THE EFFECT OF CORPORATE ENVIRONMENTAL INVESTMENTS ON SHAREHOLDER VALUE IN SELECTED JSE SRI LISTED MINING COMPANIES

by

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DISSERTATION

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DEDICATION

Every challenging work needs self-effort as well as guidance from elders, especially those who are close to our hearts. My humble effort is dedicated to my amazingly sweet and loving Father and Mother, whose affection, love, encouragement and prayers of day and night make me able to get such success and honour; along with my grandmother, a strong and gentle soul who taught me to trust in God, believe in hard work and that so much could be done with little.

DECLARATION

I declare that "**EFFECT OF CORPORATE ENVIRONMENTAL INVESTMENTS IN SHAREHOLDER VALUE IN SELECTED JSE SRI LISTED MINING COMPANIES"** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

CHITEPO K.T (MR) 04.09.2017

Full names Date

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ABSTRACT

Corporate environmental investments have traditionally been deemed to be an unnecessary cost to companies because of perceived or no significant return on investment. However, recent literature is highlighting financial benefits accruing from environmental investments. This study investigates the relationship between corporate environmental investment and shareholder value. The study uses the stakeholder and legitimacy theory to define the company's engagement with its external society and environment. From that perspective, the study examines the effect of corporate environmental investment on carbon emissions, hazardous solid waste disposal and company share price. Panel data multiple regression was used to investigate the relationship between the variables under study. Findings show a significant positive relationship between investment in carbon emissions and share price while there is an insignificant negative relationship between investment in hazardous solid waste and share price. The study contributes to the notion that reducing the environmental footprint generates positive shareholder gains by bringing new evidence from the South African mining industry. Further studies can be performed with company profitability as a measure of financial performance and further in a different sector such as manufