh) for a specific period or operation within the company's premises (Pomoni, Koukou, Vrachopoulos & Vasiliadis, 2023).

Independent variables

Recycling investment is money or funds invested to prevent waste that can be reused by converting waste material to reusable material (Wu, Zhang & Liang, 2020). It is a long-term strategy funding used in the recycling processes, such as the collection, processing and manufacturing of recycled items. For example, paper and plastics are the worst polluters in the manufacturing industry (Mondal & Giri, 2021).

Water investment is the number of funds that are invested for sustainable growth and the treatment of water purification and usage (Ferreira, Graziele, Marques & Gonçalves, 2021). The investment is important since water is scarce. The investment, which is used for water security, enhances the financial performance of companies (Voth-Gaeddert, Fikru & Oerther, 2022).

Energy investment refers to funds that are invested for the usage of energy, the promotion of energy efficiency and for clean energy, which helps companies to sustain their energy over a while since they can use the money to invest in renewable energy and other types of energy (Liu, Zhang, Cai & Davenport, 2021).

Investment in renewable energy is the commitment of capital to companies and innovations that make use of renewable energy sources for generating power (Lema *et al*., 2021).

Corporate Social Investment includes initiatives that are not directly aimed at boosting a company's profits and are instead conducted outside of its regular commercial operations (Dionisio & de Vargas, 2022).

BBBEE investment is the investment in Broad-based black economic empowerment for the transformation strategy (Busse, Kupzig & Vogel, 2023).

Control variable

Market capitalisation is one method of determining the size of a company where all of a company's outstanding shares of stock, including both restricted and publicly traded shares held by corporate officers and insiders, add up to the entire value of the stock (Yatim, 2023).

The next section discusses the statistical tests that were employed to the secondary data analysis.

Statistical tests

The researcher commenced the analysis with the descriptive upon the conclusion of data collection. Thereafter, statistical tests were performed which are statistical

techniques for examining and evaluating whether the quantitative information produced by a study supported the aim of the study. In this study, the explanations and correlation of the significance and insignificance were done through probability values (p-values). The following tests were done unit root test, correlation matrix, cointegration test, cross-sectional data, and the diagnostic and stability tests were performed to ensure that the proposed linear regression estimates are accurate heteroskedasticity, autocorrelation, and the test of normality. Lastly, the Hausman tests were performed on all the models.

Descriptive statistics

Descriptive statistics is a collection of succinct descriptive coefficients that provide an overview of a specific data set and are indicative of the complete or sample population (Banerjee & Carrion-i-Silvestre, 2024). Descriptive statistics were conducted for all the equations from the data collected and this was done through the Stata software for all the models.

Correlation matrix

A form of statistical analysis to determine the correlation between two variables in a particular set of data (Banerjee & Carrion-i-Silvestre, 2024). The correlation matrix has a statistical value between -1.0 and 1. A robust connection is indicated by values close to 1, a negative correlation is indicated by values near -1, and a neutral correlation is indicated by values near 0. The study employed the correlation matrix to determine the correlation between variables as per the models. Model 1 dependent variable water consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation were tested. Model 2 dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation were tested. Model 3 dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation were tested. Model 4 dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation were tested. Model 5 dependent variable net profit and independent variables investment in renewable

energy, water investment, recycling investment and control variable market capitalisation were tested. Model 6 dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation were tested. Model 7 dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation were tested. Lastly, model 8 dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation were tested.

Multicollinearity test

Multicollinearity occurs when the independent variables under an analysis exhibit a significant correlation with one another (Chavez-Chong, Hardouin & Fermin, 2024). It is important to conduct multicollinearity test in this study because multiple linear regression was employed as there are more than two independent variables used and it indicates collinearity. One of the potential obstacles with panel data is the multicollinearity tests. The Variance Inflation Factor (VIF) assesses the extent to which the variance of the derived regression coefficients differs from instances where predicted variables do not exhibit a linear relationship and A VIF of 10 indicates a high degree of correlation between the variables (Chavez-Chong, Hardouin & Fermin, 2024). Analysis of data with multicollinearity can be challenging since it indicates that variables tested are not independent. Thus, this study tested multicollinearity using VIF.

Panel data analysis

Panel data analysis is a method of grouping quantities acquired and accumulated over consistent time intervals and arranged in a certain sequence (Herwartz, Maxand & Walle, 2023). It is a statistical technique that is used to analyse longitudinal and cross-sectional data. Panel data has the advantage of resulting in revealing correlations between variables. Panel data was chosen for this study because the data was collected from 24 companies for a period of 5 years each. The secondary data was collected from annual integrated reports and sustainability reports of the JSE SRI companies for five (5) years (see Appendix D). The secondary data was entered into a Microsoft Excel spreadsheet and had twelve columns commencing with the column

of company codes followed by the number of years and then by dependent variables namely net profit, asset return, water consumption and energy consumption. Independent variables followed investment in renewable energy, recycling investment, water investment; corporate social investment and BBBEE investment lastly, the control variable market capitalisation. Furthermore, the data was entered into Stata software for the panel data analysis and E-views.

Cross-sectional dependence (CSD)

The study followed Pesaran, Schuermann and Weiner (2004) and Pesaran (2015) to conduct cross-sectional dependence, which investigates the mean correlation between panel units. The main insight of Pesaran *et al.* (2004) is that a transformation of the sum of pairwise correlations between panel units is normally distributed. This test was conducted before the unit tests to determine the systematic residual correlation across the panel's various units for all the models.

Diagnostic tests

The researcher performed panel data diagnostic tests and the steps taken were as follows: Unit root/stationarity tests for testing the relationships between variables. Lastly, the panel data included the Hausman tests, heteroscedasticity and homoscedasticity tests which were used to check variance errors and equal or unequal distributions.

Unit root test

The unit root test determines if a time series variable has a unit root and is non-stationary and if values are discovered to be non-stationary, the unit root test must be used in order to anticipate successful outcomes (Herwartz, Maxand & Walle, 2023). The unit test root was employed in all the models using E-views.

Cointegration test

Cointegration is a statistical approach for modelling long- and short-term interactions to search for commonly observed patterns in multivariate data sets (Banerjee & Carrion-i-Silvestre, 2024). Tests whether, even in the case when there is no or little

linear relationship over the short term, the long-term relationship between two or more time series is stationary. The test was performed for all the models in the study.

Heteroskedasticity test

Heteroskedasticity describes circumstances in which there is an uneven variance in the residuals throughout a range of measured values (Herwartz, Maxand & Walle, 2023). The study used the Modified Wald test. Modified Wald test is a unique technique for assessing heteroscedasticity in panel data and it is predicated on the notion that the variance of the residuals within each group can be used to estimate the variance of the error term. The analysis' conclusions could be erroneous if there was heteroskedasticity and unequal variance in the population used in the regression. The test was performed for all the models in the study where the null hypothesis states that panel data have no heteroscedasticity in panel data and the alternative hypotheses indicate that the data have heteroscedasticity in panel data. It is preferable if the panel has no heteroscedasticity, and the p-value is less than 0.05.

Autocorrelation test

Autocorrelation occurs when a given variable's correlation with itself over several periods (Humta & Şahin, 2024). Wooldridge test for autocorrelation is the test that finds first-order autocorrelation in a panel data model's mistake (Humta & Şahin, 2024). All the equations used the Wooldridge test for autocorrelation. The test was performed for all the models in the study to test for autocorrelation. The null hypothesis states that there is no autocorrelation while the alternative asserts that there is autocorrelation. The null hypothesis is accepted when the p-value is more than 0.05 which is desirable as it shows the non-existence of autocorrelation.

Test of normality

The errors between the observed and predicted values, or the regression's residuals, must follow a normal distribution to be used in multiple linear regression analysis. There are several methods for testing normality, nonetheless, the researcher opts for to use Epanechnikov kernel density estimates, which display the residuals' normal distribution, when using Stata. The test was performed for all the models in the study.

Hausman test

Hausman test was employed to compare an estimator's relevance to that of a substitute estimator. In panel analysis, the Hausman test can be used to distinguish between the fixed effects model and the random effects model (Humta & Şahin, 2024). Since fixed effects (FE) are at least as consistent as random effects (RE) under the alternative hypothesis, random effects (RE) are preferred in this scenario due to their higher efficiency.

Fixed and random effect models

The random effect model assumes that the individual-specific effect is a random variable that is uncorrelated with the explanatory variables of all the same individual's past, present, and future time periods (Balázsi, Baltagi, Mátyás and Pus, 2024). Accordingly, the individual-specific effect is a random variable that is uncorrelated with the explanatory variables (Balázsi, Baltagi, Mátyás and Pus, 2024). Most significantly, the random effect estimator is only used if we are certain that the effect that is specific to each individual is unrelated. Conversely, the fixed effect model assumes that slopes will remain constant, but intercepts will vary depending on the cross-sectional group (Balázsi, Mátyás and Wansbeek, 2024).

Feasible generalised least square regression (FGLS)

The study employed Feasible Generalised Least Squares (FGLS) estimator that control for heteroscedasticity and auto-correlation, respectively, as well as standard error (Humta & Şahin, 2024). Feasible Generalised Least Squares (FGLS) generates a good estimator when the period is more than or equal to the number of cross sections. FGLS is used to improve the efficiency of regression estimates when dealing with heteroscedasticity (unequal variances) or serial correlation in the error terms, essentially giving more weight to observations with smaller variances and providing more accurate results compared to standard OLS regression by accounting for the structure of the error covariance matrix.

The next section describes the second level analysis for research objective 5 of the study.

5.3.6.2. Second level analysis (Qualitative analysis) for research objective 5

Second level analysis of qualitative data used thematic analysis, which is a method of analysis that involves reading through qualitative data, and interpreting and identifying meanings of patterns (Braun & Clarke, 2022). Primary data that are qualitative in nature can be analysed using either deductive or inductive methods (Ayre & McCaffery, 2022). The two analyses differ in that in deductive analysis, the themes, codes, and categories are selected prior to the commencement of data collection, but in inductive analysis, these elements are discovered during data analysis. Inductive analysis is described as the application of particular findings to more general theories and generalisations (Ayre & McCaffery, 2022). Inductively analysed data progresses from specifics to broad themes, and the researcher interprets the significance of the data. Through deductive analysis one moves from the general to the specific. Developing categories to organise or classify the data may start with a theory on an interesting issue (Ayre & McCaffery, 2022). In this study, the primary data analysis was performed deductively since the researcher needed to use a consistent structure to achieve research objective 5.

The commencement of the data analysis was to organise the data to identify the themes. One benefit of thematic analysis is its great flexibility, which allows it to be adjusted to accommodate a variety of study types (Braun & Clarke, 2023). There are six phases of thematic analysis namely, familarisation with the data, coding the data, searching for themes of the data, reviewing the themes, defining and naming the themes as well as writing the report of the data by making conclusions (Braun & Clarke, 2022). Therefore, the researcher followed the thematic phases as follows:

Phase One: Familiarisation with data

Questionnaires were sent to the respondents through emails and responses came through email back to the researcher. Upon receipt of the responses, the researcher familiarised herself with the qualitative data collected by reading it, which helped the researcher to focus on the meanings of the responses from the respondents.

Phase two: Coding the data

Deductive coding was employed in an attempt to generate the initially generated codes. Identifying patterns of the data was done through coding. The codes were grouped together to generate initial themes, which were reviewed to check the central concept organisation for the next phase.

Phase three: Searching for themes of the data

Discovering patterns in data is the first step in searching for themes. Research issues are addressed through themes, which help to achieve the objectives of the research. The researcher therefore knew the themes in advance and looked up the codes that corresponded to them.

Phase four: Reviewing the themes

The themes were reviewed to check if they need any refinement and if they supported the data and to check if there were any themes within the identified themes. The researcher opted to have subthemes, as the themes identified were too broad to fit into a theme.

Phase five: Defining and naming the themes

Themes and subthemes were named and defined for conceptual clarity. The themes for the primary data analysis were as follows:

Theme 1: Improved Resource efficiency and additional environmental investment

Theme 2: Improved Profitability and additional environmental investment

Theme 3: Improved Resource efficiency and additional social investment

Theme 4: Improved Profitability and additional social investment

Phase six: Writing the report of the data

The phase involving writing of the report is regarded as the thematic analysis process' conclusion. This stage gave the researcher access to extensive data that was ready for thorough analysis. A report was written to narrate the analysis.

The justification for using thematic analysis is that objective 5 of the study used the interpretivist paradigm and the qualitative method to interpret responses from respondents, were gathered through questionnaire survey with closed-ended questions.

5.4 RELIABILITY AND VALIDITY

The researcher ensured validity and reliability of the primary data (research questionnaires) by using pilot test, test-retest and Cronbach alpha (Ravinder & Saraswathi, 2020).

The researcher ensured validity and reliability of the secondary data by using the diagnostic tests as mentioned above the unit root/stationarity tests, tests for cointegration, Hausman tests, heteroscedasticity and homoscedasticity tests.

5.5 ETHICAL CONSIDERATIONS

The researcher required ethical clearance from Turfloop Research Ethical Committee (TREC). Secondary data was collected from the annual integrated reports by accessing companies' websites that are in the public domain. As such, the study did not need the researcher to pay licence fees, and the data required and the data presented and analysed in this study does not protected by copyright. Therefore, the researcher did not use the information extracted from the annual integrated reports for personal gain. Professional confidentiality standards will be maintained.

In addition, the researcher required ethical clearance from Turfloop Research Ethical Committee (TREC) as required when primary data is collected.

- Protection of the rights of participants: The researcher obtained permission to study the companies and issued informed consent forms.
- Protection of the rights of the institution: The researcher required ethical clearance from TREC for compliance purposes by applying for ethical

clearance since the collection of data involves interacting with participants of companies to get information.

- Scientific integrity of the research: The researcher shared the results of the study with interested parties.
- No risk: The researcher did not harm or tarnish the name of the participants and companies.
- Anonymity: The researcher ensured that there is a guarantee of anonymity by protecting the privacy of the respondents.
- Confidentiality: The researcher maintained the confidentiality of companies and the respondents as the names of the latter will not be mentioned.
- Permission to study: The researcher requested permission to study from the sampled companies.
- Consent form: Respondents were informed about the aim of the research and what is required from them before the interviews. The researcher gave respondents a form to agree and sign to participate in the study.
- Benefits to the society: This research will benefit society because when companies improve their corporate sustainability, it means they will be effective and make the environment eco-friendly.

5.6 RESEARCH LIMITATIONS

The researcher targeted to use 30 top FTSE/JSE Responsible Investment Index companies but there was no consistency of data from 6 top FTSE/JSE Responsible Investment Index companies therefore the researcher only used 24 top FTSE/JSE Responsible Investment Index companies for secondary data while for primary data the researcher targeted to get 60 responses from 30 top FTSE/JSE Responsible Investment Index companies' CEOs and environmental officers and only got 30 responses from the issued questionnaires. This may not be fully representative to allow for generalisation to the entire JSE listed companies index since the study only focused on top FTSE/JSE Responsible Investment Index companies. Hence, future research may include other JSE indexes aside from the Responsible Investment Index. Furthermore, the research is limited to two main types of analysis, namely, regression analysis (for the quantitative section) and thematic analysis (for the

qualitative section). The researcher opted for only one control variable for the regression analysis. Finally, secondary data is limited to a period of 5 years.

5.7 Research onion

Saunders and Tosey (2013) recommend using research onion to represent the entire research design. The figure below is a research onion, which is a diagrammatic representation of the proposed research design as recommended by Saunders and Tosey (2013).

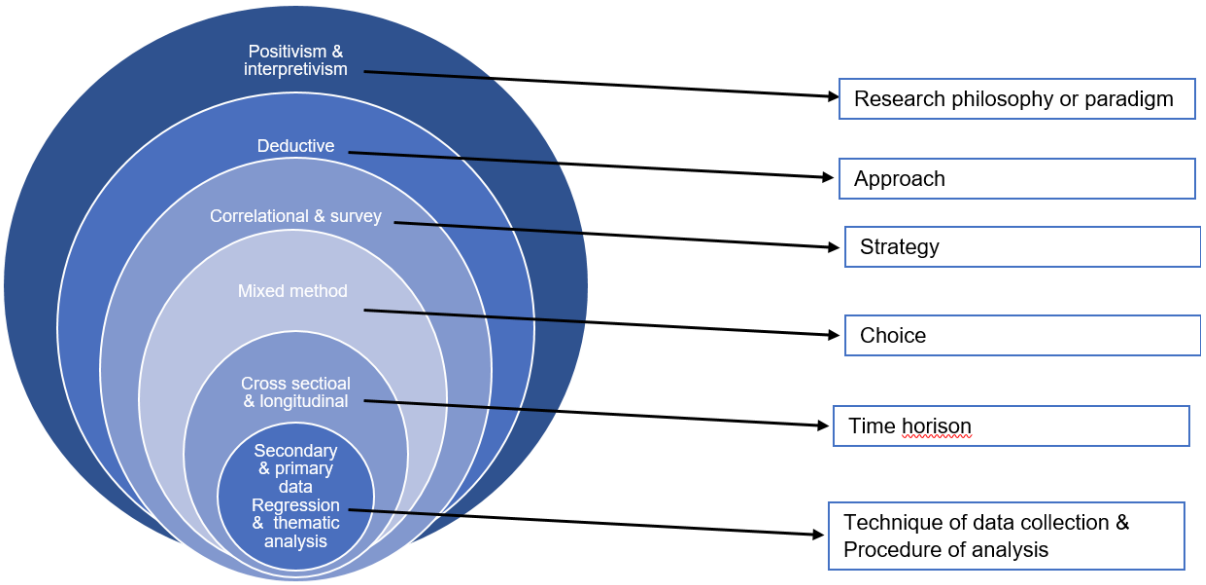

Figure 5.3 Research onion

Source: Researcher

5.8 SUMMARY OF THE CHAPTER

The chapter emphasised the appropriateness of the research paradigm, research design, and research method of the study by responding to the research objectives. Also, the chapter linked the aim of the study, which was to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return) and to develop a framework based on the above relationship to the research methodology.

The research methodology indicated that the study used both quantitative and qualitative data based on research objectives where research objectives 1-4 are for quantitative data and research objective 5 for qualitative data method. This implies that the researcher used a mixed method and the research design for quantitative data is correlational design while for quantitative data a questionnaire survey was used.

CHAPTER 6- QUANTITATIVE DATA ANALYSIS

6.1 INTRODUCTION

The previous chapter describes the research methodology used in this study. It outline the research paradigm, research method, research design, study area, research population, sample sampling method, sample size, data collection, data analysis, reliability and validity, ethical consideration and research limitations used in the study. This chapter discuss the quantitative data analysis of secondary data using the regression statistics based on the research problem and the research objectives of the study. The synopsis of the analysis of quantitative data chapter is; Data management and analysis (Section 6.2), panel data analysis (Section 6.3), statistical models and tests (Section 6.4), study overview (Section 6.5), and chapter summary (Section 6.6).

6.2 Data management and analysis

The study used a panel dataset from 24 FTSE/JSE Responsible Investment Index companies with a scope of 2017 to 2021. One of the issues the study confronted in the analysis is that some variables are strings, which were destringed to numeric data (Cox & Schechter, 2018; Morgan, 2023). The empirical analysis started with an objective: to determine the impact of environmental investment on water consumption. Like many other panel analyses, missing values or data points were an issue that must be treated with caution. The study employed interpolation (or extrapolation) to populate the missing values. The multiple linear regression was performed for the first level analysis (variables for quantitative analysis for objectives 1-4) as follows:

Research objective 1: To determine the relationship between corporate environmental investment and resource efficiency. Research objective 1 has two models (Model 1 and Model 2) as follows:

$$WATECO_{it} = \alpha_i + \beta_1 \,\mathrm{INVIRE}_{it} + \beta_2 \,\mathrm{WATINV}_{it} + \beta_3 \,\mathrm{RECINV}_{it} + \beta_4 \,\mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots..(1)$$

$$ENERCO_{it} = \alpha_i + \beta_1 \,\mathrm{INVIRE}_{it} + \beta_2 \,\mathrm{WATINV}_{it} + \beta_3 \,\mathrm{RECINV}_{it} + \beta_4 \,\mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots..(2)$$

Research objective 2: To analyse the effect of corporate social investment on resource efficiency. Research objective 2 has two models (Model 3 and Model 4) as follows:

$$WATECO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$ENERCO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Research objective 3: To evaluate the impact of corporate environmental investment on profitability. Research objective 3 has two models (Model 5 and Model 6) as follows:

$$NETPRO_{it} = \alpha_i + \beta_1 \, \mathrm{INVIRE}_{it} + \beta_2 \, \mathrm{WATINV}_{it} + \beta_3 \, \mathrm{RECINV}_{it} + \beta_4 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots (5)$$

$$ASERER = \alpha_i + \beta_1 \, \mathrm{INVIRE}_{it} + \beta_2 \, \mathrm{WATINV}_{it} + \beta_3 \, \mathrm{RECINV}_{it} + \beta_4 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots (6)$$

Research objective 4: To analyse the influence of corporate social investment on profitability. Research objective 2 has two models (Model 7 and Model 8) as follows:

$$NETPRO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$ASERER_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where:
NETPRO=Net profit (Dependent variable)
ASERER=Asset return (Dependent variable)
WATECO=Water consumption (Dependent variable)
ENERCO= Energy consumption (Dependent variable)
INVIRE=Investment in renewable energy (Independent variable)
WATINV=Water investment (Independent variable)
RECINV=Recycling investment (Independent variable)
CSI=Corporate Social Investment (Independent variable)
BBINV=BBBEE investment (Independent variable)
MKTCAP=Market capitalisation (Control variable)
α =intercept
β =Beta representing coefficiency
ε = error
$_i$=represents the company
$_t$=represents the year

The aforementioned models were analysed with all the statistical tests separately.

6.3 Panel data analysis

The analysis of the secondary data obtained for this study was done using panel data analysis. The study's raw data was taken from the annual integrated and sustainability

reports of the chosen companies (see Appendix D). To analyse the relationship between corporate sustainability investment on resource efficiency and profitability, the data was inputted into a Microsoft Excel spreadsheet and applied to Stata software and E-views. The dependent variables of this study are net profit, asset return, water consumption and energy consumption, the independent variables are investment in renewable energy, water investment, recycling investment, corporate social investment, BBBEE investment and the control is market capitalisation, which was used to justify the study findings.

Statistical tests are discussed in the following section.

6.4 Statistical tests

To confirm that the suggested regression model estimates are correct, the following tests were conducted out: autocorrelation, heteroskedasticity, unit root test, correlation matrix, cointegration test, cross-sectional data, and stability and diagnostic tests. Lastly, each model performed the Hausman tests.

The data is described in the section that follows.

6.4.1 Research objective 1 (Model 1): To determine the relationship between corporate environmental investment and resource efficiency.

This section presents the results of model 1 and 2 which are based on research objective 1.

Model 1:

$$WATECO_{it} = \alpha_i + \beta_1 \, \mathrm{INVIRE}_{it} + \beta_2 \, \mathrm{WATINV}_{it} + \beta_3 \, \mathrm{RECINV}_{it} + \beta_4 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots..(1)$$

6.4.1.1 Descriptive Statistics for model 1

Table 6.1 presents descriptive statistics of key variables for objective one in this current study, which are dependent variable water consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation.

The descriptive statistics table 6.1 shows the variables mentioned above along with

the number of observations, mean, standard deviation, minimum and maximum values.

The study has a strongly balanced panel, Table 6.1 indicates the descriptive statistics for model 1 where the observations are 120, and all the variables are continuous. Water consumption (dependent variable) has an average of 12.21, a minimum of 7.00, and a maximum of 18.41. The renewable energy investment (independent variable) has an average of 9.94 with a minimum value of 0.69 and a maximum of 16.40. The mean water investment (independent variable) is 11.76, the minimum value is 10.90, and the maximum value is 12.79. Recycling investment (independent variable) has an average value of 11.06, the minimum is 10.53, and the maximum is 11.40. The market capitalisation (control variable) is 18.08, the minimum is 17.83, and the maximum is 18.50.

Table 6.1 Descriptive Statistics for Model 1

Variable	Obs.	Mean	Std. Dev.	Min	Max
Water consumption	120	12.206	2.626	6.999	18.405
Investment in Renewable energy	120	9.938	3.135	0.693	16.402
Water investment	120	11.755	0.61	10.898	12.792
Recycling investment	120	11.056	0.3	10.525	11.396
Market capitalisation	120	18.082	0.233	17.827	18.503

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses the correlation analysis for model 1.

6.4.1.2 Correlations analysis for model 1

The correlation analysis of water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is presented in Table 6.2. The current study suggests that water consumption and renewable energy investment (r = 0.25) are positively correlated. Water consumption (r = 0.012) is likely to positively correlate with recycling investment. While water consumption and water investment (r = -0.027) are negatively correlated. Additionally, water consumption and market capitalisation (r = -0.013) are negatively correlated. The next paragraph discusses the cross-sectional dependence for model 1.

Table 6.2 Matrix of correlations for model 1

Variables	(1)	(2)	(3)	(4)	(5)
(1) Water consumption	1.000				
(2) Investment in Renewable energy	0.247	1.000			
(3) Water investment	-0.027	-0.012	1.000		
(4) Recycling investment	0.012	0.009	-0.588	1.000	
(5) Market capitalisation	-0.013	-0.021	0.045	0.225	1.000

Source: Stata outcomes

The next paragraph discusses Multicollinearity test for model 1.

6.4.1.2.1 Multicollinearity test for model 1

Table 6.2.1 presents variance inflationary factors (VIF) analysis. When it comes to the variance inflationary factors (VIF), the general guideline is that the VIF cannot be greater than 10. If not, there is a chance that the model will exhibit collinearity. The VIF mean is 1.350 indicating that it is unlikely that multicollinearity in the estimation will affect the analysis since it is less than 10.

Table 6.2.1 Variance inflation factor for Model 1

Variables	VIF	1/VIF
Recycling investment	1.690	0.591
Water investment	1.610	0.622
Market capitalisation	1.110	0.901
Investment in Renewable energy	1.000	0.999
	1.350	

Source: Stata outcomes

The next paragraph discusses cross-sectional dependence for model 1.

6.4.1.4 Cross-sectional dependence (CSD) for model 1

The current study investigated whether there is cross-sectional dependence on water consumption as a water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation (see Table 6.3). Table 6.3 presents the Cross-sectional dependence (CSD) for model 1, which has a null hypothesis stating that there is no cross-sectional dependence pitted against an alternative stating that there

is cross-sectional dependence. The null hypothesis is accepted if the probability value takes a value of 0.05 or higher and is rejected if the probability is less than 0.05. Cross-sectional dependence results were computed on Cross-section SUR. This is a corrective measure taken in cases where it is found that data sets in the model are cross-sectionally dependent on one another. Based on the results of the table above, it is indicated that the null hypothesis is accepted.

Table 6.3 Cross-Sectional dependence test results for model 1

Item description	Test name	Statistic	P-value	Conclusion
Cross-sectional dependence- **SUR**:	- Breusch-Pagan LM - Pesaran scaled LM - Pesaran CD	1.64756 -1.867672 0.692344	0.9984 0.0618 0.4887	Accept null Accept null Accept null

Source: Author's calculations using E-views version 12

The next paragraph discusses the unit root test.

6.4.1.5 Unit root test

Unit root test results are shown in Table 6.4 for each variable in the eight models developed from objective 1 to 4 for this study. Table 6.4 present unit root test results for all the variables across eight models estimated in this study. Two unit root tests are used namely, Fisher augmented Dickey-Fuller (fisher ADF) and I, m Pesaran (IPS) are used to assess the stationarity of the variables and they all have a null hypothesis of non-stationarity pitched against the alternative to the null hypothesis, which is stationarity. This implies that for stationarity of the variable, the computed probability value should be 0.05 or less. Reading from Table 6.4, it is established that all variables contain a unit root or are non-stationary at level because the calculated probability is greater than the critical value of 0.05. However, after 1st differencing, all the variables become stationary at 1% level of significance. Meaning, that all eight estimated models integrate at order I(1).

Table 6.4 Abridged unit-root tests

		Fisher ADF			IPS	
Variable	***Order of integration***	***Individual intercept***	***Individual trend & intercept***	***None***	***Individual intercept***	***Individual intercept & trend***
Water Consumption	Level	0.1720	0.5635	0.9807	0.1129	0.5829
Water Consumption	1ST difference	0.0000	0.0001	0.0000	0.0000	0.0000
Energy consumption	Level	0.2231	0.2026	1.0000	0.2118	0.1556
Energy consumption	1st difference	0.2526	0.0000	0.0000	0.0000	0.0000
Net profit	Level	0.1377	0.2421	0.9886	0.1568	0.8824
Net Profit	1st difference	0.0003	0.0053	0.0000	0.0001	0.0022
Asset returns	Level	0.9396	0.7274	1.0000	0.8683	0.8027
Asset returns	1st difference	0.0000	0.0000	0.0000	0.0000	0.0000
Renewable energy investment	Level	0.5891	0.8624	0.0957	0.1874	0.07258
Renewable energy investment	1st difference	0.0000	0.0006	0.0018	0.0000	0.0000
Recycling Investment	Level	0.6870	0.5687	0.9684	0.2861	0.3548
Recycling Investment	1st difference	0.001	0.0000	0.00015	0.0000	0.0000
Water Investment	Level	0.0560	0.8354	0.5840	0.0350	0.7951
Water Investment	1st difference	0.0000	0.0000	0.0000	0.0000	0.0000
Corporate Social Investment	Level	0.9831	0.6348	0.4391	0.1872	0.27810
Corporate Social Investment	1st difference	0.0000	0.0000	0.0000	0.0000	0.0000
BBBEE Investment	Level	0.6354	0.5842	0.4582	0.1457	0.87910
BBBEE Investment	1ST difference	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Authors computation using E-views 12

In the next paragraph, the study presents a cointegration test for model 1.

6.4.1.6 Cointegration estimations for model 1

The current study performed cointegration estimation using variable series that are stationary at the level, which means they are integrated of order zero, I(0). The study assumed that water consumption as a dependent variable and independent variables

investment in renewable energy, water investment, recycling investment and control variable market capitalisation are correlated, hence, the combination of water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is likely to be integrated. Cointegration estimation indicates whether there is a long-run relationship between water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.5 presents the results of Kao's (1999), and Westerlund's (2005) cointegration tests, which show that Dickey–Fuller's statistics are statistically significant at a 1% level. The null hypothesis states that there is no cointegration and the alternative states that there is cointegration. The findings reject the null hypothesis that there is no cointegration, which implies that there is a long-term relationship between water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment as well as the control variable market capitalisation.

Table 6.5 Cointegration Test for model 1

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	1.986**	
Dickey-Fuller t	-8.134***	
Augmented Dickey-Fuller t	-3.838***	
Unadjusted modified Dickey Fuller t	-1.254	
Unadjusted Dickey-Fuller t	-11.334***	
Variance ratio		168.087***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next subsection presents the diagnostic tests for model 1.

6.4.1.7 Heteroskedasticity for model 1

The results of the heteroskedasticity of model 1 are based on water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.6 presents the heteroscedasticity test for model 1, which has a null hypothesis of no heteroscedasticity in the panel data pitted against an alternative of

heteroscedasticity in the panel data. The null hypothesis of no heteroskedasticity in the panel data is rejected if the calculated probability is less than or equal to the critical value of 0.05. Based on the results the null hypothesis is rejected given that the p-value is less than the critical value of 0.05. Consequently, even though the tests were conducted after adding a control variable to a regression model, there is undesired heteroscedasticity in the panel data. This suggests that the study's results are skewed and unreliable unless the heteroscedasticity issue is resolved.

Table 6.6 Modified Wald test for groupwise heteroskedasticity for model 1

	Coef.
Chi-square test value	3.6e+05
P-value	0.0000

Source: Stata outcomes

The next paragraph presents the autocorrelation test for model 1.

6.4.1.8 Autocorrelation test for model 1

The results for autocorrelation model 1 are based on water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.7 presents the autocorrelation test in model 1. The null hypothesis states that there is no autocorrelation while the alternative states that there is autocorrelation. The null hypothesis is accepted when the p-value is more than 0.05. Therefore, the null hypothesis is accepted given that the computed probability value is 0.0805 which is insignificant. Hence, the conclusion is that there is no autocorrelation amongst the variables in model 1.

Table 6.7 Wooldridge test for autocorrelation in panel data for model 1

	Coef.
F (1,23)	3.342
Prob > F	0.0805

Source: Stata outcomes

In the next paragraph, test of normality for model 1 is discussed.

6.4.1.9 Test of Normality for model 1

Figure 6.1 denotes the test and results of normality using the Epanechnikov kernel density estimates for model 1. The dataset kernel density is smooth and symmetrical, which implies that they are normally distributed. The Epanechnikov bandwidth is relatively low, at 0.82.

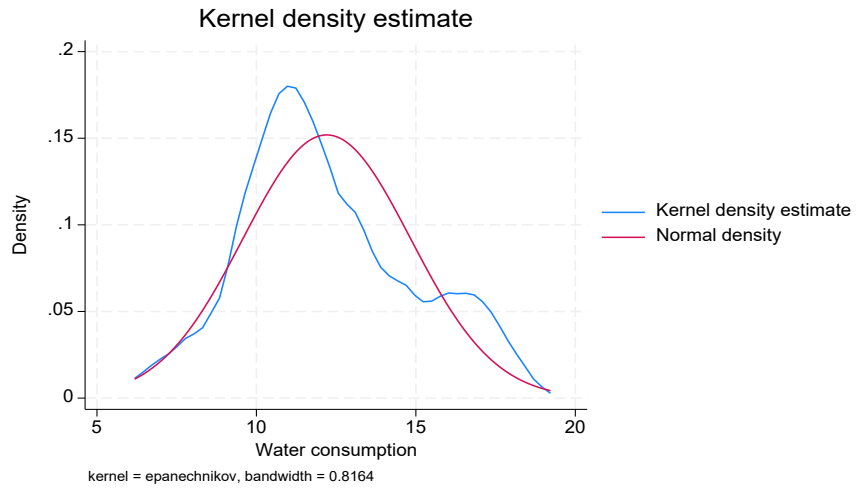

Figure 6.1: Kernel density of model 1

Source: Stata outcomes

The next paragraph discusses the Hausman test for model 1.

6.4.1.10 Hausman test for model 1

Table 6.8 presents the abridged results of the Hausman test for model 1. The null hypothesis suggests that the random effect is suitable while the alternative suggests that the fixed effect is suitable. Results in Table 6.8 show that the computed p-value is 0.299 which is greater than the critical value of 0.05. Since the p-value is higher than the significant level, so random effect estimation is accepted as the best estimator while the fixed effect estimation is rejected.

Table 6.8 Hausman (1978) specification test for model 1

	Coef.
Chi-square test value	4.887
P-value	0.299

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 1.

6.4.1.11 Overview of the Regression Assumption for model 1

Except for heteroscedasticity, which is present in model 1, the other regression assumptions i.e. normality and autocorrelation are not violated. Even though the random effect model is a better model than the fixed effect model, the heteroscedasticity issue might have affected the estimating coefficient. Therefore, the study employs feasible generalised least squares (FGLS) that control for heteroscedasticity, auto-correlation, and standard error (Hansen 2007). In contrast to the random effect model Hansen (2007) further opines that feasible generalised least square produce stronger and efficient tests by taking serial correlation into account. The results of the OLS robust, fixed and random effects are shown in the next paragraph.

Results of ordinary least squares random effect (RE) and fixed effect (FE) for model 1

Table 6.8.1 (OLS), FE and RE for model 1 indicates the results of the impact of independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation on dependent water consumption using random effect (RE) and fixed effect (FE) by showing the relationships between the dependent variable and the independent variables. Column (1) presents the estimation of OLS robust results. This shows that investment in renewable energy has an insignificant positive relationship with water consumption. While water investment and market capitalisation have an insignificant negative relationship with water consumption. Recycling investment have a significant negative relationship with water consumption.

Column (2) presents the results of fixed effect estimator. This shows that investment in renewable energy has an insignificant negative relationship with water consumption. Water investment and market capitalisation have an insignificant negative impact on water consumption. Moreover, recycling investment has a significant positive impact on water consumption.

Column (3) indicates results from random effect estimator and investment in renewable energy has an insignificant negative impact on water consumption. While water investment and market capitalisation have an insignificant negative impact on water consumption. Recycling investment has a significant positive impact on water consumption.

Table 6.8.1 Results for OLS robust, FE and RE for model 1

Variables	(1) OLS robust Water consumption	t	(2) Fixed effect Water consumption	(3) random effect Water consumption
Investment in Renewable energy	0.206*	3.42	-0.136*	-0.0721*
	(0.0604)		(0.0771)	(0.0714)
Water investment	-0.109*	-0.22	-0.118*	-0.116*
	(0.491)		(0.171)	(0.173)
Recycling investment	-0.0302**	-0.03	0.00969***	0.00220***
	(1.015)		(0.357)	(0.362)
Market capitalisation	-0.0694*	-0.07	-0.176*	-0.156*
	(1.064)		(0.373)	(0.378)
Constant	13.03	0.63	18.03**	17.09**
	(20.72)		(7.303)	(7.406)
Observations	120		120	120
R-squared	0.062		0.042	
Number of Code			24	24
sigma_u			2.692	2.450
sigma_e			0.897	0.897
rho			0.900	0.882

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; variables are logarithms

Source: Stata outcomes

The next paragraph discusses the interpretation for model 1 feasible least squares results.

6.4.1.12 Interpretation for model 1 feasible generalised least squares and panel corrected standard error results

Table 6.9 presents the results for feasible generalised least squares for model 1. These regressions were employed since there was the existence of heteroscedasticity in the panel data which suggests that the study's results are skewed and unreliable unless the heteroscedasticity issue is resolved. The feasible generalised least squares control for heteroscedasticity, serial correlation and cointegration to accomplish the validity of the results (Adeleye, Akam, Inuwa, James & Basila, 2023). While panel corrected standard error controls for the existence of cross-sectional dependence, robustness check and observation of the consistency of results (Adeleye, Bengana, Boukhelkhal, Shafiq & Abdulkareem, 2022; Alferez, Bagtasos, Chio, Payot, Laygan, Abing, Capulong & Teves, 2024). Therefore, the study employed FGLS to discuss the results of the study. Table 6.9 column (1) presents the estimation based on FGLS and revealed an impact of water consumption as a dependent variable and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. The results indicate that investment in renewable energy has an insignificant positive impact on water consumption. While water investment and market capitalisation have insignificant negative impacts on water consumption. Recycling investment has significant negative impacts on water consumption.

In column (2), panel corrected standard error estimator. The results indicate that investment in renewable energy has an insignificant positive impact on water consumption. While water investment and market capitalisation have insignificant negative impacts on water consumption. Recycling investment has significant negative impacts on water consumption.

Table 6.9 Feasible generalised least squares and panel corrected standard error for model 1

	(1)		(2)
	Main results		
	FGLS		PCSE
Variables	Water consumption	Z	Water consumption
Investment in Renewable energy	0.206*	2.78	0.206*
	(0.0741)		(0.0350)
Water investment	-0.109*	-0.23	-0.109*
	(0.483)		(0.175)
Recycling investment	-0.0302**	-0.03	-0.0302**
	(1.007)		(0.367)
Market capitalisation	-0.0694*	-0.07	-0.0694*
	(1.051)		(0.384)
Constant	13.03	0.64	13.03*
	(20.40)		(7.449)
Observations	120		120
R-squared			0.062
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and the Panel Corrected Standard Error (PCSE

Source: Stata outcomes

The next paragraph discusses the results for research objective 1 model 2.

6.4.2 Research objective 1 (Model 2): To determine the relationship between corporate environmental investment and resource efficiency

Model 2

$$ENERCO_{it} = \alpha_i + \beta_1 \,\mathrm{INVIRE}_{it} + \beta_2 \,\mathrm{WATINV}_{it} + \beta_3 \,\mathrm{RECINV}_{it} + \beta_4 \,\mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots..(2)$$

6.4.2.1 Descriptive Statistics for model 2

Table 6.10 presents descriptive statistics of key variables for objective one in this current study, which are dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation.

The descriptive statistics for model 2 are displayed in table 6.10, the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. The study has a strongly balanced panel, the

observations are 96 and all the variables are continuous. Energy consumption has an average of -0.023, the minimum is -7.42 and the maximum is 3.201. Renewable energy investment has an average of 0.044 with a minimum value of -8.72 and a maximum of 3.797. The mean of water investment is -0.17, with a minimum value of -1.097 and a maximum value is 1.213. Recycling investment has an average value of -0.01, the minimum is -0.539 and the maximum value is 11.40. The market capitalisation is 18.08, the minimum is 17.83 and the maximum is 0.87. The energy consumption has an average of 0.033, with a minimum value is -0.68 and a maximum value is 0.402.

Table 6.10 Descriptive Statistics for model 2

Variables	Obs.	Mean	Std. Dev.	Min	Max
Energy consumption	96	-0.023	1.127	-7.423	3.201
Investment in Renewable energy	96	0.044	1.528	-8.718	3.797
Water investment	96	-0.17	0.927	-1.097	1.213
Recycling investment	96	-0.01	0.533	-0.539	0.871
Market capitalisation	96	0.033	0.42	-0.676	0.402

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses the correlation analysis for model 2.

6.4.2.2 Correlations analysis for model 2

The correlation analysis of dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is presented in Table 11. The current study suggests that energy consumption and renewable energy investment (r = 0.023) are positively correlated. Energy consumption (r = 0.054) is likely to have a positive correlation with recycling investment. While energy consumption and water investment (r = -0.22) are negatively correlated. Also, energy consumption and market capitalisation (r = -0.028) are negatively correlated.

Table 6.11 Matrix of correlations for model 2

Variables	(1)	(2)	(3)	(4)	(5)
(1) Energy consumption	1.000				
(2) Investment in Renewable energy	0.023	1.000			
(3) Water investment	0.054	0.034	1.000		
(4) Recycling investment	-0.216	-0.012	-0.717	1.000	

(5) Market capitalisation	-0.028	-0.086	-0.316	0.319	1.000

Source: Stata outcomes

In the next paragraph, multicollinearity test for model 2 is discussed.

6.4.2.2.1 Multicollinearity test

Table 6.11.1 presents a variance inflationary factors (VIF) analysis. According to standard guidelines, the variance inflationary factors (VIF) cannot be higher than 10. Otherwise, the model can show signs of collinearity. The data does not exhibit multicollinearity, as indicated by the mean VIF of 1.590, which is less than 10.

Table 6.11.1 Variance inflationary factor for model 2

	VIF	1/VIF
Recycling investment	2.100	0.475
Water investment	2.100	0.477
Investment in Renewable energy	1.140	0.876
Market capitalisation	1.010	0.992
Mean VIF	1.590	

Source: Stata outcomes

In the next paragraph, cross-sectional dependence analysis for model 2 is discussed.

6.4.2.3 Cross-sectional dependence (CSD) for model 2

The current study investigated whether there exist cross-sectional dependence in dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation the model in Table 6.12. A null hypothesis stating that there is no cross-sectional dependence is presented alongside the cross-section dependence results in Table 6.12. If the probability value is less than 0.05, the null hypothesis is rejected; otherwise, it is accepted if the probability value is 0.05 or higher. The results shown on the Table support the acceptance of the hypothesis that there is no cross-sectional dependence.

Table 6.12 Cross-sectional dependence (CSD) for model 2

Item description	Test name	Statistic	P-value	Conclusion	Item description

Cross-sectional dependence	- Breusch-Pagan LM - Pesaran scaled LM Pesaran CD	13.19161 0.713666 0.282812	0.2132 0.4754 0.7773	Accept Null Accept Null Accept Null	Cross-sectional dependence

Source: Author's calculations using E-views version 12

The next paragraph presents the cointegration test for model 2.

6.4.3.4 Cointegration estimations for model 2

The present research used variable series integrated of order one, I(1), that are stationary at the level for cointegration estimation. The study assumed that energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation are correlated, hence, the combination of energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is likely to be integrated. Cointegration estimation indicates whether there is a long-run relationship between energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Results shown in Kao's (1999) cointegration tests are that in Table 6.13, demonstrating the statistical significance of Dickey-Fuller's statistics at the 1% level. There is cointegration, according to the alternative hypothesis, and there is not, according to the null hypothesis. The findings reject the null hypothesis that there is no cointegration, which implies that there is a long-term relationship between energy consumption and investment in renewable energy as well as the control variables.

Table 6.13 Cointegration Test for model 2

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	.	
Dickey-Fuller t	.	
Augmented Dickey-Fuller t	.	
Unadjusted modified Dickey Fuller t	0.3133	
Unadjusted Dickey-Fuller t	-10.726***	
Variance ratio		188.495***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next paragraph presents the diagnostic tests for model 2.

6.4.2.5 Test for heteroskedasticity for model 2

The results for test for heteroskedasticity for model 2 are based on dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.14 provides the model 2 heteroscedasticity test, which sets the alternative of heteroscedasticity in the panel data against the null hypothesis of no heteroscedasticity in the panel data. If the estimated probability is less than or equal to the crucial value of 0.05, the null hypothesis that there is no heteroskedasticity in the panel data is rejected. Since the p-value is less than the crucial value of 0.05, the null hypothesis is rejected that there is no heteroscedasticity in the panel data in model 2. Hence, there is a presence of heteroskedasticity in the panel data in model 2 following the results. Thus, there is undesirable heteroscedasticity in the panel data despite the fact that the tests were carried out after a control variable was added to a regression model. This implies that until the heteroscedasticity problem is fixed, the study's results are inaccurate and untrustworthy.

Table 6.14 Modified Wald test for groupwise heteroskedasticity for model 2

	Coef.
Chi-square test value	7586.72
P-value	0.0000

Source: Stata outcomes

The next subsection discusses the autocorrelation test for model 2.

6.4.2.6 Autocorrelation test for model 2

The results for the autocorrelation test for model 2 are based on dependent variable energy consumption and independent variables investment in renewable energy, water investment, recycling investment, and control variable market capitalisation. Table 6.15 shows model 2's autocorrelation test. There is autocorrelation, according to the alternative hypothesis, whereas the null hypothesis claims that there is none.

When the p-value is greater than 0.05, the null hypothesis is rejected. Model 2 exhibits autocorrelation, as indicated by the computed p-value of 0.0012.

Table 6.15 Wooldridge test for autocorrelation in panel data for model 2

	Coef.
F (1,23)	13.535
Prob > F	0.0012

Source: Stata outcomes

The next section discusses the test of normality for model 2.

6.4.2.7 Test of Normality

Figures 6.2 presents the test of normality using the Epanechnikov kernel density estimates of model 2. It is implied that data is normally distributed by the smooth and symmetric kernel density of the dataset. At 0.86, the Epanechnikov bandwidth is comparatively small.

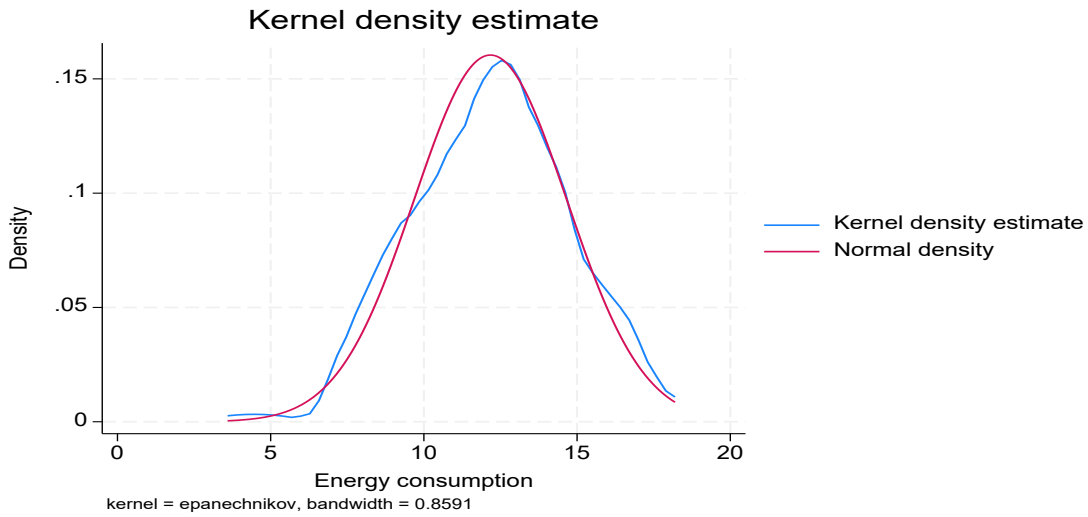

Figure 6.2: Kernel density of model 2

Source: Stata outcomes

The next section discusses the Hausman test for model 2.

6.4.2.8 Hausman test for model 2

Table 6.16 presents the abridged results of the Hausman test for model 2. The null hypothesis proposes that the random effect is suitable while the alternative proposes that the fixed effect is suitable. The computed p-value, as indicated by the results in Table 6.16, is 1, which is higher than the crucial value of 0.05, the p-value is higher than the significant level, so random effect estimation is accepted and fixed effect estimator is rejected.

Table 6.16 Hausman (1978) specification test for model 2

	Coef.
Chi-square test value	0.029
P-value	1

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 2.

6.4.2.9 Overview of the Regression Assumption for Model 2

The other regression assumptions such as normality and autocorrelation, are not broken, except heteroscedasticity, which is present in model 2. The estimating coefficient may have been impacted by the heteroscedasticity problem, even though the random effect model is superior to the fixed effect model. To account for heteroscedasticity, auto-correlation, and standard error, the study uses practicable generalised least squares (FGLS) (Hansen, 2007). Hansen (2007) goes on to say that by accounting for serial correlation, feasible generalised least squares generate more powerful and effective tests than the random effect model.

Table 6.16.1 column (1) presents the results OLS robust estimation. The results show that investment in renewable energy has a significant positive relationship with water consumption. Water investment and recycling investment have an insignificant negative impact on energy consumption and market capitalisation have a significant positive impact on energy consumption.

Column (2) indicates the results of random effect estimator. The results show that investment in renewable energy has a significant positive relationship with water

consumption. Water investment and recycling investment have an insignificant negative impact on energy consumption and market capitalisation have a significant positive impact on energy consumption.

Column (3) displays the results of fixed effect estimator. The results show that investment in renewable energy has a significant positive relationship with water consumption. Water investment and recycling investment have an insignificant negative impact on energy consumption and market capitalisation have a significant positive impact on energy consumption.

Table 6.16.1 Results for OLS robust, random effect and fixed effect for model 2

Variables	(1) OLS robust Energy consumption	(2) Random effect Energy consumption	(3) Fixed effect Energy consumption
Investment in Renewable energy	0.0204**	0.0127**	0.0204**
	(0.0354)	(0.0874)	(0.0749)
Water investment	-0.249*	-0.248*	-0.249*
	(0.123)	(0.190)	(0.178)
Recycling investment	-0.784*	-0.783*	-0.784*
	(0.353)	(0.330)	(0.310)
Market capitalisation	0.0767*	0.0743*	0.0767*
	(0.268)	(0.309)	(0.290)
Constant	-0.0763	-0.0758	-0.0763
	(0.119)	(0.126)	(0.118)
Observations	96	96	96
R-squared	0.069	0.080	
Number of Code		24	24
sigma_u		0.431	0
sigma_e		1.184	1.184
Rho		0.117	0

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next paragraph discusses the interpretation of FGLS and PCSE for model 2.

6.4.2.10 Interpretation for model 2 FGLS and PCSE results

The results for model 2's FGLS and PCSE are shown in Table 6.17. Due to the panel data's heteroscedasticity, which indicates that the study's findings are biased and untrustworthy unless the heteroscedasticity problem is fixed, these regressions were used. To ensure the validity of the findings, the feasible generalised least squares

method accounts for cointegration, serial correlation, and heteroscedasticity (Adeleye *et al.,* 2023). The presence of cross-sectional dependence is checked for by panel corrected standard error, and the consistency of the results is observed (Adeleye *et al.,* 2022; Alferez, 2024). Table 6.17 column (1) presents the results of feasible generalised least squares. They shows that investment in renewable energy has a significant positive impact on energy consumption while water investment and market capitalisation have an insignificant negative impact on energy consumption. However, recycling investment has a significant positive impact on energy consumption.

Column (2) presents the panel corrected standard error estimator. The results show that investment in renewable energy has a significant positive impact on energy consumption. While water investment, recycling investment and market capitalisation have an insignificant positive impact on energy consumption.

Table 6.17 feasible generalised least squares and the panel corrected standard error for model 2

	(1)		(2)
	Main results		
Variables	FGLS Energy consumption	z	PCSE Energy consumption
Investment in Renewable energy	0.0204	0.28	0.0204
	(0.0729)		(0.0775)
Water investment	-0.249	-1.43	-0.249***
	(0.173)		(0.00467)
Recycling investment	-0.784***	-2.60	-0.784***
	(0.302)		(0.00941)
Market capitalisation	0.0767	-0.27	0.0767***
	(0.283)		(0.0249)
Constant	-0.0763	0.66	-0.0763***
	(0.115)		(0.00509)
Observations	96		96
R-squared			0.069
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and the Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next paragraph discusses the results for research objective 2 model 3.

6.4.3 Research objective 2 (Model 3): To analyse the effect of corporate social investment on resource efficiency

Model 3

$$WATECO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

6.4.3.1 Descriptive Statistics for model 3

Table 6.18 presents descriptive statistics of key variables for objective one in this current study which are dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

The descriptive statistics Table 6.18 indicates the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. In this model 3, water investment is the outcome variable with an average of 12.21, the minimum is 6.99 and the maximum is 18.41. The variables were log (logarithm) and ranges between 1 and 2 digits. Corporate Social Investment has a mean of 11.34, a minimum value of 3.09 and maximum value of 14.79. The BBBEE investment has an average of 10.71 with a minimum value of 7.65 and a maximum value is 18.75. Market capitalisation has an average of 18.08, minimum is 17.83 and the maximum is 0.87.

Table 6.18 Descriptive Statistics for model 3

Variable	Obs	Mean	Std. Dev.	Min	Max
Water consumption	120	12.206	2.626	6.999	18.405
Corporate Social Investment	120	11.338	2.006	3.091	14.785
BBBEE investment	119	10.707	2.478	7.65	18.75
Market capitalisation	120	18.082	.233	17.827	18.503

Note: All variables are log (logarithm)

Source: Stata outcomes

In the next paragraph, correlation analysis for model 3 is discussed.

6.4.3.2 Correlations analysis for model 3

The correlation analysis of dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market

capitalisation are presented in Table 6.19. The correlation suggested that Water investment and Corporate Social Investment (r = 0.16) are positively correlated. Water investment and BBBEE investment are likely to be positively correlation (r = 0.23). Whereas water investment and market capitalisation (r = -0.028) are negatively correlated.

Table 6.19 Matrix of correlations for model 3

Variables	(1)	(2)	(3)	(4)
(1) Water investment	1.000			
(2) Corporate Social Investment	0.158	1.000		
(3) BBBEE investment	0.230	0.431	1.000	
(4) Market capitalisation	-0.017	-0.022	0.089	1.000

Source: Stata outcomes

The next paragraph discusses the multicollinearity test for model 3.

6.4.3.2.1 Multicollinearity test for model 3

Table 19.1 presents variance inflationary factors (VIF) analysis. The basic rule is that the variance inflationary factors (VIF) cannot be more than 10. Otherwise, the model can show signs of collinearity. Given that the mean VIF is 1.160, which is less than 10, multicollinearity is absent from the data.

Table 6.19.1 Variance invariance factor for model 3

Variables	VIF	1/VIF
BBBEE investment	1.240	0.805
Corporate Social Investment	1.230	0.811
Market capitalisation	1.010	0.988
Mean VIF	1.160	

Source: Stata outcomes

The next paragraph presents the results of cross-sectional dependence for model 3.

6.4.3.3 Cross-sectional dependence (CSD) for model 3

The current study investigated whether there is presence of Cross-sectional dependence (CSD) for dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market

capitalisation for model 3. Table 6.20 displays the cross-section dependence results along with a null hypothesis indicating that there is no cross-sectional dependence. The null hypothesis is accepted if the probability value is 0.05 or higher, but it is rejected if it is less than 0.05. The findings shown in the Table lend credence to the rejection of the cross-sectional dependence theory.

Table 6.20 cross sectional dependence for model 3

Item description	Test name	Statistic	P-value	Conclusion	Item description
Cross-sectional dependence	- Breusch-Pagan LM - Pesaran scaled LM Pesaran CD	15.14924 1.151406 -0.241518	0.1267 0.296 0.8092	Accept null Accept null Accept null	Cross-sectional dependence

Source: Author's calculations using E-views version 12

The next section discusses the cointegration estimations for model 3.

6.4.3.4 Cointegration estimations for model 3

Using variable series that are integrated of order one, or I(1), and stationary at the level, the current study carried out cointegration estimation. Cointegration estimation indicates whether there is a long-run relationship between dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Dickey-Fuller's statistics are statistically significant at the 1% level, according to Table 6.21's results of Kao's (1999) cointegration tests. There is no cointegration, according to the null hypothesis, and cointegration, according to the alternative. The findings reject the null hypothesis that there is no cointegration, which implies that there is a long-term relationship between water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. The study assumed that water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation are likely to be integrated. Hence, water consumption is likely to increase corporate social investment, BBBEE investment in the long run.

Table 6.21 Cointegration Test for model 3

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	1.100	
Dickey-Fuller t	-9.426***	
Augmented Dickey-Fuller t	-4.977***	
Unadjusted modified Dickey Fuller t	-1.1742	
Unadjusted Dickey-Fuller t	-11.166***	
Variance ratio		9.9682***

*, **, *** implies series stationary significant level at 10%, 5%, 1%, respectively

Source: Stata outcomes

The next paragraph discusses the diagnostic tests for model 3.

6.4.3.5 Heteroskedasticity test for model 3

Heteroskedasticity test for model 3 results are based on dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.22 presents the heteroscedasticity test for model 3, which pits the possibility of heteroscedasticity in the panel data against the null hypothesis that there is no heteroscedasticity in the data. The null hypothesis indicated that there is no heteroskedasticity in the panel data and is rejected if the estimated probability is less than or equal to the critical value of 0.05. The null hypothesis, according to which there is no heteroscedasticity in the panel data in model 3, is rejected because the p-value is less than the critical value of 0.05. We reject the null hypothesis that there is no heteroscedasticity in the model 3. Hence, there is a presence of heteroskedasticity in panel data in model 3, which could be responsible for the insignificant in the results.

Table 6.22 Modified Wald test for groupwise heteroskedasticity for model 3

	Coef.
Chi-square test value	2.1e+06
P-value	0.0000

Source: Stata outcomes

The next section discusses the autocorrelation test for model 3.

6.4.3.6 Autocorrelation test for model 3

The results for autocorrelation test for model 3 are based on the dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation for model 3. Table 6.23 demonstrates model 3's autocorrelation test. There is autocorrelation, according to the alternative hypothesis, whereas the null hypothesis claims that there is none. When the p-value is greater than 0.05, the null hypothesis is accepted. The computed probability value is found to be statistically insignificant at of 0.079 thus implying that the null hypothesis is accepted.

Table 6.23 Wooldridge test for autocorrelation in panel data for model 3

	Coef.
F (1,23)	3.371
Prob > F	0.079

Source: Stata outcomes

The next section discusses the test of normality for model 3.

6.4.7 Test of Normality for model 3

Figures 6.3 represent the test of normality using the Epanechnikov kernel density estimates of model 3. The independent variables and dependent are likely normally distributed because the dataset kernel density is symmetrical and smooth. At 0.82, the Epanechnikov bandwidth is comparatively small.

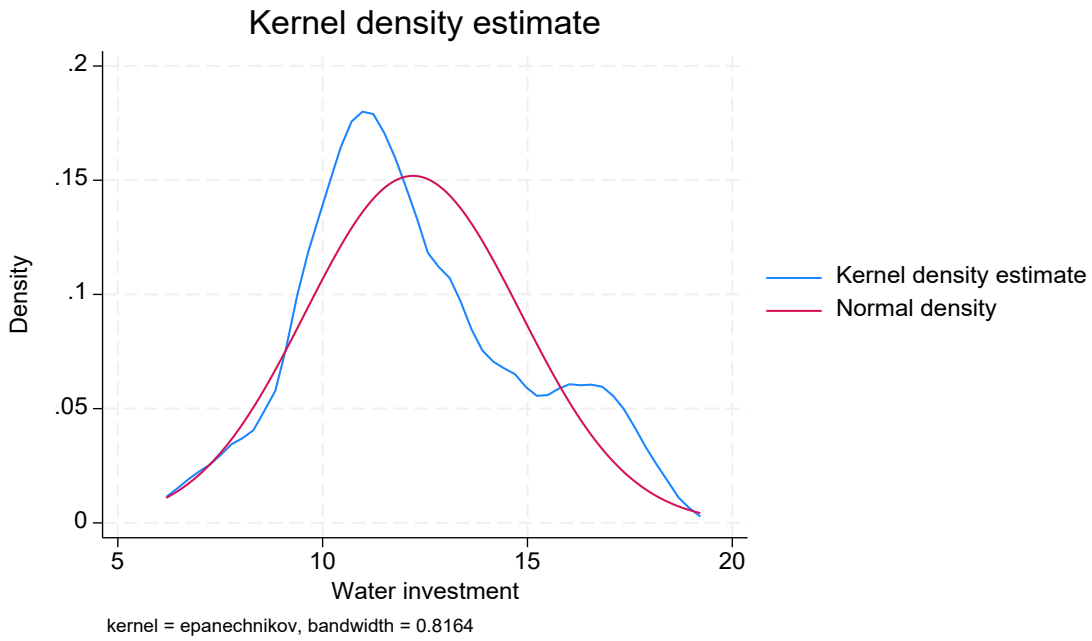

Figure 6.3: Kernel density of model 3

Source: Stata outcomes

The next section discusses the Hausman test for model 3.

6.4.3.8 Hausman test for model 3

Table 6.24 presents the abridged results of the Hausman test for model 3. The null hypothesis recommends that the random effect is suitable while the alternative recommends that the fixed effect is suitable. Based on the results random effect estimation is accepted and fixed effect estimator is rejected because the computed p-value, as shown by the results in Table 6.15, is 0.7, which is higher than the critical value of 0.05. The p-value is also higher than the significant level.

Table 6.24 Hausman (1978) specification test for model 3

	Coef.
Chi-square test value	1.423
P-value	0.7

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 3.

6.4.3.9 Overview of the Regression Assumption for model 3

All other assumptions of regression, including normality and autocorrelation, remain intact, with the exception of heteroscedasticity, which is inherent in model 3. Even though the random effect model outperforms the fixed effect model, the heteroscedasticity issue may have had an influence on the estimating coefficient. Practical generalised least squares (FGLS) are used in the study to account for heteroscedasticity, auto-correlation, and standard error (Hansen, 2007). Hansen (2007) continues, feasible generalised least squares generate more powerful and effective tests than the random effect model by accounting for serial correlation. The results of OLS robust, random and fixed effects are presented on table 6.24.1.

Column (1) presents the results of OLS robust. The results show that corporate social investment has an insignificant positive relationship with water consumption. BBBEE investment has an insignificant positive relationship with water consumption. Whereas market capitalisation has an insignificant negative relationship with water consumption.

Column (2) indicates the results of random effect estimator. The results show that corporate social investment has an insignificant negative relationship with water consumption. BBBEE investment has a significant positive relationship with water consumption. Market capitalisation has an insignificant negative impact on water consumption.

Column (3) indicates results of fixed effect estimator. The results show that corporate social investment has a significant positive impact on water consumption. BBBEE investment has a significant positive relationship with water consumption. Market capitalisation has an insignificant negative impact on water consumption.

Table 6.24.1 Results of OLS robust, random and fixed effects of model 3

Variables	(1) OLS robust Water investment	t	(2) Random effect Water investment	(3) Fixed effect Water investment
Corporate Social Investment	0.0910*	0.86	-0.00718**	0.0181**
	(0.106)		(0.104)	(0.0971)
BBBEE investment	0.216*	1.99	0.0139**	0.0308**
	(0.108)		(0.0606)	(0.0589)
Market capitalisation	-0.373*	-0.37	-0.164*	-0.175*
	(1.020)		(0.367)	(0.365)
Constant	15.62	0.85	15.12*	14.83*
	(18.27)		(6.754)	(6.726)
Observations	119		119	119
R-squared	0.058		0.002	
Number of Code			24	24
sigma_u			2.537	2.551
sigma_e			0.916	0.916
rho			0.885	0.886

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The next paragraph discusses the interpretation of FGLS and PCSE results for model 3.

6.4.3.10 Interpretation for model 3 FGLS and PCSE results

The findings for model 1's feasible generalised least squares are shown in Table 6.25. Due to the panel data's heteroscedasticity, which indicates that the study's findings have been inflated and not reliable unless the heteroscedasticity problem has been resolved, this regression was applied. The results' validity is achieved by controlling for cointegration, serial correlation, and heteroscedasticity using feasible generalised least squares error (Adeleye *et al.,* 2023). The presence of cross-sectional dependency, robustness check, and consistency of results are all controlled for by panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024).

Column (1) presents the estimation of model 3 using feasible generalised least squares. The results show that corporate social investment has an insignificant positive effect on water consumption. BBBEE investment has a significant positive influence on consumption. Whereas market capitalisation has an insignificant negative

relationship with consumption. Column (2) presents the results of the estimation of panel-corrected standard error estimator. The results show that corporate social investment has an insignificant positive effect on water consumption. BBBEE investment has a significant positive influence on water investment. Whereas market capitalisation has an insignificant negative relationship with water investment.

Table 6.25 feasible generalised least squares and panel corrected standard error for model 3

	(1)		(2)
	Main results		
Variables	FGLS Water investment	z	PCSE Water investment
Corporate Social Investment	0.0910*	0.70	0.0910*
	(0.129)		(0.0599)
BBBEE investment	0.216**	2.05	0.216***
	(0.105)		(0.0581)
Market capitalisation	-0.373*	-0.37	-0.373*
	(1.011)		(0.300)
Constant	15.62	0.85	15.62*
	(18.31)		(5.557)
Observations	119		119
R-squared			0.058
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and the Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next paragraph discusses the results for research objective 2 model 4.

6.4.4 Research objective 2 (Model 4): To analyse the effect of corporate social investment on resource efficiency.

Model 4

$$ENERCO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Empirical results

6.3.4.1 Descriptive Statistics for model 4

Table 6.26 presents descriptive statistics of key variables for objective one in this current study which are dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

The descriptive statistics shown in Table 6.26 indicates the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. The descriptive statistics of key variables in model 4 in the current study indicate that energy consumption has an average of -0.023, the minimum is -7.42 and the maximum is 3.20. Corporate Social Investment has an average of 0.05 with a minimum value of -4.58 and maximum of 5.41. The BBBEE investment has a mean of -0.02, with a minimum value of -6.59 and a maximum value of 7.22. The market capitalisation is 0.03 on average, with a minimum of -0.68 and the maximum is 0.40.

Table 6.26 Descriptive Statistics for model 4

Variable	Obs	Mean	Std. Dev.	Min	Max
Energy consumption	96	-0.023	1.127	-7.423	3.201
Corporate Social Investment	96	0.052	1.201	-4.579	5.405
BBBEE investment	95	-0.016	1.927	-6.593	7.222
Market capitalisation	96	0.033	0.42	-0.676	0.402

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses the correlation analysis for model 4.

6.4.4.2 Correlations analysis for model 4

The correlation analysis of model 4 indicates dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. In Table 6.27, energy consumption and Corporate Social Investment (r = 0.40) are positively correlated. Energy consumption and BBBEE investment (r = -0.01) are negatively correlated. Also, energy consumption and market capitalisation (r = -0.027) are negatively correlated.

Table 6.27 Matrix of correlations for 4

Variables	(1)	(2)	(3)	(4)
(1) Energy consumption	1.000			
(2) Corporate Social Investment	0.402	1.000		
(3) BBBEE investment	-0.014	0.037	1.000	
(4) Market capitalisation	-0.027	-0.077	0.167	1.000

Source: Stata outcomes

The next paragraph discusses the multicollinearity model for model 4.

6.4.4.2.1 Multicollinearity test for model 4

Table 6.27.1 presents variance inflationary factors (VIF) analysis. It is generally accepted that the variance inflationary factors (VIF) cannot exceed 10. Failure to do so may result in collinearity in the model. The data supplied does not exhibit multicollinearity, as indicated by the mean VIF of 1.025, which is less than 10.

Table 6.27.1 Variance inflation factor for Model 4

	VIF	1/VIF
Market capitalisation	1.036	.965
BBBEE investment	1.031	.97
Corporate Social Investment	1.009	.992
Mean VIF	1.025	.

Source: Stata outcomes

The next paragraph discusses the cross-sectional dependence for model 4.

6.4.4.3 Cross-sectional dependence (CSD) for model 4

The cross-sectional dependence for model 4 consists of dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation cross-sectional dependence. The cross-section dependence results are shown in Table 6.28 along with a null hypothesis stating that there is no cross-sectional dependence. If the probability value is less than 0.05, the null hypothesis is rejected; if it is 0.05 or higher, it is accepted. The results shown in the Table support the denial of the cross-sectional dependence theory for all tests given that all probability values are found to be statistically insigninificant.

Table 6.28 Cross-sectional dependence (CSD) for model 4

Item description	Test name	Statistic	P-value	Conclusion	Item description
Cross sectional dependence	- Breusch-Pagan LM	16.66342	0.0822	Accept null	Cross sectional dependence
	- Pesaran scaled LM	1.489985	0.1362	Accept null	
	Pesaran CD	1.184961	0.2360	Accept null	

Source: Author's calculations using E-views version 12

6.4.4.4 Cointegration estimations for model 4

Variable series that are integrated of order one, or I(1), and stationary at the level were used in the current study's cointegration estimation procedure. Kao (1999) conducted cointegration tests, the results of which are shown in Table 6.29. The statistical significance of Dickey-Fuller's statistics is demonstrated at the 1% level. The null hypothesis states that there is no cointegration and the alternative states that there is cointegration. The null hypothesis is rejected that there is no cointegration. The study assumed that energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation are correlated. This implies that the combination of energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation is likely to be integrated and have a long-run relationship.

Table 6.29 Cointegration Test for model 4

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	1.567*	
Dickey-Fuller t	-5.187***	
Augmented Dickey-Fuller t	5.413***	
Unadjusted modified Dickey Fuller t	0.541	
Unadjusted Dickey-Fuller t	-6.035***	
Variance ratio		10.681***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next paragraph presents the diagnostic tests for model 4.

6.4.4.5 Test for heteroskedasticity for model 4

The results for heteroskedasticity for model 4 are based on dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.30 indicates the heteroscedasticity test for model 4, which pits the alternative of heteroscedasticity in the panel data against the null hypothesis that there is no heteroscedasticity in the data. The hypothesis stating that there is no heteroskedasticity in the panel data is rejected if the estimated probability is less than or equal to the significant value of 0.05. The null hypothesis that there is no heteroscedasticity in the panel data in model 4 is rejected because the p-value is less than the critical value of 0.05. Therefore, considering that the tests were conducted after a control variable was included in a regression model, there is undesired heteroscedasticity in the panel data. This means that the study's findings are erroneous and unreliable until the heteroscedasticity issue is addressed.

Table 6.30 Modified Wald test for groupwise heteroskedasticity for model 4

	Coef.
Chi-square test value	7.9e+06
P-value	0.0000

Source: Stata outcomes

The next section discusses the autocorrelation test for model 4.

6.4.4.6 Autocorrelation test for model 4

The results for autocorrelation test for model 4 are based on the dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.31 displays the model 4 autocorrelation test. There is autocorrelation, according to the alternative hypothesis, whereas the null hypothesis claims that there is none. A p-value of greater than 0.05 indicates acceptance of the null hypothesis. Consequently, since the calculated probability value is 0.609, the null hypothesis is accepted. Therefore, the inference that follows is that the variables in model 4 do not exhibit autocorrelation.

Table 6.31 Wooldridge test for autocorrelation in panel data for model 4

	Coef.
F (1,23)	0.268
Prob > F	0.609

Source: Stata outcomes

The next section presents the test of normality for model 4.

6.4.4.7 Test of Normality for model 4

Figures 6.4 denote the test of normality using the Epanechnikov kernel density estimates of energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Based on figure 6.4 the dataset kernel density is smooth and symmetrical, which implies that variables are normally distributed. The Epanechnikov bandwidths are low, at 0.03.

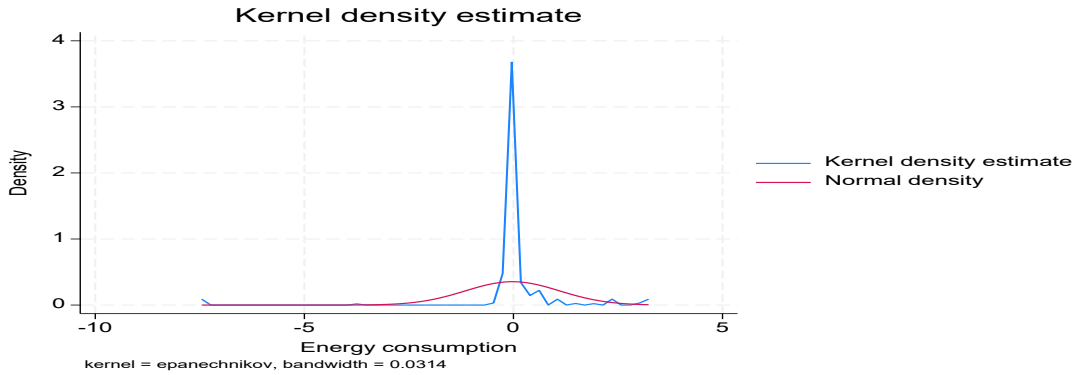

Figure 6.4: Kernel density of model 4

Source: Stata outcomes

The next section discusses the Hausman test for model 4.

6.4.4.8 Hausman test for model 4

Table 6.32 presents the abridged results of the Hausman test for model 4. The null hypothesis proposes that the random effect is appropriate while the alternative proposes that the fixed effect is appropriate. Computed p-value of 0.142 is greater than the critical value of 0.05 and the p-value is greater than the significant level, the fixed effect estimator is rejected, and the random effect estimation is accepted, as shown by the results in Table 6.32.

Table 6.32 Hausman (1978) specification test for model 4

	Coef.
Chi-square test value	5.44
P-value	0.142

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 4.

6.4.4.9 Overview of the Regression Assumption for model 4

Except for heteroscedasticity, which is a feature of model 4, all other regression assumptions such as normality and autocorrelation remain true. The estimating coefficient might have been impacted by the heteroscedasticity problem, despite the random effect model performing better than the fixed effect model. The study makes use of practical generalised least squares (FGLS) to take auto-correlation, standard error, and heteroscedasticity into account Hansen (2006). According to Hansen (2007), feasible generalised least squares generate more potent and efficient tests than the random effect model by accounting for serial correlation. Table 6.32.1 presents the results of OLS robust, random and fixed effects.

Column (1) presents the results of OLS robust. The results show that corporate social investment has an insignificant positive relationship with energy consumption. While BBBEE investment has a significant negative relationship with energy consumption. Market capitalisation has a significant positive relationship with energy consumption.

Column (2) presents the results of random effect estimator. The results show that corporate social investment has an insignificant positive impact on energy consumption. While BBBEE investment has a significant negative impact on energy

consumption. Market capitalisation has an insignificant positive impact on energy consumption.

Column (3) presents results of fixed effect estimator. The results show that corporate social investment has an insignificant positive impact on energy consumption. While BBBEE investment has a significant negative impact on energy consumption. Market capitalisation has an insignificant positive impact on energy consumption.

Table 6.32.1 Results of OLS robust, random and fixed effects for model 4

Variables	(1) OLS robust Energy consumption	t	(2) Random effect Energy consumption	(3) Fixed effect Energy consumption
Corporate Social Investment	0.380*	1.68	0.448*	0.380*
	(0.226)		(0.0968)	(0.0906)
BBBEE investment	-0.0181**	-0.26	-0.0482**	-0.0181**
	(0.0691)		(0.0614)	(0.0573)
Market capitalisation	0.0238**	0.11	0.0606*	0.0238**
	(0.226)		(0.268)	(0.262)
Constant	-0.0402	-0.36	-0.0449	-0.0402
	(0.111)		(0.111)	(0.109)
Observations	95		95	95
R-squared	0.163		0.243	
Number of Code			24	24
sigma_u			0.506	0
sigma_e			1.074	1.074
rho			0.181	0

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next paragraph discusses the interpretation for model 4 FGLS and PCSE results.

6.4.4.10 Interpretation for model 4 FGLS and PCSE results

Table 6.33 displays the results for the feasible generalised least squares for model 4. This regression was conducted because the panel data was heteroscedastic, which suggests that the study's conclusions have been exaggerated and are unreliable until

the heteroscedasticity issue has been fixed. The results are legitimate since the feasible generalised least squares account for cointegration, serial correlation, and heteroscedasticity (Adeleye *et al.,* 2023). The presence of cross-sectional dependency, robustness check, and consistency of results are all controlled for by panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024).

Table 6.33 column (1) presents the results of feasible generalised least squares. The results show that corporate social investment has an insignificant positive impact on energy consumption. While BBBEE investment has a significant negative impact on energy consumption. Market capitalisation has a significant positive impact on energy consumption. Column (2) reveals the results of panel-corrected standard error estimator. The results show that corporate social investment has a significant positive impact on energy consumption. While BBBEE investment has an insignificant negative impact on energy consumption. Market capitalisation has a significant positive impact on energy consumption.

Table 6.33 feasible generalised least squares and panel corrected standard error for model 4

Variables	(1) FGLS Energy consumption	z	(2) PCSE Energy consumption
Corporate Social Investment	0.380*	4.29	0.380*
	(0.0886)		(0.133)
BBBEE investment	-0.0181**	-0.32	-0.0181**
	(0.0561)		(0.0593)
Market capitalisation	0.0238**	0.09	0.0238**
	(0.257)		(0.286)
Constant	-0.0402	-0.38	-0.0402
	(0.106)		(0.139)
Observations	95		95
R-squared			0.163
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and the Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next subsection discusses results for model 5.

6.4.5 Research objective 3 (Model 5): To evaluate the impact of corporate environmental investment on profitability.

Model 5

$$NETPRO_{it} = \alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots..(5)$$

6.4.5.1 Descriptive Statistics for model 5

Table 6.34 present descriptive statistics of key variables for objective one in this current study which are dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation.

The descriptive statistics in Table 6.34 indicates the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. The results of descriptive statistics presents key variables in this current study, which are continuous variables. Net profit has an average of 9.01, the minimum is 4.77 and the maximum is 13.79. Investment in renewable energy has an average of 9.94 with a minimum value of 0.693 and maximum of 16.402. The mean of water investment is -11.76 with a minimum value of 10.90 and a maximum value is 12.79. Recycling investment has an average value of 11.06, the minimum is 10.53 and the maximum value is 11.40. The market capitalisation is 18.08, the minimum is 17.83 and the maximum is 18.53.

Table 6.34 Descriptive statistics for model 5

Variables	Obs	Mean	Std. Dev.	Min	Max
Net profit	103	9.014	1.573	4.771	13.79
Investment in Renewable energy	120	9.938	3.135	0.693	16.402
Water investment	120	11.755	0.61	10.898	12.792
Recycling investment	120	11.056	0.3	10.525	11.396
Market capitalisation	120	18.082	0.233	17.827	18.503

Note: All variables are log (logarithm)

Source: Stata outcomes

The next subsection discusses the correlation analysis for model 5.

6.4.5.2 Correlations analysis for model 5

The correlation analysis of dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.35 presents a correlation analysis of net profit and the control variables. The current study suggests that net profit and investment in renewable energy (r = 0.42) are positively correlated. Net profit and water investment (r = -0.037) are negatively correlated. Net profit and recycling investment (r = 0.042) are positively correlated. Net profit and market capitalisation (r = 0.051) are positively correlated.

Table 6.35 Matrix of correlations for model 5

Variables	(1)	(2)	(3)	(4)	(5)
(1) Net profit	1.000				
(2) Investment in Renewable energy	0.422	1.000			
(3) Water investment	-0.037	-0.018	1.000		
(4) Recycling investment	0.042	0.022	-0.573	1.000	
(5) Market capitalisation	0.051	-0.022	0.040	0.221	1.000

Source: Stata outcomes

6.4.5.2.1 Multicollinearity test for model 5

It is generally accepted that the variance inflationary factors (VIF) cannot exceed 10. Failure to do so may result in collinearity in the model. The data supplied does not exhibit multicollinearity, as indicated by the mean VIF of 1.353, which is less than 10.

Table 6.35.1 Variance inflation factor for Model 5

	VIF	1/VIF
Recycling investment	1.691	0.591
Water investment	1.609	0.622
Market capitalisation	1.11	0.901
Investment in Renewable energy	1.001	0.999
Mean VIF	1.353	.

Source: Stata outcomes

The next subsection discusses the cross-sectional dependence for model 5.

6.4.5.3 Cross-sectional dependence (CSD) for model 5

Cross-sectional dependence for dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and

control variable market capitalisation in model 5. The cross-section dependence results are shown in Table 6.36, where an alternative hypothesis asserting cross-sectional dependence is contrasted with a null hypothesis claiming no cross-sectional dependence. If the probability value is less than 0.05, the null hypothesis is rejected; otherwise, it is accepted. Rejecting the cross-sectional dependence theory is supported by the table's results. Cross-section SUR is used to compute the results in Table 6.36. When it is discovered that data sets in the model are cross-sectionally dependent on one another, this corrective action is done.

Table 6.36 Cross-sectional dependence (CSD) for model 5

Item description	**Test name**	**Statistic**	**P-value**	**Conclusion**	**Item description**
Cross sectional dependence- **SUR**	- Breusch-Pagan LM - Pesaran scaled LM Pesaran CD	15.84964 1.308019 -1.268124	0.1040 0.1919 0.2048	Accept null Accept null Accept null	Cross sectional dependence- **SUR**

Source: Author's calculations using E-views version 12

The next subsection discusses the cointegration estimates for model 5.

6.4.5.4 Cointegration estimations for model 5

The study's cointegration estimation technique performed employing variable series that have been both stationary at the level and integrated of order one, or I(1). Table 6.37 displays the cointegration test results that Kao (1999) performed. Dickey-Fuller's statistics are shown to have statistical significance at the 1% level. The null hypothesis suggests that there is no cointegration and the alternative suggests that there is cointegration. The findings reject the null hypothesis that there is no cointegration, which implies a long-term relationship between dependent variable net profit and independent variable investment in renewable energy, water investment, recycling investment as well as the control variable market capitalisation. A combination of the aforementioned variables is likely to be integrated.

Table 6.37 Cointegration Test for model 5

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	1.6777**	
Dickey-Fuller t	-1.438*	
Augmented Dickey-Fuller t	1.712**	
Unadjusted modified Dickey Fuller t	0.000	
Unadjusted Dickey-Fuller t	-2.901***	
Variance ratio		217.356***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next subsection discusses the test for heteroskedasticity for model 5.

6.4.5.5 Test for heteroskedasticity for model 5

Table 6.38 is constructed on dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. The model 5 heteroscedasticity test is displayed in Table 6.38, which sets the possibility of heteroscedasticity in the panel data against the null hypothesis that there is no heteroscedasticity in the data. The null hypothesis that there is no heteroskedasticity in the panel data is rejected if the estimated probability is less than or equal to the critical value of 0.05. The null hypothesis that there is no heteroscedasticity in the panel data in model 5 is rejected because the p-value is less than the critical value of 0.05. Thus, given that the tests were conducted after a control variable had been inserted in a regression model, there is unforeseen heteroscedasticity in the panel data. This implies that the study's conclusions are inappropriate and not reliable until the heteroscedasticity issue is taken care of.

Table 6.38 Modified Wald test for groupwise heteroskedasticity for model 5

	Coef.
Chi-square test value	5.8e+28
P-value	0.0000

Source: Stata outcomes

The next subsection discusses the autocorrelation test for model 5.

6.4.5.7 Autocorrelation test for model 5

The autocorrelation test results are based on dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation for model 5. Table 6.39 indicates model 5's autocorrelation test. The alternative hypothesis asserts that autocorrelation exists, whereas the null hypothesis claims that it does not. A p-value of greater than 0.05 indicates acceptance of the null hypothesis. Given that the calculated probability value is 0.222, the null hypothesis is thus accepted. Thus, it can be concluded that the variables in model 5 have no autocorrelation.

Table 6.39 Wooldridge test for autocorrelation in panel data for model 5

	Coef.
F (1,23)	1.590
Prob > F	0.222

Source: Stata outcomes

The next subsection presents the test of normality for model 5.

6.4.5.7 Test of Normality for model 5

Figures 6.5 present the test of normality using the Epanechnikov kernel density estimates of model 5. Dependent variable net profit and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation dataset kernel density are smooth and symmetrical, which implies that they are normally distributed. The Epanechnikov bandwidth is 0.53.

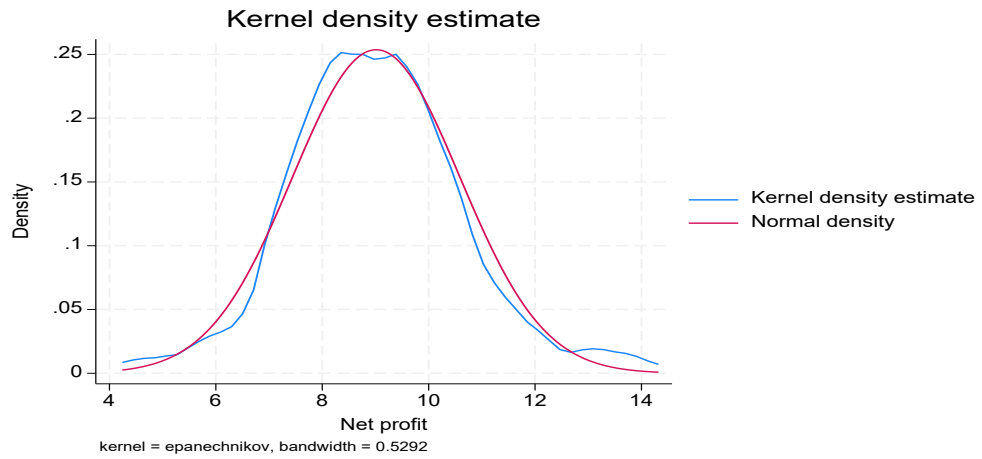

Figure 6.5: Kernel density of model 5

Source: Stata outcomes

The next paragraph discusses the diagnostic tests of model 5.

6.4.5.8 Hausman test for model 5

Table 6.40 presents the abridged results of the Hausman test for model 5. The null hypothesis states that the random effect is acceptable while the alternative states that the fixed effect is acceptable. The results in Table 6.40 indicate that the fixed effect estimator is rejected, and the random effect estimation is accepted because the computed p-/value of 0.519 is greater than the critical value of 0.05 and the p-value is greater than the significant level.

Table 6.40 Hausman (1978) specification test for model 5

	Coef.
Chi-square test value	3.239
P-value	0.519

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 5.

6.4.5.9 Overview of the Regression Assumption for model 5

All the assumptions of regression, such as normality and autocorrelation, are met with the exception of model 5's heteroscedasticity. The heteroscedasticity problem might have had an impact on the estimating coefficient even though the random effect model performed better than the fixed effect model. The study uses useful generalised least squares (FGLS) to take autocorrelation, standard error, and heteroscedasticity into account. According to Hansen (2007), feasible generalised least squares generate more reliable as well as effective tests than the random effect model by considering serial correlation. The results of OLS robust, random and fixed effect are presented in table 6.40.1.

Column (1) presents the results of OLS robust. The results show that investment in renewable energy has an insignificant positive relationship with net profit. While water investment has an insignificant negative relationship with net profit, recycling investment and market capitalisation have an insignificant positive relationship with net profit. Column (2) indicates results of random effect estimator. The results show that investment in renewable energy has an insignificant positive impact on net profit. While water investment has an insignificant negative relationship with net profit, recycling investment and market capitalisation have an insignificant positive impact on net profit. Column (3), fixed effect estimator. The results show that investment in renewable energy has a significant positive impact on net profit. Water investment has an insignificant negative impact on net profit. Recycling investment and market capitalisation have an insignificant positive impact on net profit.

Table 6.40.1 Results for OLS robust, random and fixed effect for model 5

Variables	(1) OLS robust Net Profit	t	(2) Random effect Net Profit	(3) Fixed effect Net Profit
Investment in Renewable energy	6.37e-05*	0.24	6.37e-05*	0.000549***
	(0.000261)		(0.000238)	(0.000779)
Water investment	-0.0830*	-70.37	-0.0830*	-0.0830*
	(0.00118)		(0.00155)	(0.00173)
Recycling investment	0.0671*	28.89	0.0671*	0.0671*
	(0.00232)		(0.00323)	(0.00361)
Market capitalisation	0.330*	116.74	0.330*	0.330*
	(0.00282)		(0.00337)	(0.00377)
Constant	3.283*	77.76	3.283*	3.276*
	(0.0422)		(0.0655)	(0.0738)
Observations	120		120	120
R-squared	0.994			0.994
Number of Code			24	24
sigma_u			0	0.00165
sigma_e			0.00907	0.00907
rho			0	0.0319

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next paragraph discusses the interpretation of FGLS and PCSE results of model 5.

6.4.5.10 Interpretation for model 5 FGLS and PCSE results

Table 6.41 demonstrates the results for the feasible generalised least squares for model 5. This regression was conducted for the reason the panel data was heteroscedastic, which implies that the findings of the research have been exaggerated and are unreliable when the heteroscedasticity problem has been resolved. The results' validity is achieved by controlling for cointegration, serial correlation, and heteroscedasticity using feasible generalised least squares. Cross-sectional dependence is checked for, and the consistency of the results is observed, using panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024). The generalised least squares method has been employed to discuss the results of the study.

Table 6.41 column (1) presents the results of feasible generalised least squares estimator. The results show that investment in renewable energy has an insignificant positive impact on net profit. Recycling investment and market capitalisation have an insignificant positive impact on net profit. Water investment has an insignificant negative influence on net profit.

Column (2) presents the results of panel-corrected standard error estimator. The results show that investment in renewable energy has an insignificant positive impact on net profit. Recycling investment and market capitalisation have an insignificant positive impact on net profit. Water investment has an insignificant negative impact on net profit.

Table 6.41 Feasible generalised least squares and panel corrected standard error for model 5

	(1)		(2)
	Main results		
	FGLS	z	PCSE
VARIABLES	Net profit		Net profit
Investment in Renewable energy	6.37e-05*	0.27	6.37e-05*
	(0.000233)		(3.72e-05)
Water investment	-0.0830*	-54.76	-0.0830*
	(0.00152)		(0.00743)
Recycling investment	0.0671*	21.20	0.0671*
	(0.00317)		(0.0155)
Market capitalisation	0.330*	99.83	0.330*
	(0.00330)		(0.0162)
Constant	3.283*	51.23	3.283*
	(0.0641)		(0.313)
Observations	120		120
R-squared			0.994
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next subsection discusses the results for model 6.

6.4.6 Research objective 3 (Model 6): To evaluate the impact of corporate environmental investment on profitability.

Model 6

$$ASERER=\alpha_i + \beta_1 \text{INVIRE}_{it} + \beta_2 \text{WATINV}_{it} + \beta_3 \text{RECINV}_{it} + \beta_4 \text{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots(6)$$

6.4.6.1 Descriptive Statistics for model 6

Table 6.42 present descriptive statistics of key variables for objective one in this current study which are dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation.

The descriptive statistics for model 6 indicate the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. Table 6.42 presents descriptive statistics of key variables in this current study, which are continuous variables. Asset return has an average of 7.01, the minimum is 0.13 and the maximum is 23. Investment in renewable energy has an average of 9.94 with a minimum value of 0.693 and maximum of 16.402. The mean of water investment is -11.76 with a minimum value of 10.90 and a maximum value is 12.79. Recycling investment has an average value of 11.06, the minimum is 10.53 and the maximum value is 11.40. The market capitalisation is 18.08, the minimum is 17.83 and the maximum is 18.53.

Table 6.42 Descriptive Statistics for model 6

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset return	120	7.008	5.731	0.13	23
Investment in Renewable energy	120	9.938	3.135	0.693	16.402
Water investment	120	11.755	0.61	10.898	12.792
Recycling investment	120	11.056	0.3	10.525	11.396
Market capitalisation	120	18.082	0.233	17.827	18.503

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses cointegration analysis for model 6.

6.4.6.2 Correlations analysis for model 6

The correlation analysis of dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is presented for model 6. Table 6.43 presents a correlation analysis for model 5 of the current study suggests that asset return and investment in renewable energy (r = 0.046) are positively correlated. Asset return and water investment (r = 0.073) are positively correlated. Asset return and recycling investment (r = 0.049) are positively correlated. Asset return and market capitalisation (r = 0.051) are positively correlated.

Table 6.43 Matrix of correlations for model 6

Variables	(1)	(2)	(3)	(4)	(5)
(1) Asset return	1.000				
(2) Investment in Renewable energy	0.046	1.000			
(3) Water investment	0.073	-0.012	1.000		
(4) Recycling investment	0.049	0.009	-0.588	1.000	
(5) Market capitalisation	0.023	-0.021	0.045	0.225	1.000

Source: Stata outcomes

6.4.6.2.1 Multicollinearity test for model 6

The rule of thumb of Variance inflationary factors state that VIFs greater than 10 should be treated with caution to reduce collinearity. VIF mean show that there will be no multicollinearity in the estimation because VIF mean is 1.353.

Table 6.43.1 Variance inflation factor for Model 6

	VIF	1/VIF
Recycling investment	1.691	.591
Water investment	1.609	.622
Market capitalisation	1.11	.901
Recycling investment	1.001	.999
Mean VIF	1.353	.

Source: Stata outcomes

The next paragraph discusses the cross-sectional dependence for model 6.

6.4.6.3 Cross-sectional dependence (CSD) for model 6

Cross-sectional dependence for dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation in the model in Table 6.44.

The results of the cross-sectional dependence analysis are displayed in Table 6.44, where a null hypothesis that states there is no cross-sectional dependence is contrasted with an alternative hypothesis that claims there is. The null hypothesis is accepted if the probability value is greater than 0.05 and rejected otherwise. The table results support rejecting the cross-sectional dependence theory. The results shown in Table 6.44 are computed using cross-section SUR. In this case the corrective measure was to correct the Panel Corrected Standard Error (PCSE) tests.

Table 6.44 Cross-sectional dependence (CSD) for model 6

Item description	Test name	Statistic	P-value	Conclusion	Item description
Cross sectional dependence: **SUR**	- Breusch-Pagan LM - Pesaran scaled LM Pesaran CD	21.78391 2.634963 -0.780727	0.0162 0.0084 0.4350	Reject null Reject null Accept null	Cross sectional dependence: **SUR**

Source: Author's calculations using E-views version 12

The next subsection discusses the cointegration estimations for model 6.

6.4.6.4 Cointegration estimations for model 6

The present research's cointegration estimation technique employs variable series that have been stationary at the level and integrated of order one, or I(1). Table 6.45 presents the results of Kao's (1999) cointegration tests, which show that Dickey–Fuller's statistics are statistically significant at a 1% level. The null hypothesis proposes that there is no cointegration and the alternative proposes that there is cointegration. The findings reject the null hypothesis that there is no cointegration, which implies that there is a long-term relationship between dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. A combination of dependent

variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation is likely to be integrated.

Table 6.45 Cointegration Test for model 6

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey-Fuller t	2.445***	
Dickey-Fuller t	-0.919	
Augmented Dickey-Fuller t	-6.620***	
Unadjusted modified Dickey Fuller t	-0.488	
Unadjusted Dickey-Fuller t	-3.913***	
Variance ratio		191.979***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next paragraph discusses the diagnostic tests for model 6.

6.4.6.5 Test for heteroskedasticity for model 6

The results for test for heteroskedasticity are constructed on dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation. Table 6.46 display the heteroscedasticity test where heteroscedasticity in the panel data is tested against the null hypothesis that there is no heteroscedasticity in the data using the model 6 heteroscedasticity test, which is presented. If the estimated probability falls within or equals the critical value of 0.05, the null hypothesis that there is no heteroskedasticity in the panel data is rejected. The p-value is less than the crucial value of 0.05, which leads to the rejection of the null hypothesis, which states that there is no heteroscedasticity in the panel data in model 6. As a result, model 6's panel data demonstrates heteroskedasticity, which may account for the results' insignificance.

Table 6.46 Modified Wald test for groupwise heteroskedasticity for model 6

	Coef.
Chi-square test value	13034.30
P-value	0.0000

Source: Stata outcomes

The next subsection discusses the results of the autocorrelation test for model 6.

6.4.6.6 Autocorrelation test for model 6

Table 6.47 is based on dependent variable asset return and independent variables investment in renewable energy, water investment, recycling investment and control variable market capitalisation.

Table 6.47 exhibits model 6's autocorrelation test. While autocorrelation is stated in the alternative, it is asserted in the null hypothesis. If the p-value exceeds 0.05, the null hypothesis is accepted. Consequently, since the calculated probability value is 0.396, the null hypothesis is accepted. Therefore, it can be concluded that the variables in model 6 are not showing autocorrelation.

Table 6.47 Wooldridge test for autocorrelation in panel data for model 6

	Coef.
F (1,23)	0.748
Prob > F	0.396

Source: Stata outcomes

The next subsection presents the results for the test of normality for model 6.

6.4.6.7 Test of Normality for model 6

Figure 6.6 illustrate the test of normality using the Epanechnikov kernel density estimates of model 6. The dataset kernel density is smooth and symmetrical, which implies that they are normally distributed. The Epanechnikov bandwidth is 1.98.

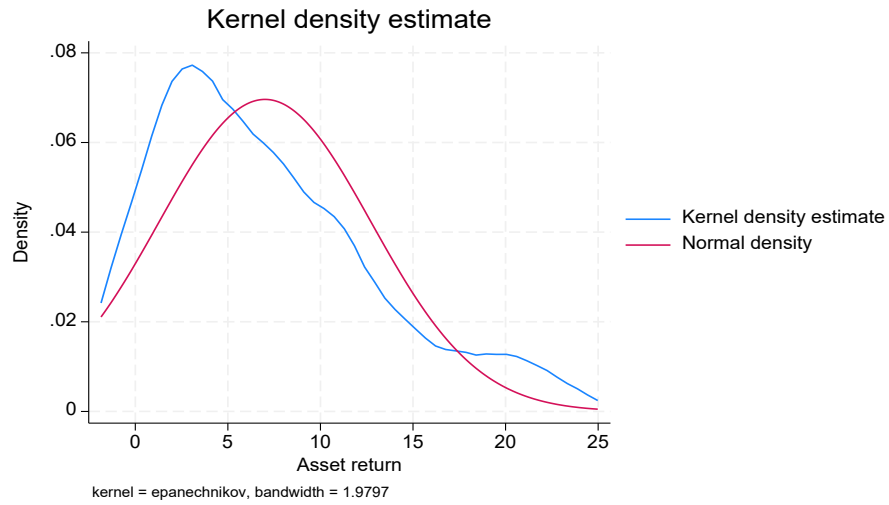

Figure 6.6: Kernel density of model 6

Source: Stata outcomes

The next subsection discusses the Hausman test for model 6.

6.4.6.8 Hausman test for model 6

Table 6.48 present the abridged results of the Hausman test for model. The null hypothesis states that the random effect is acceptable while the alternative states that the fixed effect is acceptable. As shown in Table 6.48, the fixed effect estimator is rejected, and the random effect estimation is accepted because the computed p-value of 1 is greater than both the critical value of 0.05 and the significant level.

Table 6.48 Hausman (1978) specification test model 6

	Coef.
Chi-square test value	0.01
P-value	1

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 6.

6.4.6.9 Overview of the Regression Assumption for model 6

All the assumptions of regression, such as normality and autocorrelation, are satisfied alongside the exception of model 6's heteroscedasticity. The heteroscedasticity obstacle could have had an influence on the determining coefficient notwithstanding the fact that the random effect model performed better than the fixed effect model. The study incorporates handy generalised least squares (FGLS) to factor auto-correlation, standard error, and heteroscedasticity into account. According to Hansen (2007), feasible generalised least squares generate improved efficacy and successful tests than the random effect model by considering serial correlation. The results of OLS robust, random effect and fixed effect are shown in table 6.48.1.

Column (1) presents the results of using OLS robust. The results show that investment in renewable energy has an insignificant positive relationship with asset return. While market capitalisation has an insignificant negative relationship with asset return. Water investment and recycling investment have an insignificant positive relationship with asset return.

Column (2) presents the results of random effect estimator. The results show that investment in renewable energy has an insignificant positive effect on asset return. Water investment has an insignificant positive effect on asset return. Recycling investment has an insignificant positive impact on asset return while market capitalisation has an insignificant negative impact on asset return.

Column (3) presents the results of fixed effect estimator. The results show that investment in renewable energy has an insignificant positive effect on asset return. Water investment has an insignificant positive effect on asset return. Recycling investment has an insignificant positive impact on asset return while market capitalisation has an insignificant negative impact on asset return.

Table 6.48.1 Results of OLS robust, random effect and fixed effect for model 6

Variables	(1) OLS robust Asset return	t	(2) Random effect Asset return	(3) Fixed effect Asset return
Investment in Renewable energy	0.0855*	0.53	0.133*	0.0965*
	(0.162)		(0.405)	(0.229)
Water investment	1.507*	1.38	1.509*	1.508*
	(1.093)		(0.899)	(0.895)
Recycling investment	2.797*	1.18	2.791*	2.796*
	(2.367)		(1.877)	(1.869)
Market capitalisation	-0.398*	-0.16	-0.383*	-0.395*
	(2.512)		(1.962)	(1.951)
Constant	-35.29	-0.75	-35.97	-35.45
	(46.83)		(38.41)	(37.94)
Observations	120		120	120
R-squared	0.021		0.035	
Number of Code			24	24
sigma_u			3.935	3.421
sigma_e			4.720	4.720
rho			0.410	0.344

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next paragraph discusses the interpretation of FGLS and PCSE results for model 6.

6.4.6.10 Interpretation for model 6 FGLS and PCSE results

Table 6.49 illustrates the findings for the feasible generalised least squares for model 6. This regression was carried out given the panel data turned out heteroscedastic, which demonstrates that results of a study are overstated and inaccurate until the heteroscedasticity problem has been rectified. The results are legitimate since the feasible generalised least squares account for cointegration, serial correlation and heteroscedasticity (Adeleye *et al.,* 2023). Cross-sectional dependence is checked for, and the consistency of the results is observed, using panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024). The main results of the study are discussed using

FGLS. Table 6.49 column (1) presents the results of feasible generalised least squares. The results show that investment in renewable energy had an insignificant positive effect on asset return. Water investment had an insignificant positive effect on asset return. Recycling investment had an insignificant positive impact on asset return. Market capitalisation had an insignificant negative impact on asset return. Column (2) indicates the results of panel-corrected standard error estimator. The results show that investment in renewable energy had an insignificant positive effect on asset return. Water investment had an insignificant positive effect on asset return. Recycling investment had an insignificant positive impact on asset return. While market capitalisation had an insignificant negative impact on asset return.

Table 6.49 feasible generalised least squares and panel corrected standard error for model 6

	(1)		(2)
	Main results FGLS	z	PCSE
Variables	Asset return		Asset return
Investment in Renewable energy	0.0855*	0.52	0.0855*
	(0.165)		(0.0775)
Water investment	1.507*	1.40	1.507*
	(1.076)		(0.159)
Recycling investment	2.797*	1.25	2.797*
	(2.246)		(0.332)
Market capitalisation	-0.398*	-0.17	-0.398*
	(2.344)		(0.349)
Constant	-35.29	-0.78	-35.29***
	(45.47)		(6.889)
Observations	120		120
R-squared			0.021
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS) and the Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next subsection discusses the results of model 7.

6.4.7 Research objective 4 (Model 7): To analyse the influence of corporate social investment on profitability.

Model 7

$$NETPRO_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

6.4.7.1 Descriptive Statistics for model 7

Table 6.50 presents descriptive statistics of key variables for objective one in this current study which are dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

The descriptive statistics shown in Table 6.50 indicate the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations. Table 6.50 presents descriptive statistics of key variables in model 7 in the current study. Net Profit has an average of 9.014, the minimum is 4.77 and the maximum is 13.79. Corporate Social Investment has an average of11.33 with a minimum value of 3.09 and maximum of 14.78. The BBBEE investment had a mean of 10.71, with a minimum value of 7.65 and a maximum value of 18.75. The market capitalisation is 18.08 on average, with a minimum of 17.83 and the maximum is 18.50.

Table 6.50 Descriptive statistics for model 7

Variable	Obs	Mean	Std. Dev.	Min	Max
Net Profit	103	9.014	1.573	4.771	13.79
Corporate Social Investment	120	11.338	2.006	3.091	14.785
BBBEE investment	119	10.707	2.478	7.65	18.75
Market capitalisation	120	18.082	.233	17.827	18.503

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses the correlation analysis for model 7.

6.4.7.2 Correlations analysis for model 7

The correlation analysis for model 7 is based on dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. In Table 6.51, the net profit and corporate social investment (r = 0.35) were positively correlated. Net profit and BBBEE investment (r = -0.32) are positively correlated. Also, net profit and market capitalisation (r = 0.045) are positively correlated.

Table 6.51 Matrix of correlations for model 7

Variables	(1)	(2)	(3)	(4)
(1) Net Profit	1.000			
(2) Corporate Social Investment	0.349	1.000		
(3) BBBEE investment	0.316	0.456	1.000	
(4) Market capitalisation	0.045	-0.016	0.166	1.000

Source: Stata outcomes

6.4.7.2.1 Multicollinearity test for model 7

The rule of thumb of Variance inflationary factors state that (VIFs greater than 10) should be treated with caution to reduce collinearity. VIF mean show that there would be no multicollinearity in the estimation because VIF mean is 1.16.

Table 6.51.1 Variance inflation factor for model 7

	VIF	1/VIF
BBBEE investment	1.24	0.805
Corporate social investment	1.23	0.811
Market capitalisation	1.01	0.988
Mean VIF	1.16	.

Source: Stata outcomes

The next subsection discusses the cross-sectional dependence for model 7.

6.4.7.3 Cross-sectional dependence (CSD) for model 7

Cross-sectional dependence for model 7 is based on dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.52 presents the cross-section dependence analysis results. It contrasts an alternative hypothesis claiming cross-sectional

dependence with a null hypothesis stating there is none. If the probability value is more than 0.05, the null hypothesis is accepted; if not, it is rejected. The cross-sectional dependence theory is supported to be rejected by the table results. Cross-section SUR was used in the computation of the results displayed in Table 6.52. When it is discovered that data sets inside the model are cross-sectionally dependent on one another, this corrective action is taken.

Table 6.52 Cross-sectional dependence (CSD) for model for 7

Item description	**Test name**	**Statistic**	**P-value**	**Conclusion**	**Item description**
Cross sectional dependence: **SUR**	- Breusch-Pagan LM - Pesaran scaled LM Pesaran CD	13.01236 0.673584 0.392559	0.2230 0.5006 0.6946	Accept null Accept null Accept null	Cross sectional dependence: **SUR**

Source: Author's calculations using E-views version 12

The next subsection discusses the test for heteroskedasticity for model 7.

6.4.7.4 Test for heteroskedasticity for model 7

The test for heteroskedasticity for model 7 is based on dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.53 display the model 7 heteroscedasticity test, which tests if there is heteroscedasticity in the panel data against the null hypothesis that it does not exist. If the estimated probability falls below or equals the critical value of 0.05, the null hypothesis that there is no heteroskedasticity in the panel data is rejected. Because the p-value is less than the crucial value of 0.05, the null hypothesis that there is no heteroscedasticity in the panel data in model 7 is rejected. Therefore, heteroskedasticity is present in the panel data in model 7, which might be responsible for the results' irrelevant.

Table 6.53 Modified Wald test for groupwise heteroskedasticity for model 7

	Coef.
Chi-square test value	63835.60
P-value	0.0000

Source: Stata outcomes

The autocorrelation test for model 7 is discussed in the next section.

6.4.7.5 Autocorrelation test for model 7

The results for autocorrelation test for model 7 is based on dependent variable net profit and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.54 demonstrates model 7's autocorrelation test. The alternative asserts that there is autocorrelation, whereas the null hypothesis claims that there is none. If the p-value is greater than 0.05, the null hypothesis is accepted. With the computed probability value of 0.243, the null hypothesis is thus accepted. Thus, it can be concluded that the variables in model 7 have no autocorrelation.

Table 6.54 Wooldridge test for autocorrelation in panel data for model 7

	Coef.
F (1,23)	1.445
Prob > F	0.243

Source: Stata outcomes

The next section presents the test of normality for model 7.

6.4.7.6 Test of Normality for model 7

Figures 6.7 demonstrate the test of normality using the Epanechnikov kernel density estimates of model 7. The smooth and symmetrical dataset kernel density of the dependent and independent variables suggests a normally distributed dataset. For net profit and corporate social investment, the Epanechnikov bandwidth is 0.53.

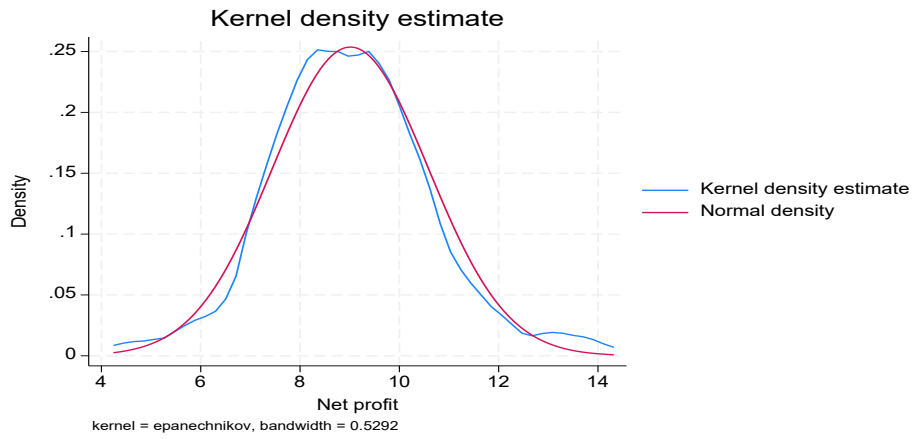

Figure 6.7: Kernel density of model 7

Source: Stata outcomes

The Hausman test for model 7 is discussed in the next section.

6.4.7.7 Hausman test for model 7

Table 6.55 presents the abridged results of the Hausman test for model 7. The null hypothesis states that the random effect is satisfactory while the alternative states that the fixed effect is satisfactory. The results in Table 6.55 indicate that the fixed effect estimator is rejected, and the random effect estimation is accepted because the computed p-value of 0.988 is greater than the critical value of 0.05 and the p-value is greater than the significant level.

Table 6.55 Hausman (1978) specification test for model 7

	Coef.
Chi-square test value	.133
P-value	.988

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 7.

6.4.7.9 Overview of the Regression Assumption for model 7

With the exception of model 7's heteroscedasticity, all regression assumptions including normality and autocorrelation are met. Given that the random effect model

outperformed the fixed effect model, the heteroscedasticity obstacle might have had an impact on the determining coefficient. The research uses the useful generalised least squares (FGLS) to account for heteroscedasticity, standard error, and auto-correlation. In the words of Hansen (2007), feasible generalised least squares generate improved efficacy and successful tests than the random effect model by considering serial correlation. The results of OLS robust, random effect and fixed effect are shown on table 6.55.1. Table 6.55.1 column (1) presents the estimation of the relationship between net profit and corporate social investment using OLS. The results show that corporate social investment had a significant positive relationship with net profit. Market capitalisation had an insignificant positive relationship with net profit. BBBEE investment had a negative significant relationship to net profit.

Column (2) presents the results of random effect estimator. The results show that corporate social investment had a significant positive impact on net profit. Market capitalisation had an insignificant positive impact on net profit. BBBEE investment had a negative significant relationship to net profit

In column (3), presents the impact of corporate social investment on net profit using a fixed effect estimator. The results show that corporate social investment had a significant positive impact on net profit. While market capitalisation had an insignificant positive impact on net profit, BBBEE investment had a positive insignificant relationship to net profit.

Table 6.55.1 results of OLS robust, random effect and fixed effect for model 7

Variables	OLS robust Net Profit	t	Random effect Net Profit	Fixed effect Net Profit
Corporate Social Investment	0.000310***	0.09	0.000310***	0.162*
	(0.00337)		(0.00336)	(0.0870)
BBBEE investment	-0.000793**	-0.28	-0.000793**	0.154*
	(0.00279)		(0.00274)	(0.0670)
Market capitalisation	0.340*	36.55	0.340*	0.144*
	(0.00931)		(0.0263)	(0.330)
Constant	2.868***	16.89	2.868***	2.986
	(0.170)		(0.476)	(5.903)
Observations	119		119	102
R-squared	0.595			0.116
Number of Code			24	24
sigma_u			0	1.488
sigma_e			0.0739	0.737
rho			0	0.803

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next paragraph discusses the interpretation of FGLS and PCSE results for model 8.

6.4.6.10 Interpretation for model 7 FGLS and PCSE results

The results obtained for the feasible generalised least squares for model 7 are presented in Table 6.56. Given that the panel data proved to be heteroscedastic, this regression was conducted. This indicates that the study's findings have been exaggerated and are unreliable until the heteroscedasticity issue has been resolved. In order to account for heteroscedasticity and ensure accuracy, the generalised least squares method is used. The results' validity is achieved by controlling for cointegration, serial correlation, and heteroscedasticity using feasible generalised least squares. Cross-sectional dependence is checked for, and the consistency of the results is observed, using panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024). The generalised least squares method was employed to discuss the results of the study.

Table 6.56 column (1) presents the results for feasible generalised least squares. The results show that corporate social investment had a significant positive impact on net profit. BBBEE investment had a significant negative impact on net profit. Market capitalisation had an insignificant positive impact on net profit.

Column (2) results the results of PCSE estimator. The results show that corporate social investment had a significant positive impact on net profit. BBBEE investment had a significant negative impact on net profit. Market capitalisation had an insignificant positive impact on net profit.

Table 6.56 feasible generalised least squares and panel corrected standard error for model 7

	(1)		(2)
	Main results		
	FGLS	z	PCSE
Variables	Net profit		Net profit
Corporate Social Investment	0.000310**	0.09	0.000310**
	(0.00330)		(0.00137)
BBBEE investment	-0.000793**	-0.29	-0.000793**
	(0.00269)		(0.00116)
Market capitalisation	0.340*	13.17	0.340*
	(0.0258)		(0.140)
Constant	2.868***	6.13	2.868
	(0.468)		(2.526)
Observations	119		119
R-squared			0.595
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Feasible Generalised Least Squares (FGLS); Panel Corrected Standard Error (PCSE)

Source: Stata outcomes

The next subsection discusses the results for model 8.

6.4.8 Research objective 4 (Model 8): To analyse the influence of corporate social investment on profitability.

Model 8

$$ASERER_{it} = \alpha_i + \beta_1 \, \mathrm{CSI}_{it} + \beta_2 \, \mathrm{BBINV}_{it} + \beta_3 \, \mathrm{MKTCAP}_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

6.4.8.1 Descriptive Statistics for model 8

Table 6.57 presents descriptive statistics of key variables for objective one in this current study which are dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

The descriptive statistics Table 6.57 indicate the aforementioned variables along with the mean, standard deviation, minimum and maximum values, and the number of observations.

Table 6.57 presents descriptive statistics of key variables in model 7 in the current study. Asset return has an average of -0.056, the minimum is -3.706 and the maximum is 2.69. Corporate Social Investment has an average of 0.052 with a minimum value of -4.58 and maximum of 5.41. The BBBEE investment has a mean of -0.021 with a minimum value of -0.54 and a maximum value of 0.39. The market capitalisation is 0.033 on average, with a minimum of -0.67 and the maximum is 0.402.

Table 6.57 Descriptive statistics for model 8

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset return	96	-0.056	0.919	-3.706	2.69
Corporate Social Investment	96	0.052	1.201	-4.579	5.405
BBBEE investment	96	-0.021	0.372	-0.543	0.389
Market capitalisation	96	0.033	00.42	-0.676	0.402

Note: All variables are log (logarithm)

Source: Stata outcomes

The next paragraph discusses correlation analysis for model 8.

6.4.8.2 Correlations analysis for model 8

Table 6.58 presents a correlation analysis of asset return and the control variables. The current study suggests that asset return and corporate social investment (r = 0.11) are positively correlated. Asset return and BBBEE investment (r = -0.081) are positively correlated. Whereas asset return is likely to have a negative correlation with asset return.

Table 6.58 Matrix of correlations for model 8

Variables	(1)	(2)	(3)	(4)
(1) Asset return	1.000			
(2) Corporate Social Investment	0.106	1.000		
(3) BBBEE investment	0.081	-0.094	1.000	
(4) Market capitalisation	-0.024	-0.075	0.856	1.000

Source: Stata outcomes

6.4.8.2.1 Multicollinearity test for model 8

The variance inflation test, as shown in Table 6.58.1, use the rule of thumb of Variance inflationary factors which state that (VIFs greater than 10) should be treated with caution to reduce collinearity. VIF mean show that there will be no multicollinearity in the estimation because VIF mean is 2.834.

Table 6.58.1 Variance inflation factor for model 8

	VIF	1/VIF
BBBEE investment	3.752	0.267
Corporate social investment	3.74	0.267
Market capitalisation	1.009	0.991
Mean VIF	2.834	.

Source: Stata outcomes

6.4.8.3 Cross-sectional dependence (CSD) for model 8

The results for cross-sectional dependence for model 8 are based on dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.59 present the cross-section dependence analysis results. It contrasts an alternative hypothesis claiming cross-sectional dependence with a null hypothesis stating there is none. If the probability value is more than 0.05, the null hypothesis is accepted; if not, it is rejected. The cross-sectional dependence theory is supported to be rejected by the table results.

Table 6.59 Cross-sectional dependence (CSD) for model 8

Item description	Test name	Statistic	P-value	Conclusion	Item description
Cross sectional dependence	- Breusch-Pagan LM - Pesaran scaled LM - Pesaran CD	14.48221 1.002253 0.362428	0.1521 0.3162 0.7170	Accept null Accept null Accept null	Cross sectional dependence

Source: Author's calculations using E-views version 12

The next section presents the cointegration estimations for model 8.

6.4.8.4 Cointegration estimations for model 8

The current study performed cointegration estimation using variable series that are stationary at the level, which means they are integrated of order one, I(1). Cointegration tests were carried out by Kao (1999), and Table 6.60 presents the findings. Dickey-Fuller's statistics have been demonstrated to have statistical significance at the 1% level. The null hypothesis recommends that there is no cointegration and the alternative recommends that there is cointegration. The study assumed that dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation are correlated, hence, a combination of dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation is likely to be integrated. Cointegration estimation indicates whether there is a long-run relationship between dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

Table 6.60 Cointegration Test for model 8

	Kao test	Westerlund test
	Statistic	Statistic
Modified Dickey–Fuller t	2.431***	
Dickey–Fuller t	-4.279***	
Augmented Dickey–Fuller t	5.409***	
Unadjusted modified Dickey–Fuller t	-0.709	
Unadjusted Dickey–Fuller t	-7.613***	
Variance ratio		62.48***

*, **, *** implies series stationary significant level at 10%, 5%, 1% respectively

Source: Stata outcomes

The next paragraph discusses the diagnostic tests for model 8.

6.4.8.5 Test for heteroskedasticity for model 8

The test for heteroskedasticity for model 8 is based on dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

Table 6.61 illustrate the heteroscedasticity test for model 8 is presented, which pits the possibility of heteroscedasticity in the panel data against the null hypothesis that no heteroscedasticity exists in the data. If the estimated probability is less than or equal to the crucial value of 0.05, the null hypothesis that there is no heteroskedasticity in the panel data is rejected. Since the p-value is less than the crucial value of 0.05, the null hypothesis that there is no heteroscedasticity in the panel data in model 8 is rejected. For that reason, considering the tests were executed after a control variable became included in a regression model, there is undesired heteroscedasticity in the panel data. This entails that the study's findings are inappropriate and inaccurate until the heteroscedasticity cause is corrected.

Table 6.61 Modified Wald test for groupwise heteroskedasticity for model 8

	Coef.
Chi-square test value	3425.38
P-value	0.0000

Source: Stata outcomes

The autocorrelation test for model 8 are discussed in the next section.

6.4.8.6 Autocorrelation test for model 8

The autocorrelation test for model 8 is beased on dependent variable asset return and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Table 6.62 shows model 8’s autocorrelation test. There is autocorrelation, according to the alternative hypothesis, whereas the null hypothesis claims that there is none. When the p-value is greater than 0.05, the null hypothesis

is rejected. Model 8 exhibits autocorrelation, as indicated by the computed p-value of 0.0003.

Table 6.62 Wooldridge test for autocorrelation in panel data for model 8

	Coef.
F (1,23)	18.27
Prob > F	0.0003

Source: Stata outcomes

The test of normality for model 8 is presented in the next section.

6.4.8.7 Test of Normality for model 8

Figures 6.8 present the test of normality using the Epanechnikov kernel density estimates of model 8. It is presumed that the smooth and symmetric kernel density of the dataset normally distributes them. At 0.19, the Epanechnikov bandwidth is comparatively small.

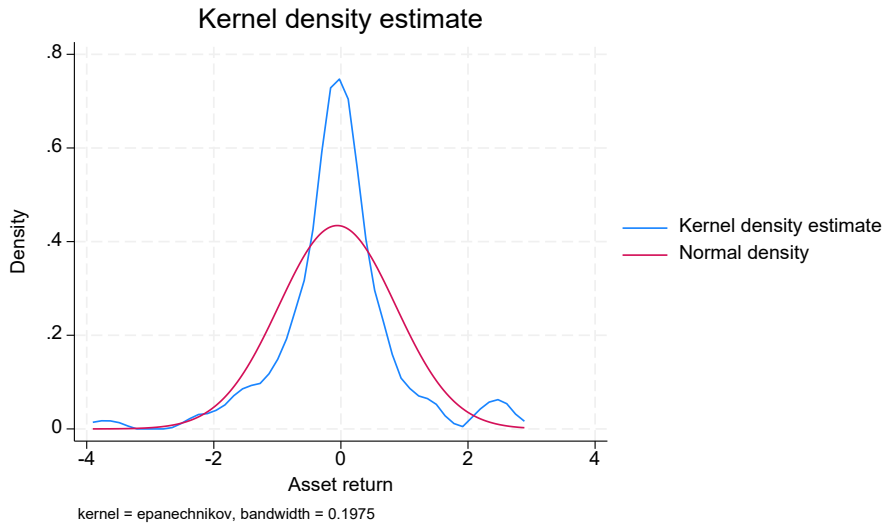

Figure 6.8: Kernel density of model 8

Source: Stata outcomes

The Hausman test for model 8 is discussed in the next section.

6.4.8.8 Hausman test for model 8

Table 6.63 presents the abridged results of the Hausman test for model 8. The null hypothesis states that the random effect is appropriate while the alternative states that the fixed effect is appropriate. As demonstrated by the results in Table 6.63, the fixed effect estimator is rejected, and the random effect estimation is accepted because the computed p-value of 0.946 is greater than the critical value of 0.05 and the p-value is significant.

Table 6.63 Hausman (1978) specification test for model 8

	Coef.
Chi-square test value	.37
P-value	.946

Source: Stata outcomes

The next paragraph discusses the overview of the regression assumption for model 8.

6.4.8.9 Overview of the Regression Assumption for model 8

All of the regression assumptions, including normality and autocorrelation, are satisfied, except the heteroscedasticity of model 8. The heteroscedasticity barrier may have affected the determining coefficient because the random effect model performed better than the fixed effect model. The useful generalised least squares (FGLS) are used in the study to take autocorrelation, standard error, and heteroscedasticity into account. According to Hansen (2007), feasible generalised least squares generate improved efficacy and successful tests than the random effect model by considering serial correlation. Table 6.63.1 indicates the results of OLS robust, random effect and fixed effect. Column (1) presents the results of OLS robust. The results show that corporate social investment has an insignificant positive relationship with asset return. Also, BBBEE investment has an insignificant positive relationship with asset return. Market capitalisation has an insignificant negative relationship with asset return.

Column (2) presents the results of random effect estimator. The results show that corporate social investment has an insignificant positive impact on asset return. Similarly, BBBEE investment has an insignificant positive relationship impact on asset return. Market capitalisation has an insignificant negative impact asset return.

Column (3) presents the results of fixed effect estimator. The results show that corporate social investment had an insignificant positive impact on asset return. The BBBEE investment had an insignificant positive relationship impact on asset return. Market capitalisation had an insignificant negative impact on asset return.

Table 6.63.1 results of OLS robust, random effect and fixed effect for model 8

Variables	(1) OLS robust Asset return	t	(2) Random effect Asset return	(3) Fixed effect Asset return
Corporate Social Investment	0.0892*	1.48	0.0892*	0.116*
	(0.0601)		(0.0780)	(0.0898)
BBBEE investment	0.971*	1.83	0.971*	0.981*
	(0.531)		(0.485)	(0.532)
Market capitalisation	-0.770*	-1.48	-0.770*	-0.772*
	(0.521)		(0.429)	(0.471)
Constant	-0.0153	-0.17	-0.0153	-0.0165
	(0.0891)		(0.0957)	(0.105)
Observations	96		96	96
R-squared	0.053			0.066
Number of Code			24	24
sigma_u			0	0.286
sigma_e			0.996	0.996
Rho			0	0.0761

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next section discusses the interpretation for model 8 FGLS and PCSE results

6.4.8.10 Interpretation for model 8 FGLS and PCSE results

Table 6.64 demonstrates the findings for the model 8 feasible generalised least squares. This regression analysis was carried out because the panel data showed evidence of heteroscedasticity. This suggests that the study's conclusions have been inflated and should not be trusted until the heteroscedasticity problem has been fixed. The generalised least squares approach is utilised to guarantee accuracy and take heteroscedasticity into account. To ensure the validity of the results, the feasible generalized least squares method accounts for cointegration, serial correlation, and

heteroscedasticity. Cross-sectional dependence is checked for, and the consistency of the results is observed, using panel corrected standard error (Adeleye *et al.,* 2022; Alferez, 2024). The generalised least squares method has been employed to discuss the results of the study. Table 6.63 column (1) presents the results of feasible generalised least squares. The results show that corporate social investment had an insignificant positive impact on asset return. The BBBEE investment had an insignificant positive relationship impact on asset return. Market capitalisation had an insignificant negative impact asset return. Column (2) presents the results of panel corrected standard error estimator. The results show that corporate social investment has an insignificant positive impact on asset return. The BBBEE investment has an insignificant positive relationship impact on asset return. Market capitalisation has an insignificant negative impact on asset return.

Table 6.64 feasible generalised least squares and panel corrected standard error for model 8

	(1)		(2)
	Main results		
	FGLS	z	PCSE
Variables	Asset return		Asset return
Corporate Social Investment	0.0892*	1.17	0.0892*
	(0.0763)		(0.0768)
BBBEE investment	0.971*	2.05	0.971*
	(0.475)		(0.0452)
Market capitalisation	-0.770*	-1.83	-0.770*
	(0.420)		(0.0297)
Constant	-0.0153	-016	-0.0153**
	(0.0937)		(0.00671)
Observations	96		96
R-squared			0.053
Number of Code	24		24

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Source: Stata outcomes

The next section discusses the overview of the first level of analysis.

6.5 Overview of the first level analysis

This section discusses the results of the secondary data of the study by sequence according to research objectives 1-4. The aim of this study was to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return). This study used 24 FTSE/JSE Responsible Investment Index companies for a period of five (5) years (2017-2021). The fixed effect model and the random effect model are two panel data analysis methodologies that are used to address the issue of unobserved variation in the relations between corporate sustainability investment, resource efficiency and profitability. The choice between the fixed effect model and the random effect model was made using the Hausman test. For the purposes of this study, however, a feasible generalised least square (FGLS) regression model was used. This is because it deals with autocorrelation and heteroscedasticity and cross-sectional dependence was controlled by PCSE. To the greatest extent possible, the study results' validity depends on the FGLS regression model's capacity to take regression assumptions into account.

6.5.1 Discussion of results for research objective 1

The first research objective of the study was to determine the relationship between corporate environmental investment and resource efficiency. The objective had two models where the variables for the model 1 were as follows: Dependent variable water consumption (for resource efficiency) and independent variables investment in renewable energy, water investment, and recycling investment with control variable market capitalisation. Model 2 had the following variables: dependent variable energy consumption, independent variables and independent variables investment in renewable energy, water investment, and recycling investment with control variable market capitalisation.

The results in Table 6.9 for model 1 revealed that investment in renewable energy was positive and insignificant predictor of water consumption. On the other hand, water investment and market capitalisation were inversely related to water consumption, and they are insignificant predictors. Recycling investment indicated a negative significant relationship to water consumption. Based on the results, three out of four of the proxies

of environmental investment were negative predictors of water consumption. Thus, based on dominance it is concluded that environmental investment is negatively related to water consumption. These findings are in line with those of Bătae *et al.* (2021) where they established a positive relationship between environmental innovation and environmental emissions (environmental investment) and water usage. However, the results of the study are contrary to Bătae *et al.* (2021) with respect to the impact of water investment, recycling investment and market capitalisation on water consumption. The result of the study concurs with that by Zhang and Xie (2022), revealing a negative relationship between investment in greenness on energy consumption (resource efficiency). Additionally, Zhao and Rasoulinezhad (2023) found a negative relationship between environmental investment and resource efficiency.

The results for model 2 in Table 6.17 revealed that investment in renewable energy has an insignificant positive impact on energy consumption. Water investment and recycling investment have insignificant negative impacts on energy consumption. However, market capitalisation has an insignificant positive impact on energy consumption. The findings indicate that two of the four environmental investment variables are negatively correlated with water consumption. Therefore, it may be inferred from dominance that there is a negative correlation between environmental investment and water consumption based on model 1 and 2. The findings are consistent with those of Chang *et al.* (2021) find a negative relationship between renewable energy (environmental investment) and use of energy (resource efficiency). Zhang, Liu, Zhang and Ma (2023) found a positive relationship between environmental investment and resource efficiency. According to Adomako *et al.* (2023), the stakeholder theory suggests that being environmentally conscious enables for the development of innovative, resource-efficient, and environmentally friendly practices. Tan *et al.* (2022) suggest that a great number of individuals want to invest in companies that are involved in sustainability by maintaining a clean environment through their environmental initiatives. The findings are in contrast with the stakeholder theory since there is an indication that environmental investment is not related to the resource efficiency while the theory is in support of satisfaction of stakeholder needs. According to the theory, companies are social institutions that have a duty to their stakeholders, which includes protecting the environment (Waheed & Zhang, 2020;

Bischoff, 2021). Stakeholder pressure, according to agency theory, may lead companies to partially disregard social or environmental regulations, which could hinder their ability to use resources efficiently (Adomako, Simms, Vazquez-Brust & Nguyen, 2023).

The implication of the findings on the South African economy and resource efficiency of companies used is stated below:

The results of research objective 1 indicated a negative relationship between corporate environmental investment and resource efficiency. This suggests that the economy would suffer greatly if corporate environmental investments were not made since there would be significant environmental harm, such as pollution, which would exacerbate climate change. As a result, businesses' resource efficiency would be poorly maintained, and environmental harm would negatively impact the environment in which they operate. Companies used in this study can consider obtaining environmental literacy and keeping up with regulatory developments to help them in their future interactions with resource efficiency and environmental investment.

6.5.2 Discussion of results for research objective 2

The second research objective of the study was to analyse the effect of corporate social investment on resource efficiency. The research objective had two models which were as follows: model 3 with dependent variable water consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation. Model 4 follows dependent variable energy consumption and independent variables corporate social investment, BBBEE investment and control variable market capitalisation.

The results in Table 6.25 show that corporate social investment had an insignificant positive effect on water consumption. BBBEE investment had an insignificant positive influence on water consumption. Market capitalisation had an insignificant negative relationship with water consumption. Based on the findings, three out of three variables of corporate social investment were correlated to water consumption. Therefore, it is concluded that based on the dominance there existed a positive impact between corporate social investment and water consumption.

Table 6.33 show results of model 4 that indicate that corporate social investment had an insignificant positive impact on energy consumption. While BBBEE investment had a significant negative impact on energy consumption. Market capitalisation had a significant positive impact on energy consumption. Based on the results, two out of three variables of corporate social investment were correlated to energy consumption. Therefore, it is concluded that based on the dominance there was a positive impact between corporate social investment and energy consumption. The results are in contrast to that by Joshi *et al.* (2022) which showed a positive relationship between community donations and education (corporate social investment) and energy usage (resource efficiency). On the other hand, the results were not consistent with that by Gachie (2021) who found a negative relationship between training and education, donations (corporate social investment), BBBEE investment, and energy usage (resource efficiency). Wojewnik-Filipkowska *et al.* (2019) assert that, in addition to maximising profits, corporations should also fulfil their needs whether they be social, environmental, or economic as this is a key component of the stakeholder theory. Profit maximisation and resource efficiency are balanced when stakeholders in businesses that practice sustainability have a thorough awareness of social sustainability (Yang, Miao, Zhang & Xie, 2022).

The implication of the findings on the South African economy and resource efficiency of companies used is stated below:

The results of the findings indicate a positive relationship between corporate social investment on resource efficiency. This suggests that if companies make social investments, the South African economy would expand more since employment would be created and more effective methods of production will be developed. Due to the capabilities derived from the social investment efforts provided by companies, this would aid in the economic transformation. Increased awareness of the value of environmental health would benefit the primary resource efficiency of the companies included in the study. Companies may become more competitive and foster innovation by promoting resource efficiency.

6.5.3 Discussion of results for research objective 3

The third research objective of the study was to evaluate the impact of corporate environmental investment on profitability. The research objective had two models which were as follows:

Table 6.41 show results of model 5 that indicate that investment in renewable energy has an insignificant positive impact on net profit. Recycling investment and market capitalisation had an insignificant positive impact on net profit. Water investment had an insignificant positive influence on net profit. The findings are consistent with that of Liu *et al.* (2022) find a positive relationship between profitability, green investment, carbon dioxide emissions (environmental investment) and net profit (profitability). Additionally, it is revealed that there is a positive relationship between renewable investment and net income (Prokopenko *et al.,* 2023). Whilst Zhang and Xie (2022) find a negative relationship between investment in greenness on gross profit (profitability).

Table 6.49 show the results of model 6 that indicate that investment in renewable energy had an insignificant positive effect on asset return. Water investment had an insignificant positive effect on asset return. Recycling investment had an insignificant positive impact on asset return. While market capitalisation had an insignificant negative impact on asset return. The results are consistent with that of Bătae *et al.* (2021) find a positive relationship between environmental innovation and environmental emissions (environmental investment) on return on asset (profitability). Chang *et al.* (2021) finds a negative relationship between renewable energy (environmental investment) and total assets (profitability). When stakeholders in businesses that practice sustainability have a deep understanding of environmental sustainability, profit maximisation, and resource efficiency are balanced. Reinforcement theory states that companies must figure out how to strategically invest in sustainability by incorporating their values if they want to reap the benefits of high profitability and resource efficiency (Durall, 2022).

The implication of the findings on the South African economy and resource efficiency of companies used is stated below:

The results in the study state that there existed an impact of corporate environmental investment on profitability. This suggests that additional environmental investments benefit the economy and enable the mitigation of environmental harms by expanding the South African economy and companies. Growing environmental investments help companies that make environmental initiatives see the long-term benefits of their investments. Most companies that invest in the environment favour green energy because it appeals to their clientele and builds loyalty brands, both of which promote companies' profitability.

6.5.4 Discussion of results for research objective 4

The fourth research objective of the study was to analyse the influence of corporate social investment on profitability. The research objective had two models which were as follows:

Table 6.56 shows results for model 7 that indicates that corporate social investment has a significant positive impact on net profit. Similarly, BBBEE investment has a significant negative relationship impact on net profit. Market capitalisation has an insignificant positive impact on net profit. The results are consistent with that by Joshi *et al.* (2022) who reported a positive relationship between community donations and education (corporate social investment) and net profit margin (profitability). However, the study of Gachie (2021) found a negative relationship between training and education, donations (corporate social investment), BBBEE investment and net profit (profitability), which is not consistent with the results of model 7.

The results in Table 6.63 on model 8, indicating that corporate social investment had an insignificant positive impact on asset return. The BBBEE investment had an insignificant positive relationship impact on asset return. Market capitalisation had an insignificant negative impact on asset return. The results are consistent with that of Ajayi and Akinsomi (2022) which revealed a positive relationship between BBBEE investment (social investment) and return on assets (profitability). While Saeed *et al.* (2021) and Suwasono (2021) found a negative relationship between corporate social investment (social investments) and return on assets (profitability), which is not consistent with the results of model 8. Stakeholder theory is consistent with the results since it alludes that corporate environmental and social responsibilities serve as a

major foundation for achieving stakeholders' economic expectations (Boakye, Tingbani, Ahinful & Nsor-Ambala, 2021). While reinforcement theory argues that companies must figure out how to strategically invest in sustainability by incorporating their values if they want to reap the benefits of high profitability and resource efficiency (Durall, 2022).

The implication of the findings on the South African economy and resource efficiency of companies used is stated below:

The results in the study reveal a positive influence of corporate social investment on profitability. Social investments have the potential to strengthen the South African economy by supporting local communities and improving infrastructure. In addition to lowering government expenses, social investment can maximise human capital productivity, transforming citizens into contributors to the economy and making them a key driver of economic progress. The companies' resource efficiency will be preserved.

6.6 SUMMARY OF THE CHAPTER

The aim of the study was to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return) of companies listed in FTSE/JSE Responsible Investment Index. The study had six research objectives and four of them were analysed quantitatively in this chapter. The first research objective was to determine the relationship between corporate environmental investment and resource efficiency of companies listed in FTSE/JSE Responsible Investment Index. The results from the two models indicated a negative relationship between corporate environmental investment and resource efficiency of the participant companies listed in FTSE/JSE Responsible Investment Index. The second research objective was to analyse the effect of corporate social investment on resource efficiency of companies listed in FTSE/JSE Responsible Investment Index. The results revealed a positive effect of corporate social investment on resource efficiency of the companies, all listed in FTSE/JSE Responsible Investment Index. The third research objective was to evaluate the impact of corporate environmental investment on profitability of companies listed in FTSE/JSE Responsible Investment Index. The

results indicated a significant positive impact of corporate environmental investment on profitability of companies listed in FTSE/JSE Responsible Investment Index. The fourth research objective was to analyse the influence of corporate social investment on profitability of companies listed in FTSE/JSE Responsible Investment Index. The results indicated a significant positive influence of corporate social investment on profitability of companies listed in FTSE/JSE Responsible Investment Index.

This chapter presented the main results of the quantitative data analysis of the study. The chapter illustrated the quantitative data analysis for 8 models developed from research objective 1-4, in tables showing the statistical tests summary of the statistics shown by descriptive data. Results presented in the Tables indicate correlation analysis, cross sectional dependence, unit root and cointegration of model 1 to 8 together with the diagnostic tests results of heteroskedasticity, autocorrelation, Hausman test in table forms while the results of test of normality was graphically illustrated for models 1 to 8. It was discovered that the outcomes of the Hausman tests would not be used due to the outcomes of the diagnostic tests therefore after considering many factors, the study employed the feasible generalised least squares to base its results of the quantitative data analysis and the regression assumptions were not violated hence the regression model produced reliable and valid results to answer the research question and objectives 1-4 of the study.

The next chapter outlines the qualitative data analysis and development of a framework for the study.

CHAPTER 7- QUALITATIVE DATA ANALYSIS AND DEVELOPMENT OF FRAMEWORK

7.1 INTRODUCTION

The previous chapter discussed the quantitative data analysis, and this chapter deals with presentation, analyses and interpretation of the qualitative data analysis of primary data using the thematic data analysis. This chapter covers the questionnaire's content, demographics, and analysis of the information gathered from questionnaire replies (see Appendix C). The questionnaires were sent to CEOs and environmental officers through emails over google forms which a link.

This chapter aims to respond to research objective 5 which is: to determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment. This was done through the researcher's collection and interpretation of data. Since this study used a qualitative data analysis method, respondents' quotes were used to support the analysis. The themes were prepared in alignment with research objective 5.

7.2 DEMOGRAPHICS OF THE QUESTIONNAIRE

Thirty CEOs and environmental officers of the sampled companies answered the research questionnaire. The respondents were asked to submit details about their biography, including their age, gender, level of education attained, employment status, and number of years worked for the company. The demographic data in Section A of the questionnaire augmented the study's validity and reliability by letting participants know the quality of the questionnaire that was used. The following charts indicate the demographic data of all the respondents:

7.2.1 Age

Figure 7.1 indicates the age of all the respondents ranged between the ages of 20 to 69 with most of the respondents ranging from 40 to 49 of age with 26% while the lowest is 60 to 69 of age.

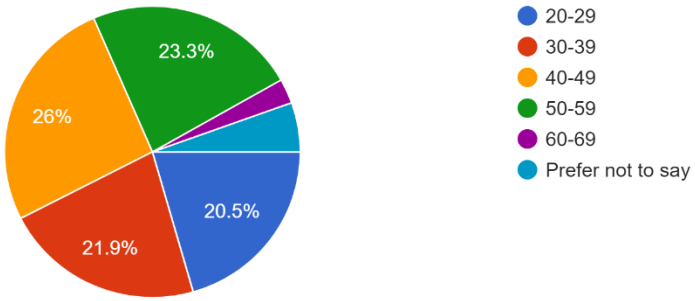

Figure 7.1: Age

Source: Researcher

The next section presents the gender of the respondents.

7.2.2 Gender

Figure 7.2 indicates information about the gender of the respondents, which indicates most respondents being male.

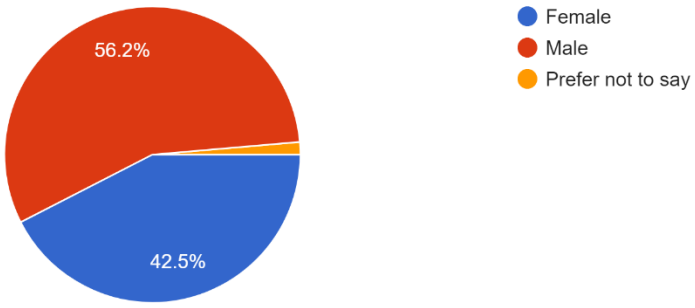

Figure 7.2: Gender

Source: Researcher

The next section presents the education of the respondents.

7.2.3 Education

Figure 7.3 indicates the education (highest qualification) of the respondents, and it shows that most of the respondents have obtained their postgraduate qualifications.

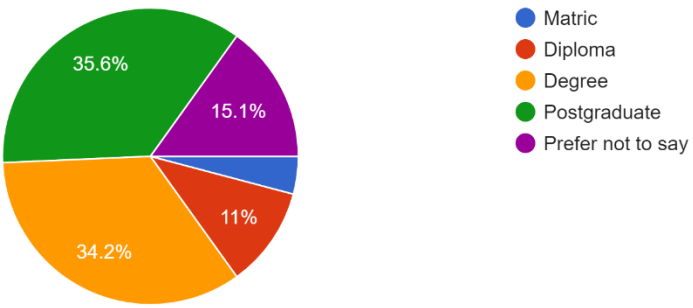

Figure 7.3: Education of respondents

Source: Researcher

The next section presents the employment status of the respondents.

7.2.4 Employment status

Figure 7.4 indicates the employment status of the respondents with most of them being full-time employees.

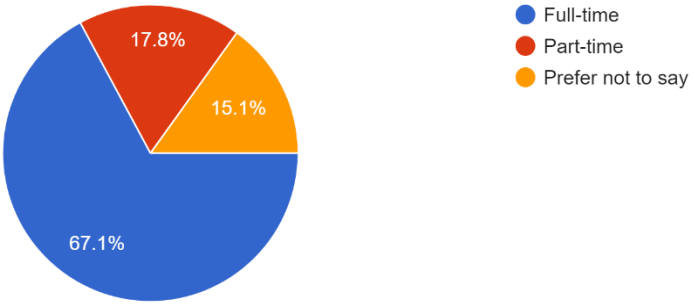

Figure 7.4: Employment status

Source: Researcher

The next section presents the years of employment of t/he respondents.

7.2.5 Years of employment

Figure 7.5 indicates the years of employment of the respondents where most of them are 4 to 6 years.

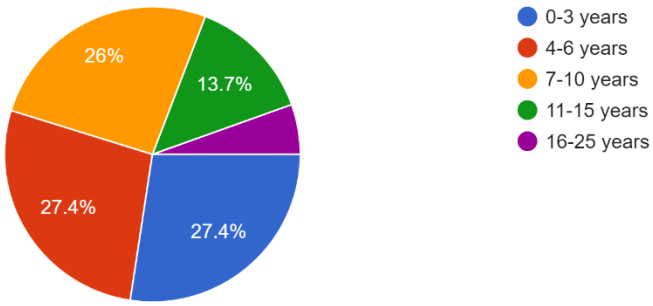

Figure 7.5: Years of employment

Source: Researcher

7.3 QUESTIONNAIRE

The researcher used a questionnaire to collect data from the study CEOs as well as environmental officers of the selected companies. Before sending the questionnaire to the intended respondents, the researcher collected data in accordance with all university research ethics protocols. Appendix C, which is attached, contains the questionnaires' format and content. The questionnaire, which was in the form of a Google Form, was sent to respondents by email, which was verified by calling the company's headquarters. Email responses were received, and the information was recorded appropriately.

7.4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This section presents the data collected from the questionnaires and the thematic approach was used to provide for the analysis of the data collected over responses of the respondents and it was interpreted.

7.4.1 Thematic analysis

The thematic analysis was employed to analyse the primary data collected by the researcher. Table 7 indicates the themes identified from the research questionnaires, which aimed to answer research objective 5, which was to determine the extent to which corporate eco-efficiency and profitability attract improved sustainability investment.

Table 7.1: Identification of themes:

Theme	**Subthemes**
Theme:1 Improved resource efficiency and additional environmental investment	Sub-theme 1.1- Reduction in energy consumption attracts investment in renewable energy. Sub-theme 1.2- Reduction in energy consumption attract investment in water reduction and recycling investment Sub-theme 1.3 - Reduction in water consumption attract investment in renewable energy.
Theme:2 Improved profitability and additional environmental investment	Sub-theme 2.1- improved net profit attracts investment in recycling. Sub-theme 2.2- improved net profit attract investment in water reduction Sub-theme 2.3- improved net profit attract investment in renewable energy Sub-theme 2.4- improved asset return attract investment in recycling Sub-theme 2.5- improved asset return attract investment in water reduction Sub-theme 2.6- improved asset return attract investment in renewable energy
Theme:3 Improved resource efficiency and additional social investment	Sub-theme 3.1-Reduction in energy consumption attract corporate social investment Sub-theme 3.2- Improved water reduction attract corporate social investment

	Sub-theme 3.3- Reduction in energy consumption attract BBBEE investment Sub-theme 3.4- Reduction in energy consumption attract BBBEE investment
Theme:4 Improved profitability and additional social investment	Sub-theme 4.1- Improved net profit attract corporate social investment Sub-theme 4.2- Improved asset return attract corporate social investment -Corporate social investment Sub-theme 4.3- Improved net profit attract BBBEE investment Sub-theme 4.4- Improved asset return attract BBBEE investment.

Source: Researcher

The next section presents and discusses the themes of the second level of analysis.

7.4.1.1 Theme 1: Improved resource efficiency attract additional environmental investment

This theme compiles the data provided by the respondents on improved resource efficiency and additional environmental investment with different sub-themes.

7.4.1.1.1 Sub-theme 1.1- Reduction in energy consumption attracts investment in renewable energy.

To get information about improved resource efficiency and additional environmental investment, the following question was asked: “In your view, would you think that reduction in energy consumption motivate your company to seek further investment in renewable energy”. In responding to the question, the respondents are quoted below:

Res1: *“*Reduction in energy does motivate our company to seek further investments on renewable energy sources.”

Res2: “It does motivate my company to go towards renewable resources as it will reduce carbon emissions.”

Res5: “Yes, there is a need for the company to seek further investment in renewable energy because when there is a reduction in energy consumption it means there will be a reduction in emitted pollution which will then create a need to invest in renewable energy.”

Res8 “Yes, it motivates my company to seek further investment as this reduction might assist in maximising company profits”.

Res9: “Yes, it motivates my company to seek further investment as this reduction might assist in maximising company profits”.

Res10: “Yes, because too much energy consumption limits any form of alternative energy generation”.

Res11: “Yes, the investment in renewable energy is of paramount important as it will assist us to really reduce the energy consumption”.

Res13: “No, energy is needed for the company to attract investment”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 1.1 where respondents had a multiple-choice question, and they all responded to it which gives a summary of the respondents above. The question posed to the respondents was as follows: Reduction in energy consumption motivates my company toward any of the following:

a. Additional heavy investment in renewable energy
b. Additional moderate investment in renewable energy
c. Additional minor investment in renewable energy
d. No additional investment in renewable energy

Figure 7.6 indicates that there was a 43.8% tie, which reveals that there was need for additional heavy investment in renewable energy and additional moderate investment in renewable energy while 11% indicated that there was additional minor investment in renewable energy. On the other hand, 1.4% indicated that there was no additional investment in renewable energy.

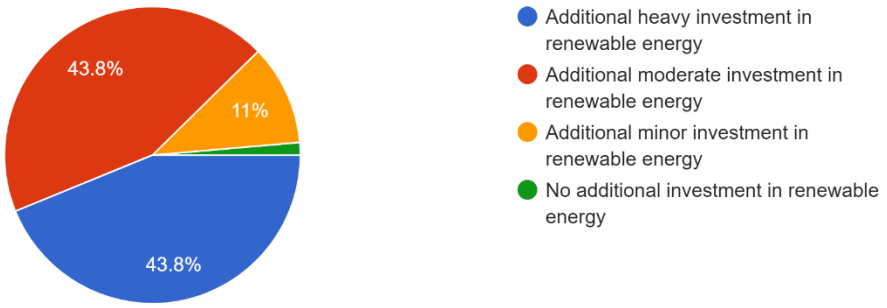

Figure 7.6: Theme 1 subtheme 1.1 Source: Researcher

From the information above obtained from the respondents, it was revealed that there is a need for the investment in renewable energy by most companies.

7.4.1.1.2 Sub-theme 1.2- Reduction in energy consumption attract investment in water reduction and recycling investment

To get information about improved resource efficiency and additional environmental investment, the following question was asked: "In your view, would you think that reduction in energy consumption motivate your company to seek further investment in water reduction and recycling investment". In responding to the question, the respondents said:

Res1: "It does play a role in recycling investments and also the conservation of water resources in our company".

Res2: "It's motivate my company to invest in recycling since it will help carbon emissions".

Res3: "Not sure."

Res7: “This reductions are part of being eco-efficient and as such they improve profits if well managed. My company should therefore be motivated”.

Res8: “Yes, there can be alternative energy can be encouraged”.

Res9: “Yes, saving on the energy consumption will motivate our company to invest in other projects such as recycling investment”.

Res10: “No, I don't think so because they are unrelated”.

Res11: “No, energy is needed to invest in recycling”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 1.2, where the respondents had a multiple-choice question, and they all responded to. Reduction in energy consumption motivates the company toward any of the following:

a. Additional heavy investment in water reduction and recycling investment.
b. Additional moderate investment in water reduction and recycling investment.
c. Additional minor investment in water reduction and recycling investment.
d. No additional investment in water reduction and recycling investment.

Based on the responses from figure 7.7, 45.2% required moderate investment in water reduction and recycling investments and 37% required additional heavy investment in water reduction and recycling investments. 15.1% required an additional minor investment in water reduction and recycling investments whereas 2.4% required no additional investment in water reduction and recycling investments

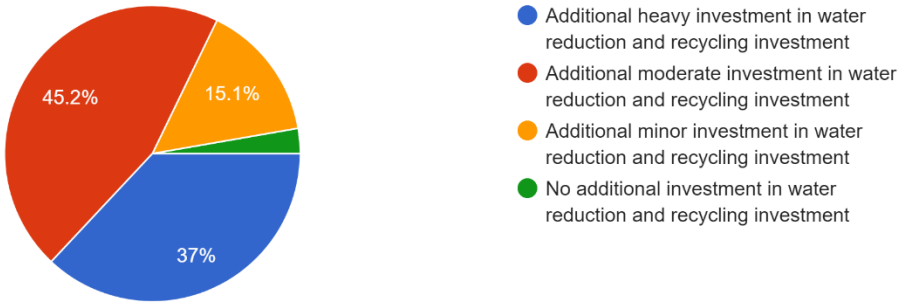

Figure 7.7: Theme 1 subtheme 1.2 Source: Researcher

7.4.1.1.3 Sub-theme 1.3 - Reduction in water consumption attract investment in renewable energy.

To get information about improved resource efficiency and additional environmental investment, the following question was asked: “In your view, would you think that reduction in water consumption motivate your company to seek further investment in renewable energy”. In responding to the question, the respondents are quoted below:

Res1: “Yes, it does motivate because we need energy to be able to have water so the water reduction highly motivates investment on renewable energy”.

Res3: “No, water consumption and renewable energy are two different aspects”.

Res4: “In our company, the reduction in water consumption wouldn't affect the investment in renewable energy much”.

Res5: “Yes, as long as water reduction enhances performance, the company should be motivated to seek for investment in renewable energy”.

Res6: “In our company, water is a major problem and the reduction in water consumption would mean that we reuse the water in some of the processes of production which would encourage us to invest more in renewable energy by equipment that will be used for a long term”.

Res10: “No, they are unrelated on my side, I do not need renewable energy to pump water”.

Res11: “Yes, the water can be used as an alternative in terms of renewable energy”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 1.3, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Reduction in water consumption motivates my company toward any of the following”:

a. Additional heavy investment in water reduction and recycling investment.
b. Additional moderate investment in water reduction and recycling investment.
c. Additional minor investment in water reduction and recycling investment.
d. No additional investment in water reduction and recycling investment.

Based on responses from figure 7.8, 38.4% require additional heavy investment in water reduction and recycling investment and 34.2% require additional moderate investment in water reduction and recycling investment, while 20.5% require additional minor investment in water reduction and recycling investment. 6.7% require no additional investment in water reduction and recycling investment.

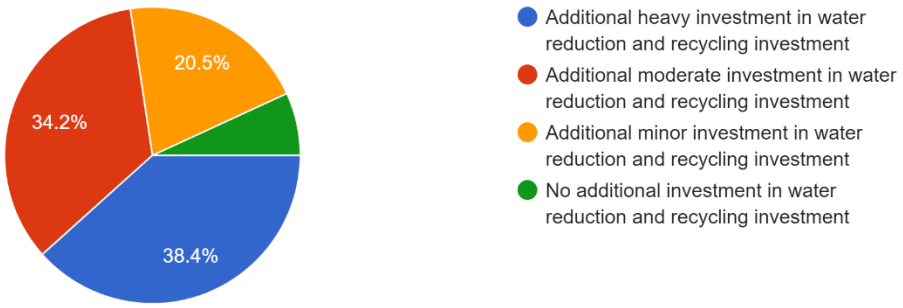

Figure 7.8: Theme 1 subtheme 1.3 Source: Researcher

Theme 1 revealed that improved resource efficiency makes companies require additional environmental investment, which is consistent with Buda and Ricz (2023) as they found that there is a positive relationship between environmental investment and resource efficiency. The findings from theme 1, which comprised subtheme 1.1 to subtheme 1.3 indicated that the respondents accepted that their company’s reduction

in energy consumption motivates their companies toward further investment in environmental investment using investment in renewable energy, investment in water reduction and recycling as proxies. The respondents reveal that need no additional environmental investment are insignificant as indicated in the percentages presented in subtheme 1.1 to subtheme 1.3. Additionally, Bătae, Dragomir and Feleagă, (2021) revealed that there is a positive relationship between environmental sustainability and stakeholder theory.

The next section discusses theme 2 with 6 subthemes.

7.4.2 Theme 2: Improved profitability attracts additional environmental investment

This theme compiles the data provided by the respondents on the improved profitability and additional environmental investment with different sub-themes.

7.4.2.1 Sub-theme 2.1- improved net profit attracts investment in recycling.

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved net profit motivates your company to seek further investment in recycling”. In responding to the question, the respondents are quoted below:

Res2: “No, there is no need for further investment in recycling”.

Res3: “Yes…”.

Res4: “In our company, investment in recycling is what we are working towards and the improved net profit would assist in having more money to invest in recycling that would assist with being environmentally friendly”.

Res5: “Yes, when net profit is enhanced resulting from strategies such as recycling, my company should be motivated to invest more in recycling”.

Res8: “Yes, expansion in recycling tend to save future costs in production”.

Res9: “Yes, any retained profit at year-end will mostly be directed to other investments on the pipeline e.g. investment in recycling”.

Res11: “No, the profit can be used to expand the company and not to seek further investment”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 2.1, where the respondents had a multiple-choice question, and they all responded to it, which summarises the responses above. “Improved net profit motivates my company toward any of the following”:

Improved net profit motivates my company toward any of the following:

a. Additional heavy investment in recycling.
b. Additional moderate investment in recycling.
c. Additional minor investment in recycling.
d. No additional investment in recycling.

Based on responses shown in figure 7.9, 34.2% require additional heavy investment in recycling, 27.4% require additional moderate investment in recycling while 24.7% require additional minor investment in recycling and only 13.7% require no additional investment in recycling.

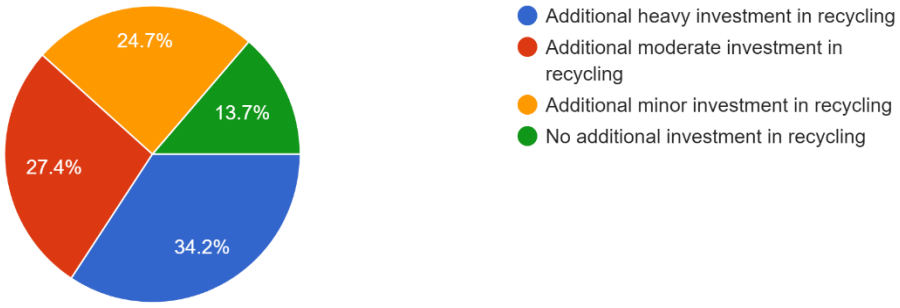

Figure 7.9: Theme 2 subtheme 2.1

7.4.2.2 Sub-theme 2.2- improved net profit attract investment in water reduction

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved net profit motivate your company to seek further investment in water reduction”. In responding to the question, the respondents are quoted below:

Res1: “It moderately influence the investment in water reduction”

Res3: “Yes, water is a scarce resource, improved net profit will encourage investment in water reduction, without water there is no production that takes place in the company. Coming up with strategies that save water will be efficient not only for the company but for the whole world”.

Res5: “Yes, when net profit is enhanced resulting from strategies such as reduction in water usage, my company should be motivated to invest more in water conservation…”.

Res6: “In manufacturing companies like ours, it will be of great benefit to have an improvement in net profit, and this would lead to the need to seek investment in water reduction because there is a need for our company to save water and by investing in water reduction we will benefit and increase our profits more”.

Res7: “Yes, because the amount paid to the water suppliers will reduce, making the operating expenses to decrease and that lead to increased net profit. The company should be motivated”.

Res9: “No, The profit will be channelled to investment in recycling”.

Res12: “Yes, less costs are incurred by the company which motivates further water reduction”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 2.2, where the respondents had a multiple-choice question and they all responded to it, which gives

a summary of the responses above. “Improved net profit motivates my company toward any of the following”:

a. Additional heavy investment in water reduction.
b. Additional moderate investment in water reduction.
c. Additional minor investment in water reduction.
d. No additional investment in water reduction.

Figure 7.10 indicates that there is 37% need for additional moderate investment in water reduction, 27.4% need for additional heavy investment in water reduction, 23.3% need for additional minor investment in water reduction and 12.3% for \no additional investment in water reduction.

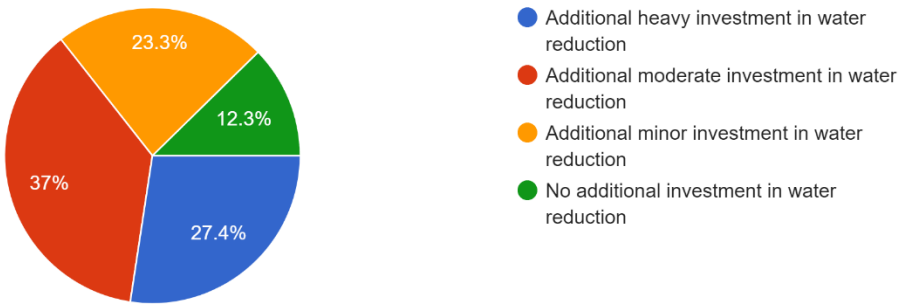

Figure 7.10: Theme 2 subtheme 2.2 Source: Researcher

7.4.2.3 Sub-theme 2.3- improved net profit attract investment in renewable energy

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved net profit motivate your company to seek further investment in renewable energy”. In responding to the question, the respondents are quoted below:

Res1: “Improved net profits are the main drive to renewable energy investments in our company”.

Res2: “We mostly invest in solar energy since there’s an increased load shedding.”

Res3: “Not really”

Res4: “Yes, most companies are now moving to better energy innovations therefore the improved net profit of the company would assist the company in investing more in renewable energy which brings about more innovative ways to sustain production in companies”.

Res6: “Improved net profit means good performance which calls for investors and investment in renewable energy is one of the environmental investments that the company would like to engage in so the improved net profit will assist with the investment for the company to have stable energy”.

Res7: “Yes, because the amount paid to electricity suppliers will reduce, making the operating expenses to decrease and that lead to increased net profit. The company should be motivated”.

Res9: “Yes, investment in renewable energy is part of the company's focus area, we are intending on going green in our company”.

Res10: “Yes, improved net profit makes it possible to seek investment in renewable energy as it is an investment, and future savings on electricity cost will be earned”.

Res12: “Yes, renewable energy is good for the environment and saves the company money”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 2.3, where respondents had a multiple-choice question, and they all responded to it, which is a summary of the responses above. “Improved net profit motivates my company toward any of the following”:

a. Additional heavy investment in renewable energy.
b. Additional moderate investment in renewable energy.
c. Additional minor investment in renewable energy.
d. No additional investment in renewable energy.

Figure 7.11 indicates that 39.7% of the respondents require additional heavy investment in renewable energy, 35.6% of the respondents require additional moderate investment in renewable energy while 13.7% of the respondents require additional minor investment in renewable energy and 11% require no additional investment in renewable energy.

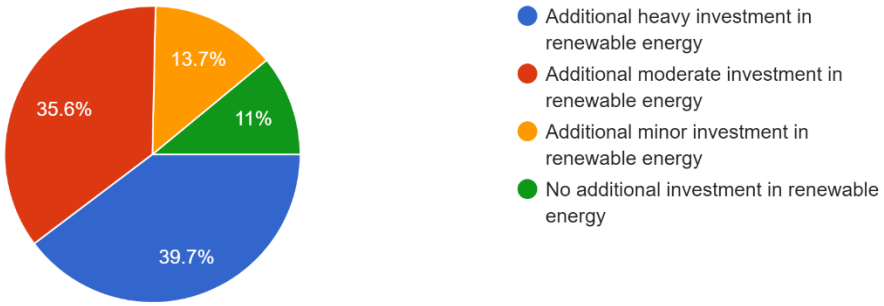

Figure 7.11: Theme 2 subtheme 2.3 Source: Researcher

7.4.2.4 *Sub-theme 2.4- improved asset return attract investment in recycling*

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved asset return motivate your company to seek further investment in recycling”. In responding to the question, the respondents are quoted below:

Res1: “Investment on recycling is not influenced by improved assets in my company”.

Res3: “No, there is no correlation between improved asset return and investment in recycling”.

Res4: “Since asset return is a measure of profitability the improved asset return must be maintained to assist with the investment in recycling, the improved asset return will increase the investment in recycling since most companies from our field will see a need to invest in recycling”.

Res5: “Yes, because the more my company invest in recycling, the lesser we spend on buying new material for production and the lesser we pay for dumping fines.This will then lead to enhanced financial performance and improved asset returns”.

Res6: “There is a lot of waste from production that could be recycled and with the improved asset return the company can seek further investment in recycling and this would help to maintain waste from production”.

Res9: “Yes, the profit will be channelled to investment in recycling”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 2.4, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the respondents above. “Improved asset return motivates my company toward any of the following”:

a. Additional heavy investment in recycling.
b. Additional moderate investment in recycling.
c. Additional minor investment in recycling.
d. No additional investment in recycling.

Responses in figure 7.12 indicates that 35.6% of the respondents require additional moderate investment in recycling, 34.2% require additional heavy investment in recycling, 16.4% require additional minor investment in recycling and 13.7% required no additional investment in recycling.

Figure 7.12: Theme 2 subtheme 2.4 Source: Researcher

7.4.2.5 Sub-theme 2.5- improved asset return attract investment in water reduction

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved asset return motivate your company to seek further investment in water reduction”. In responding to the question, the respondents are quoted below:

Res1: “Improved asset’s return does not influence water reduction on our company.”

Res3: “Not really.”

Res4: “Yes, since the investment in water reduction is part of the assets of companies the improved asset return would actually be of importance and the rate of the return would show investors that there is a need to invest in our company”’

Res5: “Yes, for as long as we spend less on water resulting from using less water from municipalities and relying on own water saving strategies, my company should be motivated to invest more in water reduction as it will maximise profits and company asset return will improve more”.

Res6: “When we have better profitability it would mean that we would be able to have more investments in environmental affairs and part of it being investment in water reduction because we will have ways to protect loss of water”.

Res9: “No, The profit will be channelled to investment in recycling”.

Res10: “No, they are unrelated on my side”.

Res11: “No, improved asset return should encourage the company to grow in its internal functions”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 2.5, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Improved asset return motivates my company toward any of the following”:

a. Additional heavy investment in water reduction
b. Additional moderate investment in water reduction
c. Additional minor investment in water reduction
d. No additional investment in water reduction

Responses in figure 7.13 indicate that 34.2% of the respondents require additional heavy investment in water reduction, 28.8% of the respondents require additional moderate investment in water reduction, 23.3% of the respondents require additional minor investment in water reduction and 13.7% require no additional investment in water reduction.

Figure 7.13: Theme 2 subtheme 2.5 Source: Researcher

7.4.2.6 Sub-theme 2.6- improved asset return attract investment in renewable energy

To get information about improved profitability and additional environmental investment, the following question was asked: “In your view, would you think that improved asset return motivate your company to seek further investment in renewable energy”. In responding to the question, the respondents are quoted below:

Res1: “It moderately influences investment on renewable energy”.

Res3: “Not really”.

Res4: “Yes, the improved asset return of our company would motivate the company to seek further investment in renewable energy because most investors would like to see the company production running even when there is loadshedding because when using renewable energy mostly the production process would not be easily affected”.

Res5: “Yes, if the company spend less on energy and electricity in order to continue with their business operations, my company should invest more in renewable energy to gain more profits which will result in improved asset return”.

Res6: “Investment in renewable energy would be much possible with improved asset return as this would help with climate change and improve the security for energy. Hence, our company will seek further investment in renewable energy through improved asset return since the asset return attracts investors”.

Res8: “Yes, renewable energy ensures high returns”.

Res9: “Yes, investment in renewable energy is part of the company's focus area, we are intending on going green in our company”.

The above responses were obtained from respondents and other respondents who responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 2.6, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Improved asset return motivates my company toward any of the following”:

a. Additional heavy investment in renewable energy.
b. Additional moderate investment in renewable energy.
c. Additional minor investment in renewable energy.
d. No additional investment in renewable energy.

Responses in figure 7.14 indicate that 38.4% of respondents require additional heavy investment in renewable energy, 32.9% respondents require additional moderate investment in renewable energy while 15.1% respondents require additional minor investment in renewable energy and 13.7% respondents require no additional investment in renewable energy.

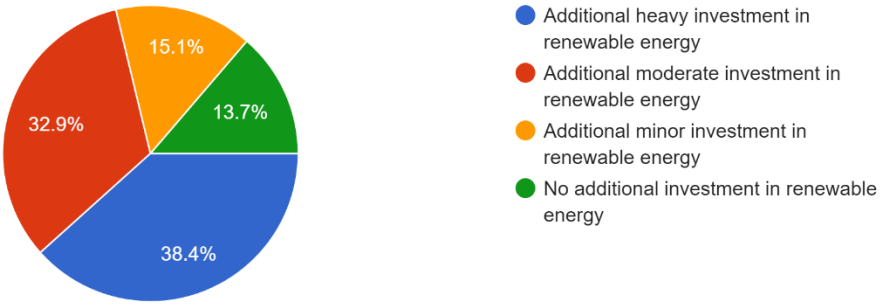

Figure 7.14 Theme 2 subtheme 2.6 Source: Researcher

The second theme demonstrated that improved profitability encourages companies to undertake greater environmental investments, which is correlated with Ibrahim *et al.* (2021) were it was revealed that there is a positive and significant relationship between corporate sustainability investment and profitability. The responses from subtheme 2.1 to subtheme 2.6 indicates that the respondents have accepted that improved profitability motivates companies towards the environmental investment. Reinforcement theory emphasis that companies achieve notable profitability by strategically investing in sustainability while adhering to their basic values, the achievement serve as a reward.

The next section discusses theme 3 with 4 subthemes.

7.4.3 Theme 3: Improved resource efficiency attract additional social investment

This theme compiles the data provided by the respondents on improved resource efficiency and additional social investment with different sub-themes.

7.4.3.1 Sub-theme 3.1-Reduction in energy consumption attract corporate social investment

To get information about improved resource efficiency and additional social investment, the following question was asked: “In your view, would you think that reduction in energy consumption motivate your company to seek further corporate social investment”. In responding to the question, the respondents are quoted below:

Res1: “I wouldn’t say it influences”.

Res2: “Yes…”.

Res3: “Yes, through skill’s development and bursary programmes”.

Res4: “Not really, in our company, corporate social investment is mostly motivated by the profitability of the company”.

Res5: “Yes, because the more we use energy, the more we emit carbon and it affects the society. The more we invest in corporate social, the more the society will feel appreciated”.

Res6: “Yes, a reduction in energy consumption would mean that there would improve the brand of our company and this will improve the working conditions of the employees of the company making it easier seek for more corporate social investment to be used to improve the skills of the employees”.

Res7: “The company should be motivated to attract the society and other stakeholders”.

Res8: “Yes, as there would be more that the company would do to invest in the public for people to benefit”.

Res9: “No, the CSI is already part of our company's priority, it will not depend on the saving on energy consumption”.

Res10: “No, they are unrelated matters on my side”.

Res11: “No, the investment made by the company will add on energy as the company tends to consume more energy and there is no alternative”.

Res12: “No, it just helps more with saving costs to company”.

The above responses were obtained from respondents and other respondents responded with “Yes” while others responded with “No”.

The following question was in line with the question in sub-theme 3.1 where respondents had a multiple-choice question, and they all responded to it which gives

a summary of the respondents above. Reduction in energy consumption motivates my company toward any of the following:

a. Additional heavy investment in corporate social investment.
b. Additional moderate investment in corporate social investment.
c. Additional minor investment in corporate social investment.
d. No additional investment in corporate social investment.

Responses in figure 7.15 indicate that 45.2% require rate additional heavy investment in corporate social investment, 30.1% require additional moderate investment in corporate social investment while 12.3% require additional minor investment in corporate social investment and 12.3% require no additional investment in corporate social investment.

Figure 7.15: Theme 3 subtheme 3.1 Source: Researcher

7.4.3.2 *Sub-theme 3.2- Improved water reduction attract corporate social investment*

To get information about improved resource efficiency and additional social investment, the following question was asked: “In your view, would you think that improved water reduction motivate your company to seek further investment in corporate social investment”. In responding to the question, the respondents are quoted below:

Res1: “It does influence”.

Res2: “Yes… corporate social helps our company to thrive and grow since our communities communicate with us through it”.

Res3: “Not really, water reduction will not have an influence in investing in corporate social investment”.

Res4: “Yes, the improved water reduction would motivate our company to invest in corporate social investment because the usage of water in our company requires that we be involved with communities more to improve production”.

Res6: “Improved water reduction will motivate our company to seek further investment in corporate social investment because this would mean that there will be protection for the environment through the involvement of society”.

Res8: “Yes, this would enable the basic need to supplement the public”.

Res9: “No, the CSI is already part of our company's priority, it will not depend on the saving on energy consumption”.

Res10: “No, they are unrelated on my side”.

Res12: “Yes, company may have extra funds to support community engagements”.

The above responses were obtained from respondents and other respondents responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 3.2, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Improved water reduction motivates my company toward any of the following”:

a. Additional heavy investment in corporate social investment.
b. Additional moderate investment in corporate social investment.
c. Additional minor investment in corporate social investment.
d. No additional investment in corporate social investment.

Responses in figure 7.16 indicate that 39.7% respondents require additional moderate investment in corporate social investment, 26% respondents require additional heavy investment in corporate social investment, 24.7% respondents require additional

minor investment in corporate social investment and 9.6% respondents require no additional investment in corporate social investment.

Figure 7.16: Theme 3 subtheme 3.2 Source: Researcher

7.4.3.3 *Sub-theme 3.3- Reduction in energy consumption attract BBBEE investment*

To get information about improved resource efficiency and additional social investment, the following question was asked: “In your view, would you think that Reduction in energy consumption motivate your company to seek further investment in BBBEE investment”. In responding to the question, the respondents are quoted below:

Res1: “It does not have any influence”.

Res2 “No, reduction in energy consumption does not affect BBBEE”.

Res3: “No, in our company there seems to be no link between energy consumption and BBBEE investment”.

Res4: “Yes, my company should consider investing more in BBBEE”.

Res5: “In our company there isn't much on the BBBEE investment”.

Res6: “Yes, it will motivate the company”.

Res7: “Yes, so the company can expand to a point of hiring and providing skills to the people”.

Res8: “No, the BBBEE is already part of our company's priority, it will not depend on the saving on energy consumption”.

Res9: “No, they are unrelated matters on my side”.

Res10: “No, the company is already well established”.

Res11: “No, there is little link between the two”.

The above responses were obtained from respondents and other respondents responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 3.3, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above.

Responses shown in figure 7.17 indicate that 31.5% of the respondents require additional moderate investment in BBBEE investments, 26% tie of respondents that require additional heavy investment in BBBEE investments and additional minor investment in BBBEE investments. While 16.4% require no additional investment in BBBEE investments.

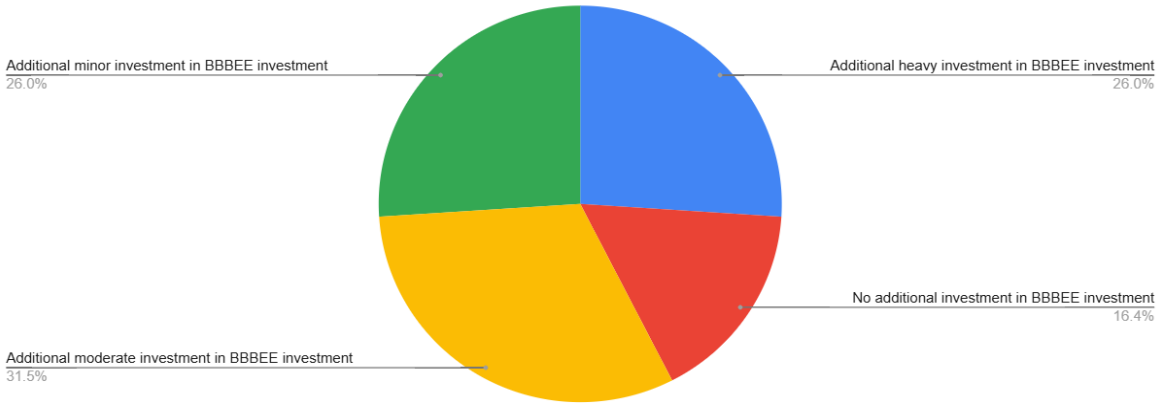

Figure 7.17: Theme 3 subtheme 3.4 Source: Researcher

7.4.3.4 Sub-theme 3.4- Reduction in energy consumption attract BBBEE investment

To get information about improved resource efficiency and additional social investment, the following question was asked: “In your view, would you think that

Reduction in water consumption motivate your company to seek further investment in BBBEE investment". In responding to the question, the respondents are quoted below:

Res1: "It does not have an influence".

Res2: "We invest in BBBEE as we will like to empower our black peoples and Women".

Res3: "No, in our work place they do not relate".

Res4: "No, in our company there seems to be no link between water consumption and BBBEE investment".

Res5: "Yes, my company should consider investing more in BBBEE".

Res6: "In our company there isn't much on the BBBEE investment".

Res7: "Yes, it will motivate the company".

Res8: "Yes, if the company is innovative to get alternative ways of operating with low levels than the company's rating can go high in the BBBEE category".

Res9: "No, the CSI is already part of our company's priority, it will not depend on the saving on water consumption".

Res10: "No, they are unrelated on my side".

Res11: "No, the company is already well established".

Res12: "No, reduction of water consumption saves the environment".

The above responses were obtained from respondents and other respondents responded with a "Yes" while others responded with a "No".

The following question was in line with the question in sub-theme 3.4, where the respondents had a multiple-choice question and they all responded to it which gives a summary of the respondents above. Reduction in energy consumption motivates my company toward any of the following:

a. Additional heavy investment in BBBEE investment.
b. Additional moderate investment in BBBEE investment.
c. Additional minor investment in BBBEE investment.
d. No additional investment in BBBEE investment.

Responses in figure 7.18 indicate that 37% of respondents require additional heavy investment in BBBEE investments, 23.3% of respondents require moderate investment in BBBEE investments, while 24.7% of respondents require additional minor investment in BBBEE investments and 15.1% of respondents require no additional investment in BBBEE investments.

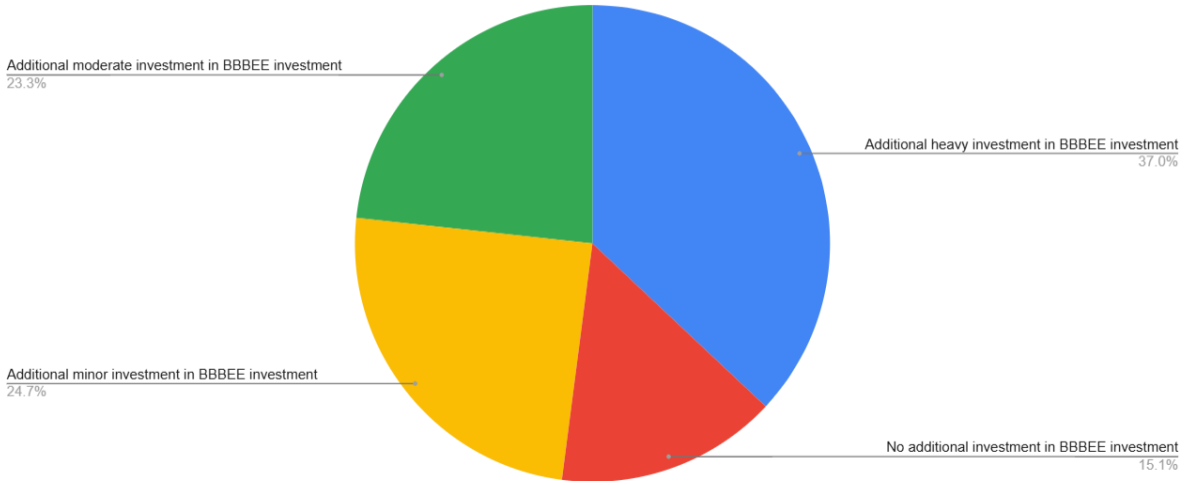

Figure 7.18 Theme 3 subtheme 3.4 Source: Researcher

The third theme demonstrated that improved resource efficiency motivates companies to make larger social investments, which is consistent with that of Joshi *et al*. (2022) where it was revealed that there is a positive relationship between community donations and education (corporate social investment) and energy usage (resource efficiency). Yang *et al.* (2022) alludes that through stakeholder theory profit maximisation and resource efficiency are balanced when stakeholders in companies that practice sustainability have a thorough awareness of social and environmental sustainability.

The next section discusses theme 4 with 4 subthemes.

7.4.4 Theme 4: Improved profitability attract additional social investment

This theme compiles the data provided by the respondents on improved profitability and additional social investment with four sub-themes.

7.4.4.1 Sub-theme 4.1- Improved net profit attract corporate social investment

To get information about improved profitability and additional social investment, the following question was asked: “In your view, would you think that improved net profit motivate your company to seek further investment in corporate social investment”. In responding to the question, the respondents are quoted below:

Res1: “It does have an influence”.

Res2: “It increase our social status around the community”.

Res3: “Yes, if we have net profit that is improved this encourages more investment in CSI”.

Res4: “Yes, in our company improved net profit would motivate us to seek more investment in corporate social investment because there are activities that are linked to corporate social investment that assist to improve profitability in our company, therefore there is a need for our company to increase corporate social investment”.

Res5: “Yes, because the more the company invest in corporate social, the society tend to patronise the company and would want to associate with it and that might bring more cash into the business. That should motivate my company”.

Res6: “Improved net profit would push the company to seek investment in corporate social investment as this will constantly increase profit for the company and this will be good for social investment because the investment will be put in good order to benefit the skills of the employees and the society at large by creating community initiatives which turn will attract the community to associate themselves with the company to maintain the performance of the company”.

Res7: “Yes because when the investment are paying off, the company will gain lots of cash”.

Res8: “Yes, the company will be able to invest more in the surrounding areas of where the company is situated”.

Res9: “Yes, the CSI normally depends on the net profit of the company the higher the profit the higher the investment allocated to a CSI PROJECTS”.

Res10: “Yes, it’s better to give funds to charity than to be taxed on the funds, we can use the money to better the livelihood of our immediate society than to let it be in the hands of the government and end up being looted”

Res11: “Yes, the company will be able to invest more to the public”.

Res12: “Yes, company would be able to make donations to communities”.

The above responses were obtained from respondents and other respondents responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 4.1, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Improved net profit motivates my company toward any of the following”:

a. Additional heavy investment in corporate social investment.
b. Additional moderate investment in corporate social investment.
c. Additional minor investment in corporate social investment.
d. No additional investment in corporate social investment.

Responses shown in figure 7.19 indicate that 43.8% of the respondents require additional heavy investment in corporate social investment, 31.5% of the respondents require additional moderate investment in corporate social investment and 17.8% of the respondents require additional minor investment in corporate social investment and the 6.9% requires no additional investment in corporate social investment.

Figure 7.19: Theme 4 subtheme 4.1 Source: Researcher

7.4.4.2 Sub-theme 4.2- Improved asset return attract corporate social investment.

To get information about improved profitability and additional social investment, the following question was asked: "In your view, would you think that improved asset return motivate your company to seek further investment in corporate social investment". In responding to the question, the respondents are quoted below:

Res1: "It does influence investment on corporates social investment such as improving labour policies".

Res2: "Yes, the more assets are not liquid the more investment in corporate social investment".

Res3: "Yes, profitability attracts more investors to engage with our company and by doing that, it means there will be more social engagements via the investment in corporate social investment".

Res4: "Yes, because the more the company invest in corporate social, the society tend to patronise the company and would want to associate with it and that might bring more cash into the business, leading to improved asset return. That should motivate my company".

Res5: "In our company the improved asset return would push the company to seek investment in corporate social investment as this will constantly increase profit for the company and this will be good for social investment because the investment will be put in good order to benefit the skills of the employees and the society at large by

creating community initiatives which turn will attract the community to associate themselves with the company to maintain the performance of the company".

Res6: "Yes, because the when the company profits increase due to the corporate investment, the asset return are positively affected".

Res7: "Yes, the more the company is able to acquire assets the more it will be interested in investing to the public".

Res8: "Yes, the CSI normally depends on the net profit of the company the higher the profit the higher the investment allocated to a CSI PROJECTS".

Res9: "Yes, asset returns lead to improved net profits, improved net profits lead to higher taxes, better invest in corporate social investments to reduce the burden of taxes".

Res10: "Yes, the company will be able to invest more to the public".

Res11: "Yes, it will do so as a way of donations and social engagements".

The above responses were obtained from respondents and other respondents responded with "Yes" while others responded with "No".

The following question was in line with the question in sub-theme 4.2, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. "Improved asset return motivates my company toward any of the following":

a. Additional heavy investment in corporate social investment.
b. Additional moderate investment in corporate social investment.
c. Additional minor investment in corporate social investment.
d. No additional investment in corporate social investment.

Reponses on figure 7.20 indicate that 39.7% of the respondents require additional heavy investment in corporate social investment, 31.5% respondents require additional moderate investment in corporate social investment, 20.5% respondents

require additional minor investment in corporate social investment and 8.2% respondents require no additional investment in corporate social investment.

Figure 7.20: Theme 4 subtheme 4.2 Source: Researcher

7.4.4.3 Sub-theme 4.3- Improved net profit attract BBBEE investment.

To get information about improved profitability and additional social investment, the following question was asked: “In your view, would you think that Improved net profit motivate your company to seek further investment in BBBEE investment”. In responding to the question, the respondents are quoted below:

Res1: “It does assist us in prioritising companies that are owned by black people”.

Res2: “Since we will be able to employ more black women in our company”.

Res3: “Yes, improved net profit encourages the company to invest in BBBEE”.

Res4: “No, in our company there isn't that much of a link between BBBEE investment and profitability”.

Res5: “Yes, my company should seek further investment in BBBEE for improved net profit.”

Res6: “In our company there isn't much on the BBBEE investment”

Res7: “Yes, it motivates my company to seek further investment in BBBEE.”

Res8: “No, the company will be more on expanding operations than seeking BBBEE investments.”

Res9: “Yes, the BBEE Investments normally depend on the net profit of the company the higher the profit the higher the investment allocated to a BBEE PROJECTS”.

Res10: “Yes, improved net profit, lead to better control of your company operations, and lead to being able to control where you put your funds as in where you buy your materials and whom you hire, in overall who you support.”

Res11: “No, there is no nexus between the two in my company”.

Res12: “Yes, company may assist upcoming small BBBEE businesses”.

The above responses were obtained from respondents and other respondents responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 4.3 where respondents had a multiple-choice question, and they all responded to it which gives a summary of the respondents above. “Improved net profit motivates my company toward any of the following”:

a. Additional heavy investment in BBBEE investment.
b. Additional moderate investment in BBBEE investment.
c. Additional minor investment in BBBEE investment.
d. No additional investment in BBBEE investment.

Responses on figure 7.21 indicate that 37% of the respondents require additional heavy investment in BBBEE investments, 28.8% of the respondents require additional moderate investment in BBBEE investments, 17.8% of the respondents require additional minor investment in BBBEE investments and 16.4% of the respondents require no additional investment in BBBEE investments.

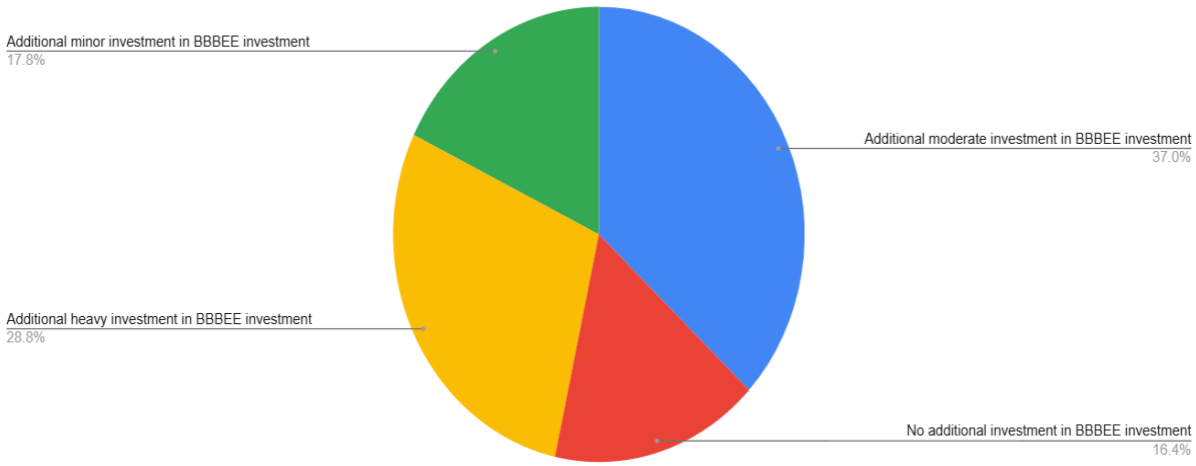

Figure 7.21: Theme 4 subtheme 4.3 Source: Researcher

7.4.4.4 Sub-theme 4.4- Improved asset return attract BBBEE investment.

To get information about improved profitability and additional social investment, the following question was asked: “In your view, would you think that improved asset return motivate your company to seek further investment in BBBEE investment”. In responding to the question, the respondents are quoted below:

Res1: “It does have an influence”.

Res2: “Yes… since, we will employ more women”.

Res3: “Yes, the more assets we have more investment in BBBEE”.

Res4: “No, in our company there isn't that much of a link between BBBEE investment and profitability”.

Res5: “Yes, my company should be motivated to seek further investment in BBBEE for improved asset return”.

Res6: “In our company there isn't much on the BBBEE investment”.

Res7: “Yes, it motivates my company to seek further investment in BBBEE.”

Res8: “No, the asset returns would assist the company in being more profitable than seeking BBBEE investments”.

Res9: “Yes, the BBEE Investments normally depend on the net profit of the company the higher the profit the higher the investment allocated to a BBEE PROJECTS”.

Res10: “Yes, improved asset return lead to independence of action amd movement, you get to choose freely where you take your funds, can support our black community freely”.

Res11: “No, there is no nexus between the two in my company”.

Res12: “Yes, company may empower BBBEE business by providing short courses and skills”.

The above responses were obtained from respondents and other respondents responded with a “Yes” while others responded with a “No”.

The following question was in line with the question in sub-theme 4.4, where the respondents had a multiple-choice question, and they all responded to it, which gives a summary of the responses above. “Improved asset return motivates my company toward any of the following”:

a. Additional heavy investment in BBBEE investment.
b. Additional moderate investment in BBBEE investment.
c. Additional minor investment in BBBEE investment.
d. No additional investment in BBBEE investment.

Responses in figure 7.22 indicate that 37% of the respondents require additional heavy investment in BBBEE investments, 28.8% require additional moderate investment in BBBEE investments; 12.3% require additional minor investment in BBBEE investments while 21.9% require no additional investment in BBBEE investments.

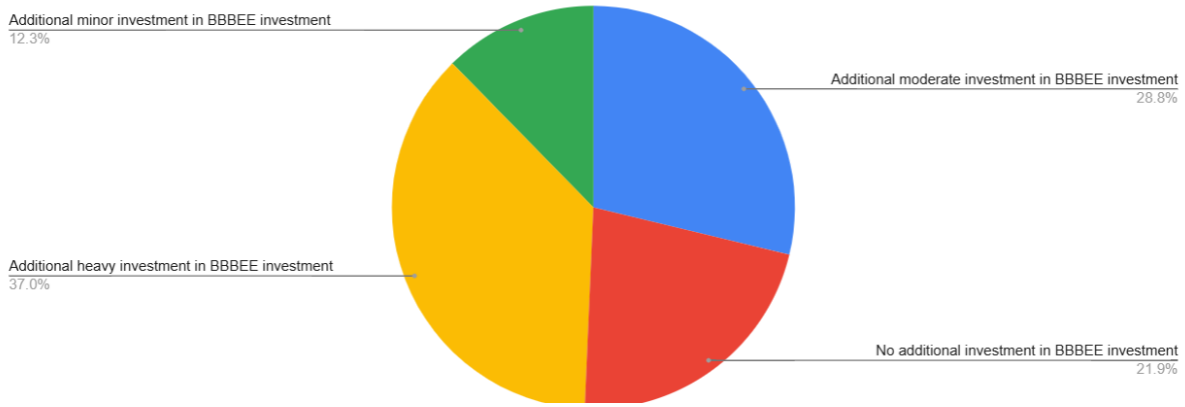

Figure 7.22: Theme 4 subtheme 4.4 Source: Researcher

The fourth theme demonstrated that improved resource efficiency motivated the companies to make larger social investments, which is consistent with that of Joshi *et al*. (2022) who found that there is a positive relationship between community donations and education (corporate social investment) and net profit margin (profitability). Reinforcement theory recommends that companies must maintain healthy earnings and successfully address social and environmental challenges to make sustainability investments (Durall, 2022).

The responses provided for the qualitative data analysis achieved the research objective 5, which was to determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment. From the responses, it was revealed that corporate eco-efficiency and profitability attract sustainability investment.

The implication of the findings on the South African economy and resource efficiency of companies used is stated below:

The findings of the research objective state that corporate eco-efficiency and profitability attract sustainability investment. Investments in sustainability could propel South Africa's economic expansion. This suggests that an increase in economic activity causes the economy to move toward more sustainable sectors. This means that the companies that were used in this study may create more jobs in their respective sectors. Investments in sustainability by companies will lead to long-term stability and the prevention of environmental harm, which would increase companies' profitability and preserve resource efficiency.

Summary of findings for research objective 5 (qualitative data analysis)

Research objective 5 had 4 themes where each theme had sub-themes. Table 7.1.1 indicates the summary of findings for research objective 5 categorised per theme.

Table 7.1.1 Summary of findings for research objective 5

Research objective 5: to determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment	Theme:1 Improved resource efficiency and additional environmental investment. The results of theme 1 derived from responses in subthemes 1.1 through 1.3, revealed that improved resource efficiency makes companies require additional environmental investment.
	Theme:2 Improved profitability and additional environmental investment Results in theme 2 derived from responses in subthemes 2.1 to 2.6 indicated that the respondents have accepted that improved profitability motivates companies towards the environmental investment.
	Theme:3 Improved resource efficiency and additional social investment Results in theme 3 derived from responses in subthemes 3.1 to 3.4 demonstrated that improved resource efficiency motivates companies to make larger social investments.
	Theme:4 Improved profitability and additional social investment. Results in theme 4 derived from responses in subthemes 4.1 to 4.4 demonstrated that improved resource efficiency motivates companies to make larger social investments.

Source: Researcher

7.5 Research objective 6: To develop a framework for the effect of corporate sustainability investment, resource efficiency and profitability.

The final research objective of the study was research objective 6, which aimed to contribute knowledge by developing a framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa. Figure 7.5 was developed from the results of the first level of analysis (analysis of quantitative data) and second level of analysis (analysis of qualitative data). The first level of analysis consisted of 8 models derived from research objectives 1-4. Based on the results investment in renewable energy is shown to be a positive predictor of environmental investment, while water investment and recycling investment are shown to be negative predictors of environmental investment. The framework developed is different from the main conceptual framework because when constructing the framework in figure 7.23 the positive predictor of the environmental investment was used, this is because it was the only variable that had a positive impact towards the resource efficiency and profitability.

Based on the results, corporate social investment and BBBEE investment were shown to be positive predictors of social investment. Additionally, market capitalisation as a control variable is a positive predictor of both environmental and social investment. The framework is different from the preliminary framework because some variables showed that they are insignificant, and it shows that they are negative predictors of either the environmental investment or social sustainability investment.

Sustainability investment, resource efficiency, and profitability are increasingly seen as primary drivers for markets in aligning with the Sustainable Development Goals (SDGs) in South Africa. Investments in sustainable practices, such as renewable energy, waste reduction, and technology processes, not only assist with the limitation of negative environmental impacts but also create long-term financial benefits. Companies that prioritize resource efficiency can reduce operational costs by minimizing waste and optimizing energy use, thus improving societal opportunities, such as increased employment, entrepreneurial opportunities and quality education benefits. Furthermore, businesses that integrate sustainability into their strategies often experience enhanced reputation, customer loyalty, and access to new markets,

all of which contribute to greater profitability. By aligning business operations with the SDGs, companies not only contribute to global development goals but also position themselves for sustainable economic success in an increasingly diligent market. As a result, all these positive effects will contribute to the economic development of South Africa.

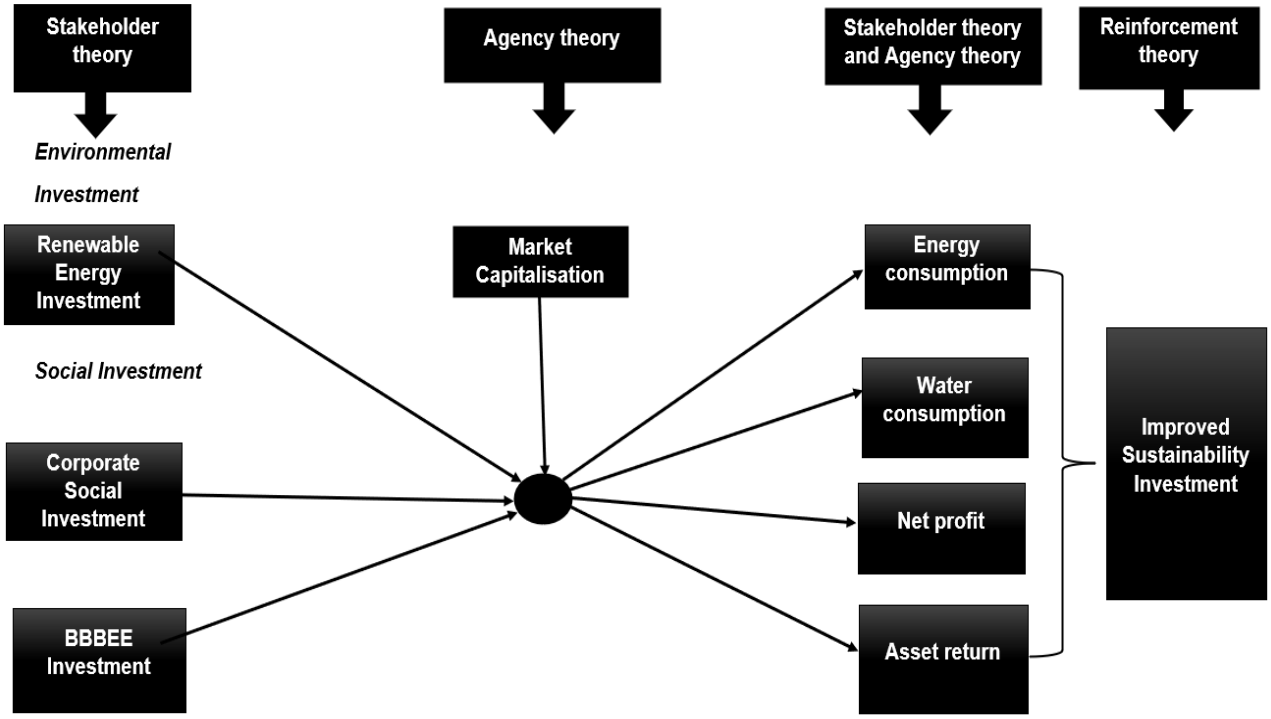

Figure 7.23: A framework for the effect of corporate sustainability investment, resource efficiency and profitability

Source: Researcher

7.6 SUMMARY OF THE CHAPTER

The data collected from respondents using Google Forms-sent questionnaires is discussed in this chapter. The research objective for the data collected was to determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment of companies listed in FTSE/JSE Responsible Investment Index. The methods described in this study's fifth chapter served as a guide for the analysis of the responses from the participants. The research findings indicate that corporate eco-efficiency and profitability attracts improved sustainability

investment of companies listed in FTSE/JSE Responsible Investment Index. The study's conclusion, summary, and recommendations are discussed in the next chapter.

CHAPTER 8- CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

Chapter 7 present qualitative data analysis and development of framework. This chapter intends to present a summary, recommendations, and a conclusion with the sections outlined as follows: Section 8.2 to 8.6 discusses the findings of the research objectives; Section 8.7 discusses the outcomes for research objective 6; Section 8.8 discusses the study's contribution to the body of knowledge; Section 8.9 discusses the limitations of the study; Section 8.10 outlines recommendations derived from the study; and Section 8.11 provides the study's conclusion. The study aimed to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return) of companies listed in the FTSE/JSE Responsible Investment Index. The study outlined a theoretical framework that led to a thorough literature review to provide an understanding of corporate sustainability investment, resource efficiency, and profitability. Reviewed literature revealed that corporate sustainability investment influences resource efficiency and profitability. Furthermore, it was revealed that maximisation of profitability by companies is important and can be derived from having various investments. The study addressed the research objectives by employing a mixed method where four research objectives employed the quantitative research approach, and one research objective employed the qualitative research approach.

8.2 Summary of the findings for Research Objective 1

To determine the relationship between corporate environmental investment and resource efficiency.

The results of models 1 and 2 reveal that there was a negative relationship between environmental sustainability investment and resource efficiency. The results were run through generalised least squares method in chapter 6 of the study, the model 1 revealed a positive and significant relationship between investment in renewable energy and water consumption. While a negative and insignificant relationship between water investment and market capitalisation and water consumption was

shown, recycling investment indicated a negative significant relationship to water consumption. Model 2 revealed positive and insignificant relationship between investment in renewable energy and energy consumption while results revealed a negative and insignificant relationship between water investment, recycling investment and energy consumption. However, the results revealed an insignificant positive relationship between market capitalisation and energy consumption.

Hence, these findings confirm prior studies such that of Bătae *et al.* (2021), Zhang and Xie (2022) and Zhao and Rasoulinezhad (2023) that concur that indeed, there is a negative relationship between corporate environmental investment and resource efficiency. Zhang *et al.* (2023) found a positive relationship between corporate environmental investment and resource efficiency which contrasts with the results revealed by Model 1 and Model 2.

8.3 Summary of the findings for Research Objective 2

To analyse the effect of corporate social investment on resource efficiency.

The results of model 3 show a positive and insignificant relationship between corporate social investment and water consumption. Additionally, the results revealed a positive an insignificant relationship between BBBEE investment and water consumption whereas market capitalisation had an insignificant negative relationship with water consumption. Model 4 indicated an insignificant and positive relationship between corporate social investment and energy consumption while BBBEE investment reveals a significant negative impact on energy consumption. Additionally, market capitalisation had a significant positive impact on energy consumption.

Findings of this study complement those of Joshi *et al.* (2022) which revealed a positive relationship between corporate social investment and resource efficiency although they contradict that of Gachie, (2021) showing a negative relationship between corporate social investment and resource efficiency.

8.4 Summary of the findings for Research Objective 3

To evaluate the impact of corporate environmental investment on profitability.

Results shown in Model 5 and Model 6 indicate a positive relationship between corporate environmental investment and profitability. In particular, results of model 5 revealed a positive insignificant relationship between investment in renewable energy and net profit. Furthermore, the results revealed that recycling investment and market capitalisation had an insignificant positive impact on net profit while water investment had an insignificant positive influence on net profit. Model 6 revealed that investment in renewable energy had no insignificant effect on asset return while water investment had an insignificant positive effect on asset return. Recycling investment had an insignificant positive impact on asset return. However, market capitalisation had an insignificant negative impact on asset return. Thus, the findings corroborate the findings of Liu *et al*. (2022), Bătae *et al.* (2021), and Prokopenko *et al.* (2023) regarding the positive relationship between corporate environmental investment and profitability. However, they conflict with Zhang and Xie's (2022) findings where they found a negative relationship between corporate environmental investment and profitability.

8.5 Summary of the findings for Research Objective 4

To analyse the influence of corporate social investment on profitability

The results of Model 7 show that net profit was significantly positively impacted by corporate social investment. While there was a negative correlation between BBBEE investment and net profit, net profit had an insignificant positive impact by market capitalisation. The results of Model 8 displayed that the positive impact of corporate social investment on asset return was negligible. The asset return was significantly positively impacted by the BBBEE investment. Hence, the results correspond to those of Ajayi and Akinsomi (2022) and Joshi *et al.* (2022) who found a positive relationship between corporate social investment and profitability. Although findings by Gachie (2021) are inconsistent where they found a negative relationship between corporate social investment and profitability.

8.6 Summary of the findings for Research objective 5

To determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment.

The summary of research objective 5 is based on the primary data and qualitative research approach to follow up on quantitative secondary analysis and to check companies' CEOs' and environmental officers' views on how sustainability investment is attracted by corporate eco efficiency and profitability. The data was from primary data through a questionnaire survey which was sent to the selected companies. The data was qualitative, and thematic analysis was employed to analyse the data. The findings from theme 1 reveal that the respondents accepted that their company's reduction in energy consumption motivates their companies toward further investment in environmental investment whereby additional heavy investment in water reduction and recycling investment displayed a higher percentage. The second theme demonstrated that improved profitability encourages companies to undertake greater environmental investment whereby investment in renewable energy indicated additional heavy investment in renewable energy indicated a higher percentage. The third theme demonstrated that improved resource efficiency motivates companies to make larger social investments whereby investment in CSI indicated a higher percentage showing additional heavy investment. The fourth theme demonstrated that improved resource efficiency motivates companies to make larger social investments whereby investment in CSI indicated a higher percentage showing additional heavy investment. Based on responses, it was found that corporate profitability and eco-efficiency are what motivate investment in sustainability. The results of the primary data support that of the secondary data by revealing that there is a relationship between corporate sustainability investment, resource efficiency and profitability. Increased profitability can support resource efficiency by implementing sustainable business practices and initiatives. For example, substantial cost savings from a decreased dependency on raw materials can help lower energy and water consumption.

8.7 Summary of the outcomes for Research objective 6

To contribute to knowledge by developing a framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa.

Based on the results, the researcher proposed a framework for corporate sustainability investment, resource efficiency and profitability of companies. The framework considered results from research objective 1 to 5. The framework indicates that environmental investment represented by renewable energy investment and social investment represented by BBBEE investment and corporate social investment linked influence resource efficiency and profitability. Additionally, it reveals that corporate eco-efficiency and profitability attracts improved corporate sustainability investment. The research objective was achieved as it consists of variables of corporate sustainability, resource efficiency and profitability.

8.8 Contribution of the Study

Although there exist little research on environmental accounting done in the South African setting, this research combined three environmental investments namely, renewable energy investment, water investment and recycling investment with two social investment, namely; corporate social investment, BBBEE investment with market capitalisation as an intervening variable to access their effect on resource efficiency (energy consumption and water consumption) and profitability (net profit and asset return). This research has closed this gap and contribution by combining three environmental investments namely, renewable energy investment, water investment and recycling investment with two social investments namely corporate social investment and BBBEE investment with market capitalisation as an intervening variable to access their effect on resource efficiency (energy consumption and water consumption) and profitability (net profit and asset return). In addition, this research contributes by further examining the reinforcement effect improved sustainability investment in doing this, this research applied stakeholder theory, agency theory and reinforcement theory to link with the dependent and independent variables of the research. The researcher developed a framework (See figure 7.23), which has never been developed before where the findings of the study were employed focusing on only the positive and significant variables of the findings and the theories used in the study. Furthermore, the study contributes to the companies by the framework developed to assist with the investments in sustainability. In addition, this study's framework is the first framework that include reinforcement theory to construct environmental accounting framework.

8.9 Limitations of the study

The limitation of the study is derived from the Companies Listed in the FTSE/JSE Responsible Investment Index. The researcher targeted the use of 30 companies listed in the FTSE/JSE Responsible Investment Index for five years for the secondary data based on the availability of the data for the study period. However, there was no consistency in the data from 6 companies therefore the researcher only used 24 companies. The study was further limited to the primary data where the researcher targeted to use 60 responses and only got 30 responses from the questionnaire survey issued to respondents. The results of this study cannot generalised as only the companies listed in the FTSE/JSE Responsible Investment Index were used.

8.10 Recommendations

Based on the findings of the secondary computed through FGLS, it was discovered that renewable energy investment, corporate social investment and BBBEE investment influence resource efficiency and profitability. In contrast, the primary results indicated that corporate eco-efficiency and profitability attract improved sustainability investment. The study's findings would be distinct and vigorous provided all JSE-registered companies had participated.

Recommendations for practice and policy

The distinctiveness of the study allows for possible influence on different stakeholders notably the ones linked to companies JSE-registered companies, particularly on the FTSE/JSE Responsible Investment Index. The findings may imply many things to different stakeholders. They might influence the pressure on companies to look more into corporate sustainability investment on how it can improve their profitability and how to use the resources efficiently. Investors may be influenced by the results to invest more in sustainability activities. Companies must implement policies on corporate sustainability investments not only on corporate sustainability performance.

Recommendations for stakeholders and board of directors

A wide range of stakeholders, such as the community, investors, and employees, are impacted directly and indirectly by the operations of companies listed on the

FTSE/JSE Responsible Investment Index. According to the findings of the study, there is a need for improved corporate sustainability investment in different sectors of companies. The researcher recommends that investors should invest more on corporate sustainability investment such as corporate environmental investments and social investments in companies as this would help with enhancing the profitability of companies and maintaining resource efficiency. The investors should look into sustainability reports to get an understanding of the sustainability investments that can help grow their wealth. The recommendation to the communities from the researcher is that the members of communities in which companies operate in should engage with such companies to gain the socio-economic opportunities that the companies offer. Additionally, this would help with their wellbeing of communities as they will get assistance with the environmental and social challenges that are encountered by community members. Board of directors of companies are encouraged to venture into corporate sustainability investments that suits their strategies and to improve their profitability. The board of directors should provide an oversight of companies' sustainability activities. Additionally, they should make decisions on corporate sustainability investments that will benefit the companies.

Recommendations from findings as per research objective

Research objective 1:

According to the findings of the study, it is recommended that the companies look into other environmental investments such as investments related to renewable energy as most companies are going green this would help with boosting resource efficiency.

Research objective 2:

It is recommended that companies should invest more on social investment since it builds on the reputation of companies, and this helps to maintain resource efficiency which in turn helps with the wellbeing of societies.

Research objective 3:

Based on the findings, it is recommended that companies should invest more into environmental investments as they positively influence profitability. The environmental

investments should be in line the industries in which companies operate for them to yield more benefits.

Research objective 4:

Based on the findings, the researcher recommends that social investments that companies engage in makes them to build strong relationships with the society while maintaining the maximisation of profitability.

Research objective 5:

Based on the results, it is recommended that when companies make more profits, they should invest more in sustainability investments.

Research objective 6:

The researcher recommends that the developed framework from this study be adopted by companies so that they can be able to determine the effect of corporate sustainability investment, resource efficiency and profitability of their companies.

Recommendations for future study

The study evaluated the effect of corporate sustainability investment on resource efficiency and profitability. In accordance with the results from the data, the researcher recommends that future research in this area be on different industries of companies listed on the JSE and have a larger number of respondents in terms of the primary data. Further studies may employ a different sample and analysis than this one. Future research should incorporate the concepts suggested in the framework, even though it is based on a developed framework. Furthermore, the researcher believes that much has not been studied about corporate sustainability investment and that additional research on the other components of corporate sustainability investment is possible.

8.11 Conclusion

The objectives of this research study were to determine the relationship between corporate environmental investment and resource efficiency, to analyse the effect of corporate social investment on resource efficiency, to evaluate the impact of corporate

environmental investment on profitability, to analyse the influence of corporate social investment on profitability, to determine the extent to which corporate eco-efficiency and profitability attracts improved sustainability investment and to contribute to knowledge by developing a framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa. The researcher achieved the research objectives by employing quantitative research approach to research objectives 1-4 and qualitative research approach research objective 5. The findings for research objectives 1 revealed that only corporate environmental investment had a negative relationship on resource efficiency based on Model 1 and Model 2 which were derived from the research objective. Model 1 revealed results from various variables indicating that investment in renewable energy has an insignificant positive impact on energy consumption while water investment and market capitalisation have insignificant negative impacts on energy consumption. However, recycling investment has a significant negative impact on energy consumption. Model 2 revealed that investment in renewable energy has an insignificant positive impact on energy consumption while water investment and recycling investment have insignificant negative impacts on energy consumption. The findings for research objectives 2 revealed a positive effect of corporate social investment on resource efficiency based on Model 3 and Model 4 which were derived from the research objective. Model 3 showed that corporate social investment has an insignificant positive effect on water consumption. BBBEE investment had an insignificant positive influence on consumption. Whereas market capitalisation had an insignificant negative relationship with water consumption. Model 4 corporate social investment had an insignificant positive impact on energy consumption. While BBBEE investment exhibited a significant negative impact on energy consumption, market capitalisation showed a significant positive impact on energy consumption. The findings for research objectives 3 revealed a positive impact of corporate environmental investment on profitability based on Model 5 and Model 6 which were derived from the research objective. Model 5 revealed that investment in renewable energy had an insignificant positive impact on net profit. Recycling investment and market capitalisation had an insignificant positive impact on net profit. Water investment had an insignificant negative influence on net profit. Model 6 revealed that investment in renewable energy had an insignificant positive effect on

asset return. Water investment had an insignificant positive effect on asset return. Recycling investment had an insignificant positive impact on asset return. While market capitalisation had an insignificant negative impact on asset return. The findings for research objectives 4 revealed a positive influence of corporate social investment on profitability based on Model 7 and Model 8 which were derived from the research objective. Model 7 revealed that corporate social investment had a significant positive impact on net profit. Similarly, BBBEE investment showed a significant negative relationship impact on net profit. Market capitalisation had an insignificant positive impact net profit. Model 8 revealed that corporate social investment recorded an insignificant positive impact on asset return. The BBBEE investment had a significant positive relationship impact on asset return. Market capitalisation had an insignificant negative impact asset return. The findings for research objective 5 revealed that corporate eco-efficiency and profitability attracts improved sustainability investment. Furthermore, research objective 6 was achieved by developing framework for the effect of corporate sustainability investment, resource efficiency and profitability on Responsible Investment Companies in South Africa. A distinctive feature of the study was its emphasis on corporate sustainability investment, which evaluated various combinations of resource efficiency and profitability, in contrast to most studies concentrating solely on sustainability performance and profitability. The findings of this study allow for future research to research more on the proxies of the sustainability investment of companies. However, there is a need for companies listed in the JSE to report more on sustainability investments and performance. All sustainability investment proxies such as environmental sustainability, social sustainability, and the governance of companies.

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APPENDIX A

PERMISSION LETTER REQUESTING TO CONDUCT A RESEARCH

University of Limpopo

Private Bag x1106

Sovenga

0727

11 October 2022

XXXXX

XXXXX

XXXXX

Dear Sir/Madam

PERMISSION TO CONDUCT THE STUDY

My name is Nakeng MV. I am writing to request permission to collect data for my Doctoral research study at the School of Accountancy, in the Faculty of management and law at the University of Limpopo, with the title,

"**A FRAMEWORK FOR CORPORATE SUSTAINABILITY INVESTMENT, RESOURCE EFFICIENCY AND PROFITABILITY OF COMPANIES LISTED IN FTSE/JSE RESPONSIBLE INVESTMENT INDEX**''.

The purpose of this research is to evaluate the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return). I would like to request the participation of your company's environmental officer and CEO in the completion of online questionnaires, which they will fill out during their spare time and not during their working hours to avoid interfering with their duties. I will keep their responses and names confidential. The information collected will not be shared with anyone and participants will be protected from being identified by keeping them anonymous.

I have attached copies of my research proposal, an ethical clearance letter that was obtained from the institution's Research and Ethical clearance department, and the consent form.

I hope to hear from you.

Sincerely,

Nakeng MV.

APPENDIX B

CONSENT FORM

I am a Doctoral student at the School of Accountancy, in the Faculty of management and law at the University of Limpopo. I am conducting research titled,

"**A FRAMEWORK FOR CORPORATE SUSTAINABILITY INVESTMENT, RESOURCE EFFICIENCY AND PROFITABILITY OF COMPANIES LISTED IN FTSE/JSE RESPONSIBLE INVESTMENT INDEX**''. To fulfil the research objectives of this study, your company is invited to participate in this research by filling out the questionnaire survey. The researcher will ensure that your responses and names are protected by maintaining the confidentiality and exercising the anonymity of the respondents.

You may withdraw from filling out the questionnaire at any point and you are not pressured to fill out the questionnaire because there is no penalty, loss, or compensation attached to participation in the questionnaire. You can contact the researcher should you have any questions or problems regarding the research at [redacted] or [redacted]@keyaka.ul.ac.za. You are requested to sign below to indicate that you have given your informed consent to participate in the abovementioned research.

Thank you,

Sincerely.

MV Nakeng

Name of respondent: _____

Signature of the participant: _____

Date: _____

APPENDIX C

RESEARCH QUESTIONNAIRE

The title: “A Framework for Corporate Sustainability Investment, Resource Efficiency and Profitability of Companies listed in FTSE/JSE Responsible Investment Index”.

Instructions

Instructions

This questionnaire survey is anticipated to collect data from your company relating to the link of variables of the effect of corporate Sustainability Investment, resource efficiency, and profitability. This data collection will allow the researcher to determine the effect of corporate sustainability investment (environmental investment and social investment) on resource efficiency (water and energy consumption) and profitability (net profit and asset return) and to identify areas of improvement. A true reflection of your company’s responses to the questionnaire is required since confidentiality and anonymity will be maintained by the researcher.

The organisation of the questionnaire survey

This questionnaire survey consists of five sections: section A to E Section A requires demographic information of the participants while section B to E, which will gather information about the attraction to corporate sustainability investment (resource efficiency and profitability). Carefully read the statements in order to give correct and reliable answers.

Before choosing the answer, read the questions carefully

Honesty and transparency are required

Fill out all the sections

SECTION A: Demographic description of respondent

This section requires your demographic information. Please cross (X) for the most appropriate response or answer in respect of the following items:

1. **Age**

20-29	
30-39	
40-49	
50-59	
60-69	
Prefer not to say	

2. **Gender**

Female		Male		Prefer not to say	

3. **Education (highest qualification)**

Matric		Diploma		Degree		Postgraduate		Prefer not to say	

4. **Employment status**

Full time		Part-time		Prefer not to say	

5. **Years of employment**

0-3 years		4-6 years		7-10 years		11-15 years		16-25 years	

Section B: Improved Resource efficiency and additional environmental investment in recycling, water and renewable energy

1. In your view, would you think that **reduction in energy consumption** motivate your company to seek further **investment in renewable energy**

   ……

2. **Reduction in energy consumption** motivates my company toward any of the following:

vii. Additional heavy investment in renewable energy
viii. Additional moderate investment in renewable energy
ix. Additional minor investment in renewable energy
x. No additional investment in renewable energy

3. In your view, would you think that **reduction in energy consumption** motivate your company to seek further **investment in water reduction and recycling investment**

   ……..

4. **Reduction in energy consumption** motivates my company toward any of the following:

e. Additional heavy investment in **water reduction and recycling investment**
f. Additional moderate investment in **water reduction and recycling investment**
g. Additional minor investment in **water reduction and recycling investment**
h. No additional investment in **water reduction and recycling investment**

5. In your view, would you think that **reduction in water consumption** motivate your company to seek further **investment in renewable energy**

……

6. **Reduction in water consumption** motivates my company toward any of the following:

e. Additional heavy investment in **water reduction and recycling investment**
f. Additional moderate investment in **water reduction and recycling investment**
g. Additional minor investment in **water reduction and recycling investment**
h. No additional investment in **water reduction and recycling investment**

Section C: Improved Profitability and additional environmental investment in recycling, water and renewable energy

7. In your view, would you think that **improved net profit** motivate your company to seek further **investment in recycling**

……

8. **Improved net profit** motivates my company toward any of the following:
   e. Additional heavy investment in recycling
   f. Additional moderate investment in recycling
   g. Additional minor investment in recycling
   h. No additional investment in recycling

9. In your view, would you think that **improved net profit** motivate your company to seek further investment in **water reduction**

   ……

10. **Improved net profit** motivates my company toward any of the following:
    e. Additional heavy investment in water reduction
    f. Additional moderate investment in water reduction
    g. Additional minor investment in water reduction
    h. No additional investment in water reduction

11. In your view, would you think that **improved net profit** motivate your company to seek further **investment in renewable energy**

    ……

12. **Improved net profit** motivates my company toward any of the following:

e. Additional heavy investment in renewable energy
f. Additional moderate investment in renewable energy
g. Additional minor investment in renewable energy
h. No additional investment in renewable energy

13. In your view, would you think that **improved asset return** motivate your company to seek further **investment in recycling**

……

14. **Improved asset return** motivates my company toward any of the following:
    e. Additional heavy investment in recycling
    f. Additional moderate investment in recycling
    g. Additional minor investment in recycling
    h. No additional investment in recycling
15. In your view, would you think that **improved asset return** motivate your company to seek further investment in **water reduction**

……

16. Improved **asset return** motivates my company toward any of the following:
    e. Additional heavy investment in water reduction
    f. Additional moderate investment in water reduction
    g. Additional minor investment in water reduction
    h. No additional investment in water reduction
17. In your view, would you think that **improved asset return** motivate your company to seek further **investment in renewable energy**

……

18. Improved **asset return** motivates my company toward any of the following:
    e. Additional heavy investment in renewable energy
    f. Additional moderate investment in renewable energy
    g. Additional minor investment in renewable energy
    h. No additional investment in renewable energy

Section D: Improved Resource efficiency and additional social investment in corporate social investment and BBBEE investment

19. In your view, would you think that **reduction in energy consumption** motivate your company to seek further **corporate social investment**

……

20. **Reduction in energy consumption** motivates my company toward any of the following:

e. Additional heavy investment in **corporate social investment**

f. Additional moderate investment in **corporate social investment**
g. Additional minor investment in **corporate social investment**
h. No additional investment in **corporate social investment**

21. In your view, would you think that **Improved water reduction** motivate your company to seek further investment in **corporate social investment**

……

22. **Improved water reduction** motivates my company toward any of the following:

e. Additional heavy investment in **corporate social investment**
f. Additional moderate investment in **corporate social investment**
g. Additional minor investment in **corporate social investment**
h. No additional investment in **corporate social investment**

23. In your view, would you think that **reduction in energy consumption** motivate your company to seek further investment in **BBBEE investment**

……

24. **Reduction in energy consumption** motivates my company toward any of the following:

a. Additional heavy investment in **BBBEE investment**
b. Additional moderate investment in **BBBEE investment**
c. Additional minor investment in **BBBEE investment**
d. No additional investment in **BBBEE investment**

25. In your view, would you think that **reduction in water consumption** motivate your company to seek further investment in **BBBEE investment**

……

26. **Reduction in water consumption** motivates my company toward any of the following:

e. Additional heavy investment in **BBBEE investment**
f. Additional moderate investment in **BBBEE investment**
g. Additional minor investment in **BBBEE investment**

h. No additional investment in **BBBEE investment**

Section E: Improved Profitability and additional social investment in corporate social investment and BBBEE investment

27. In your view, would you think that **Improved net profit** motivate your company to seek further investment in **corporate social investment**

……

28. **Improved net profit** motivates my company toward any of the following:

e. Additional heavy investment in **corporate social investment**
f. Additional moderate investment in **corporate social investment**
g. Additional minor investment in **corporate social investment**
h. No additional investment in **corporate social investment**

29. In your view, would you think that **Improved asset return** motivate your company to seek further investment in **corporate social investment**

……

30. **Improved asset return** motivates my company toward any of the following:

e. Additional heavy investment in **corporate social investment**
f. Additional moderate investment in **corporate social investment**
g. Additional minor investment in **corporate social investment**
h. No additional investment in **corporate social investment**

31. In your view, would you think that **Improved net profit** motivate your company to seek further investment in **BBBEE investment**

……

32. **Improved net profit** motivates my company toward any of the following:

e. Additional heavy investment in **BBBEE investment**
f. Additional moderate investment in **BBBEE investment**
g. Additional minor investment in **BBBEE investment**
h. No additional investment in **BBBEE investment**

33. In your view, would you think that **Improved asset return** motivate your company to seek further investment in **BBBEE investment**

……

34. **Improved asset return** motivates my company toward any of the following:

a. Additional heavy investment in **BBBEE investment**
b. Additional moderate investment in **BBBEE investment**
c. Additional minor investment in **BBBEE investment**
d. No additional investment in **BBBEE investment**

APPENDIX D

SECONDARY DATA

	Period	Profitability	Profitability	Resource efficiency	Resource efficiency	Environmental investment	Environmental investment	Environmental investment	Social investment	Social investment	
		Dependent variables	Dependent variables	Dependent variables	Dependent variables	Independent variable	Independent variable	Independent variable	Independent variable	Independent variable	Control variable
Co Code	Years	Net profit (R'000)	Asset return (%)	Water consumption (kM3)	Energy Consumption (kWh)	Investment in renewable energy R'000	Recycling investment R"000	Water investment (R'000)	Corporate Social Investment (R'000)	BBBEE investment (R'000)	Market Capitalisation (R'000)
1	2017	(2 729)	15	2 015 752	1 052 635	15 000	300	60 000	26 000	49 000	34 796
1	2018	4 744	20	2 072 375	961 802	19 000	3 400	72 000	35 000	21 000	35 613
1	2019	2 478	12	2 132 022	983 418	17 000	1 850	97 000	31 000	26 000	25 483
1	2020	439	1.6	1 878 400	956 560	23 000	2 300	109 000	18 000	11 000	18 592
1	2021	760	2.9	1 895 020	954 692	26 000	3 400	12 000	31 000	62 000	23 312
2	2017	975 000	2	4 345 233	4 235 909	3 200 000	14 000	500 000	500 000	4 200 000	580 00 000
2	2018	5 703	8.76	6 320 444	4 977 270	66 000	58 000	876 666	77 000	86 300	49 500 000
2	2019	100 690	9.4	7 305 388	5 179 561	46 000	832 000	67 000	62 070	298 000	47 000 000

2	2020	9 226	11	10 763 299	6 462 881	889 000	60 000	878 989	13 050	227 000	50 000 000
2	2021	16 373	4.6	10 280 829	5 411 267	119 300	46 000	5 000	127 700	127 700	53 400 000
3	2017	16 504	1.4	4 500	32 930 228	62 000	0	3 000	261 000	19 000	154 000 000
3	2018	43 755	3.4	6 400	33 812 548	10 000	12 777	3 000	266 000	32 300	137 200 000
3	2019	46 501	3.3	9 000	22 950 389	8 000	12 000	1 000	371 000	117 900	126 600 000
3	2020	9 357	6.1	2 700	22 969 539	252 000	5 000	48 000	380 000	105 000	101 600 000
3	2021	20 243	1.2	3 700	22 892 502	19 000	7 000	55 000	195 000	179 000	129 300 000
4	2017	16 133	0.3	36 385 000	8 940 000	21 000	3 500	165 000	1 619 000	1067000	51 000 000
4	2018	12 595	0.2	33 834 000	8 850 000	23 400	1 250	3 605 000	1 235 000	0	122 000 000
4	2019	21 316	0.31	34 060 000	8 780 000	21 350	2 140	854 000	1 709 000	139 000 000	91 000 000
4	2020	29 841	0.36	33 216 000	8 110 000	22 600	0	867 000	2 636 000	98 000 000	134 300 000
4	2021	43 657	0.53	28 944 000	8 700 000	21 900	23 500	44 000	2 575 000	103 000 000	200 700 000

5	2017	-4 433	5	54 548	6 900	39 300	0	231 000	1 200 000	10 605	34 300 000
5	2018	-2 521	2	54 725	5 500	179 000	0	245 000	1 400 000	10 800 000	22 700 000
5	2019	432 800	2.3	50 014	5 600	156 000	54913	220 000	1 600 000	19 600 000	96 000 000
5	2020	30 622	23	48 501	6 000	145 500	25296	289 000	1 780 000	12 000 000	175 000 000
5	2021	33 796	22	47 649	56 000	187 200	40720	281 000	2 200 000	16 442	169 000 000
6	2017	21 513	5.4	137 061	396 844	178 500	0	254 200	676 000	132 700	239 000 000
6	2018	10 146	2.31	134 445	404 028	85 183	0	201 000	2 000 000	3 000	313 000 000
6	2019	6 074	1.29	134 260	402 641	87 052	0	151 956	88 100	19 200	219 000 000
6	2020	-91 272	19	142 614	411 154	71 063	39 000	19 847	1 200 000	26 300 000	83 000 000
6	2021	10 532	2	138 050	407 741	65 420	2 500	20 852	1 200 000	750 000	138 000 000
7	2017	1 924	2.4	46 229	21 497	53 500	1 600	19 368	301 100	0	94 911
7	2018	6 993	7.8	43 872	20 011	58 100	1 025	0	609 000	23 500	144 544
7	2019	18 569	17	47 363	20 079	410 250	2 015	0	619 000	55 000	351 447
7	2020	30 403	21	43 796	18 045	23 890	3 214	0	803 000	50 500	381 145

7	2021	79 021	4.3	42 623	20 818	87 450	0	372 421	2 400 000	34 000	480 640
8	2017	74 523	7	186 000	97 000	4 773 600	0	282 744	876 910	12 300	36 720 000
8	2018	80 288	8	187 000	84 000	115 000	12 000	0	41 314	34 000	230 400
8	2019	84 125	8	181 000	87 000	90 250	10 125	0	41 700	73 000	35 470
8	2020	61 102	5	197 000	81 000	22 470	14 025	0	42 000	12 000	450 700
8	2021	214 793	17	177 000	85 000	158 200	15 136	0	65 500	23 000	68 090
9	2017	(8 098)	9	40 671	13 909	175 530	18 025	0	106 000	2 582 000	27 000 000
9	2018	-1 098	6	39 794	12 021	75 025	17 048	0	13 000	2 890 000	140 00 000
9	2019	1 179	5	39 894	12 2 820	65 230	19 275	0	29 400	5 032 000	50 000 000
9	2020	16 484	2.4	43 122	11 930	64 000	13 987	69 000	113 000	68 000	90 000 000
9	2021	47 85 5	1.1	50 771	12 192	108 983	0	0	126 000	58 000	192 000 000
10	2017	14 616	9.9	98 449 861	4 428 060	123 778	40 940	429 870	196 512	55 800	215 496
10	2018	17 727	10.76	204 000	4 409 764	2 558 750	20 470	1 084 910	161 713	34 000	182 203
10	2019	17 318	9	99 000	4 270 588	1 432 900	0	1 535	266 110	23 000	208 078
10	2020	12 323	7	108 000	94 500	470 810	8	1 024	61 410	2 100	191 231
10	2021	15 823	8	206 900	94 700	13 277 500	9	1 883	241 546	4 000	216 061

11	2017	8 431	7.08	91 896	540 586	750 450	6	2 423	186	8 000	112 967
11	2018	8 943	5.93	133 304	559 376	698 450	3	2 412	1 286	7 000	108 114
11	2019	8 318	5.35	142 235	606 106	988 700	12 000	3 175	646	5 000	99 440
11	2020	6 583	4.47	129 905	583 163	885 750	18 000	4 152	525	6 000	52 869
11	2021	5 055	3.5	119 805	574 050	1 025 000	14 000	5 421	22	5 000	60 648
12	2017	1 432	4.4	14 295 993	1 784 491	2 700	10 050	3 229	122 800	8 200	18 400 000
12	2018	4 822	0	18 296 551	1 656 263	5 200	18 250	5 982	167 000	11 200	24 000 000
12	2019	3 854	10.4	6 763 511	1 658 629	5 050	0	9 478	175 300	16 400	17 100 000
12	2020	5 034	11.8	8 535 536	1 563 311	4 800	32 000	14 500	130 300	14 500	43 300 000
12	2021	15 472	0.29	10 152 770	1 542 908	5 700	35 025	9 700	170 400	3 900	32 500 000
13	2017	5 128	11.5	1 667	692 449	7	35 025	0	0	0	130 900 000
13	2018	6 011	9.8	1 584	663 557	60	42 025	0	15 000	55000	117 900 000
13	2019	6 464	9	1 693	689 873	120	47 025	0	15 900	3 953	45 900 000
13	2020	4 664	8.2	1 204	660 017	377	0	0	16 200	3 190	65 500 000
13	2021	8 000	8.4	1 096	641 476	579	123 025	10 200	16 000	3 366	74 000 000
14	2017	1 757	18.4	674 000	454 600	800	189 458	12 000	18 000	6 980	26 223

14	2018	3 920	20.5	588 000	456 900	750	195 147	13 400	16 000	36 800	26 004
14	2019	2 477	18.7	9 830	502 722	680	136 189	14 100	19 000	30 000	24 423
14	2020	2 499	9.7	10 300	379 247	540	198 123	17 250	16 000	82 000	12 251
14	2021	2 823	13.9	66 330	3 893 793	550	0	0	16 000	43 000	24 287
15	2017	11 158	1.22	317 580	4 652	19 000	9 400	12 000	168 000	20 125	127 600 000
15	2018	14 135	1.33	284 053	4 599	23 000	9 500	556 000	124 000	21 805	135 500 000
15	2019	12 810	1.13	254 801	4 477	25 000	126 000	550 000	191 000	6 000 000	1 065 000 000
15	2020	4 454	0.45	191 194	5 963	32 000	122 000	42 000	103 000	58 000	65 000 000
15	2021	12 387	0.98	156 261	114 451	29 000	55 000	7 000	121 000	8 200 000	37 000 000
16	2017	3 854	8	1 496 906	619 255	16 000	45 025	5 600	32 000	0	58 000 000
16	2018	2 998	5	896 204	563 050	7 000	19 850	7 200	57 000	0	37 400 000
16	2019	2 831	5	1 140 739	53 760	9 000	18 025	0	78 000	84 000	26 583 200
16	2020	608	9	1 199 525	55 227	55 000	10 895	55 000	75 000	25 000	14 000 000
16	2021	2 622	4	1 040 535	50 695	9	17 258	0	86 800	29 870	32 476 500
17	2017	2 263	0.25	35 064	116 600	4	149 150	32 444	0	12 590	589 00 900

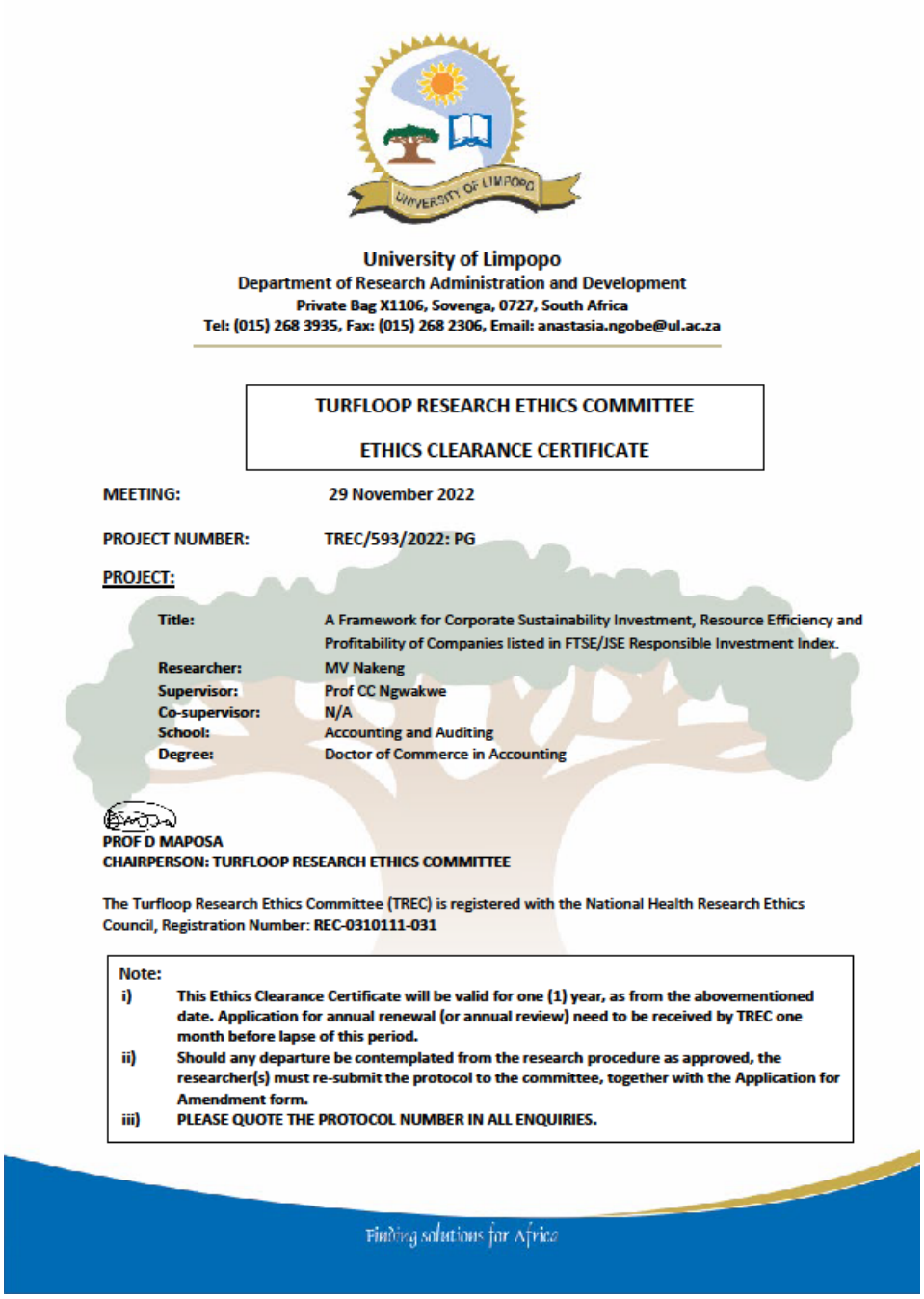
17	2018	2 781	0.27	24 419	118 700	8	175 190	21 788	28 200	36 700	73 000 000
17	2019	2 982	0.26	23 345	558 989	2	198 950	41 541	29 500	12 300	47 000 000
17	2020	2 713	0.16	22 192	1 036 375	3	162 850	51 447	39 000	10 100	31 000 000
17	2021	2 648	0.13	19 618	1 546 001	25	658 780	0	39 000	6 000	46 000 000
18	2017	-171	2.37	29 760	35 000	23	420 158	0	455 720	55 000	76 708 080
18	2018	150	2	25 380	32 000	1 025	0	14 754	385 560	34 550	95 104 800
18	2019	-7	1.01	26 320	33 000	1 330	0	12 555	477 360	10 790	170 344 080
18	2020	971	12	25 570	37 000	1 230	780 850	17 520	403 920	10 600	172 584 000
18	2021	646	8	22 400	50 000	1 120	19 000	20 440	275 400	12 000	161 568 000
19	2017	1 774	14.0	34 611	123 480	1 224	195 200	34 280	17 800	13 000	3 200 000
19	2018	2 045	13.8	9 822	124 600	2 440	30 258	55 260	18 400	13 000	50 000 000
19	2019	2 364	12.6	22 249	230 350	1 240	17 980	67 540	19 800	10 600	45 000 000
19	2020	2 639	12.4	42 300	105 727	3 420	12 098	0	19 000	12 800	57 200 000
19	2021	2 642	11.8	42 198	103 599	5 420	10 258	0	23 000	9 000	74 300 000
20	2017	21 098	9	550 000	236 000	6 450	8 00	0	2 759	12 000	862 394

20	2018	16 832	15	45 000	270 000	7 480	7 41	0	614 000	10 250	1 027 209
20	2019	23 734	11	621 049	33 629	5 840	502	551	880 000	14 000	789 885
20	2020	25 558	11	537 565	32 743	7 350	12 012	278	696 000	12 500	577 759
20	2021	11 294	3	626 670	30 899	8 420	9 025	50	737 000	13 000	988 055
21	2017	6 568	14	690 000	243 500	358 000	6 002	211	41 300	10 000	578 987
21	2018	4 297	9	58 000	675 223	353 000	74 022	887	23 000	8 000	234 543
21	2019	6 297	13	892 249	199 627	351 000	92 111	0	45 000	6 000	980 980
21	2020	-2 393	4	674 232	159 567	449 000	41 002	0	35 000	4 000	564 880
21	2021	2 197	4	649 713	162 336	502 000	78 000	0	55 900	3 000	436 400
22	2017	4 541	1.87	19 095 879	183 499	40 423	22 014	9 214	172 000	4 500	257 000 000
22	2018	9 578	3.9	19 543 742	144 000	30 470	0	14 255	185 000	23 000	168 000 000
22	2019	10 692	3.5	22 808 701	86	43 452	0	10 321	1 900	34 000	155 000 000
22	2020	19 647	5.6	20 584 208	2 112	74 500	0	12 000	168 000	12 500	108 00 000
22	2021	16 994	4.6	20 202 972	3 560	56 000	0	11 122	159 000	16 000	321 700 000
23	2017	1 807	4.6	24 500	4 350	67 000	45 000	12 333	11 500	45 500	29 471

23	2018	2 529	5.6	24 500	2 340	34 000	14 000	17 555	12 000	43 000	32 743
23	2019	2 321	4.7	690 000	3 690	33 000	18 000	15 778	15 000	23 000	32 053
23	2020	646	1.1	36 000	3 490	45 000	19 000	13 877	15 000	9 000	28 107
23	2021	2 844	4.3	56 700	3 550	56 000	7 020	12 250	0	6 000	29 633
24	2017	-129	2	59 000	56 000	750 000	8 025	20 570	93 000	3 400	188 483
24	2018	99 000	2	99 000	360 000	790 000	3 025	30 120	62 000	3 230	178 000 000
24	2019	-2 505	21	10 400	237 490	660 000	0	42 120	58 000	3 450	185 000 000
24	2020	631 000	5	65 000	188 420	650 000	0	45 550	47 000	7 000	130 800 000
24	2021	-817	8	49 000	187 180	850 000	0	50 550	82 000	0	132 193

APPENDIX E

TREC Approval



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: 29 November 2022

PROJECT NUMBER: TREC/593/2022: PG

PROJECT:

Title:	A Framework for Corporate Sustainability Investment, Resource Efficiency and Profitability of Companies listed in FTSE/JSE Responsible Investment Index.
Researcher:	MV Nakeng
Supervisor:	Prof CC Ngwakwe
Co-supervisor:	N/A
School:	Accounting and Auditing
Degree:	Doctor of Commerce in Accounting

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

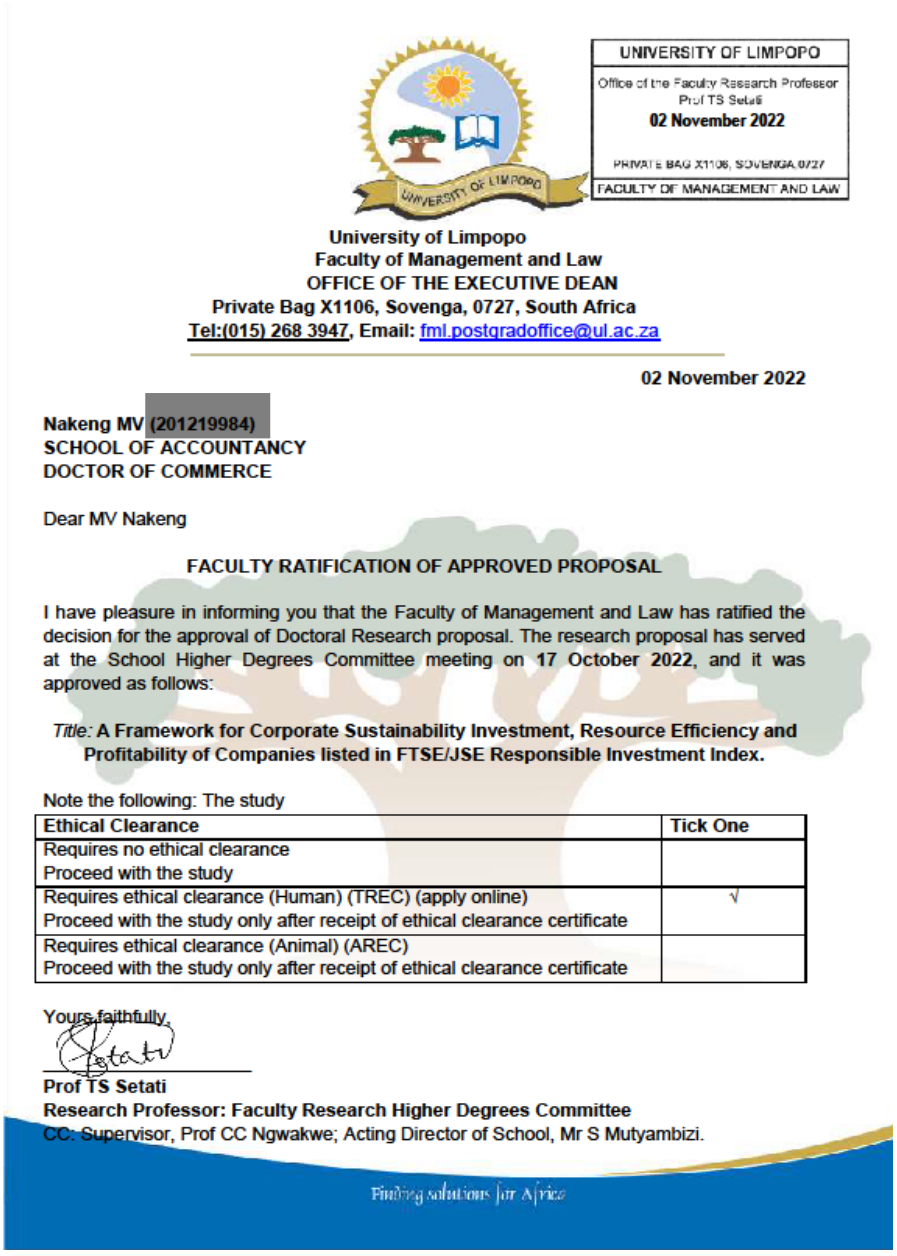
The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.
ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.
iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

APPENDIX F

Faculty approval letter



UNIVERSITY OF LIMPOPO
Office of the Faculty Research Professor
Prof TS Setati
02 November 2022
PRIVATE BAG X1106, SOVENGA 0727
FACULTY OF MANAGEMENT AND LAW

University of Limpopo
Faculty of Management and Law
OFFICE OF THE EXECUTIVE DEAN
Private Bag X1106, Sovenga, 0727, South Africa
Tel:(015) 268 3947, Email: fml.postgradoffice@ul.ac.za

02 November 2022

Nakeng MV (201219984)
SCHOOL OF ACCOUNTANCY
DOCTOR OF COMMERCE

Dear MV Nakeng

FACULTY RATIFICATION OF APPROVED PROPOSAL

I have pleasure in informing you that the Faculty of Management and Law has ratified the decision for the approval of Doctoral Research proposal. The research proposal has served at the School Higher Degrees Committee meeting on **17 October 2022**, and it was approved as follows:

Title: **A Framework for Corporate Sustainability Investment, Resource Efficiency and Profitability of Companies listed in FTSE/JSE Responsible Investment Index.**

Note the following: The study

Ethical Clearance	Tick One
Requires no ethical clearance Proceed with the study	
Requires ethical clearance (Human) (TREC) (apply online) Proceed with the study only after receipt of ethical clearance certificate	√
Requires ethical clearance (Animal) (AREC) Proceed with the study only after receipt of ethical clearance certificate	

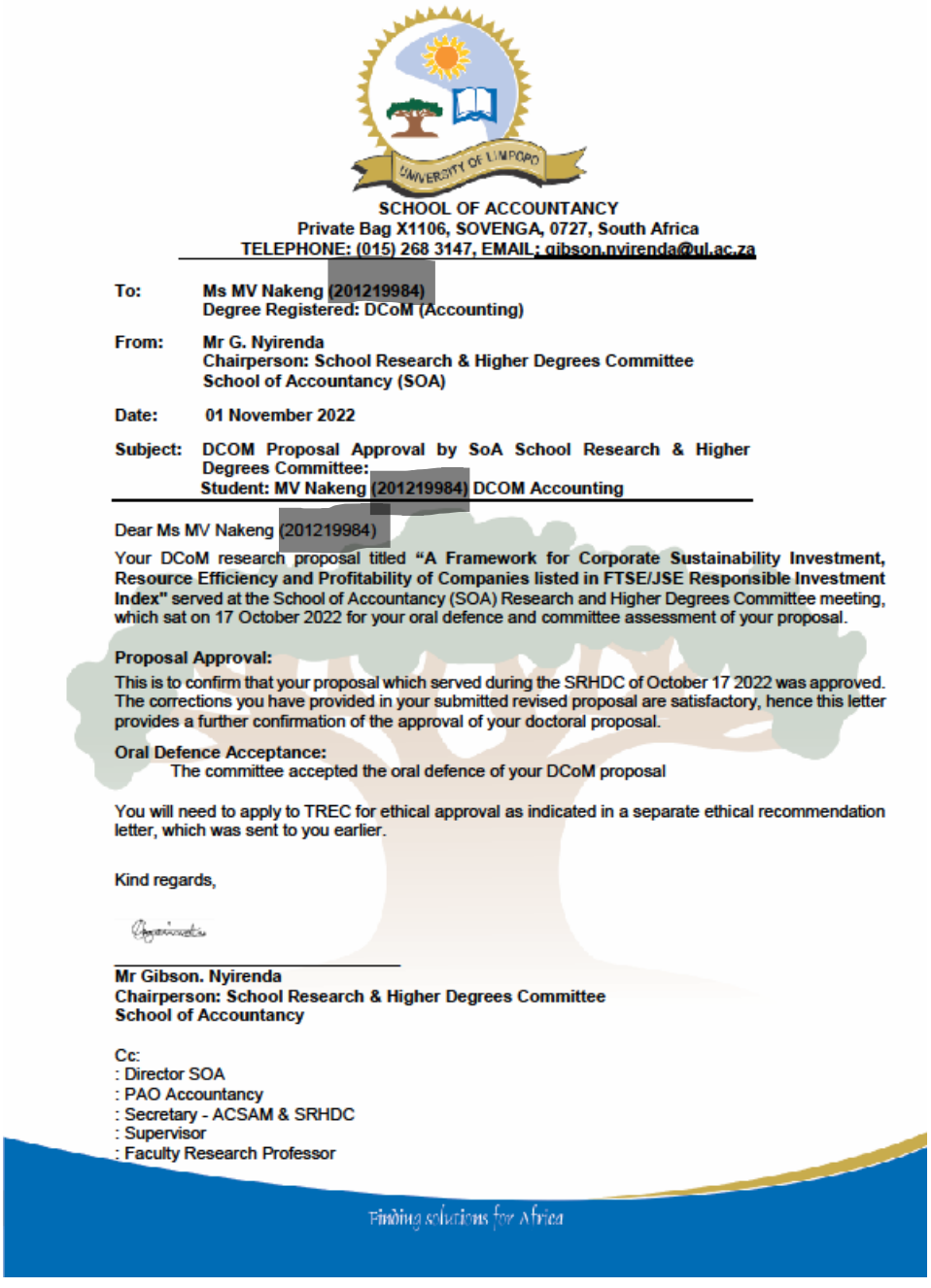
Yours faithfully,

Prof TS Setati
Research Professor: Faculty Research Higher Degrees Committee
CC: Supervisor, Prof CC Ngwakwe; Acting Director of School, Mr S Mutyambizi.

Finding solutions for Africa

APPENDIX G

SCHOOL HIGHER RESEARCH DEGREE COMMITTEE PROPOSAL APPROVAL AND ORAL DEFENCE LETTER



SCHOOL OF ACCOUNTANCY
Private Bag X1106, SOVENGA, 0727, South Africa
TELEPHONE: (015) 268 3147, EMAIL: gibson.nyirenda@ul.ac.za

To: Ms MV Nakeng (201219984)
Degree Registered: DCoM (Accounting)

From: Mr G. Nyirenda
Chairperson: School Research & Higher Degrees Committee
School of Accountancy (SOA)

Date: 01 November 2022

Subject: DCOM Proposal Approval by SoA School Research & Higher Degrees Committee:
Student: MV Nakeng (201219984) DCOM Accounting

Dear Ms MV Nakeng (201219984)

Your DCoM research proposal titled **"A Framework for Corporate Sustainability Investment, Resource Efficiency and Profitability of Companies listed in FTSE/JSE Responsible Investment Index"** served at the School of Accountancy (SOA) Research and Higher Degrees Committee meeting, which sat on 17 October 2022 for your oral defence and committee assessment of your proposal.

Proposal Approval:
This is to confirm that your proposal which served during the SRHDC of October 17 2022 was approved. The corrections you have provided in your submitted revised proposal are satisfactory, hence this letter provides a further confirmation of the approval of your doctoral proposal.

Oral Defence Acceptance:
The committee accepted the oral defence of your DCoM proposal

You will need to apply to TREC for ethical approval as indicated in a separate ethical recommendation letter, which was sent to you earlier.

Kind regards,

Mr Gibson. Nyirenda
Chairperson: School Research & Higher Degrees Committee
School of Accountancy

Cc:
: Director SOA
: PAO Accountancy
: Secretary - ACSAM & SRHDC
: Supervisor
: Faculty Research Professor

Finding solutions for Africa

APPENDIX H

Proof of editing

STMbondvo editing services
148 Aramburg
Mpumalanga
South Africa
Cell.: 0603467091

Date: 10 February 2025

This is to certify that I have edited the thesis of the following candidate:

Names and Surname: M.V Nakeng

Student number: 201219984

Title: A framework for corporate sustainability investment, resource efficiency and profitability of companies listed in FTSE/JSE responsible investment index.

Dr ST Maseko
Director
STMbondvo editing services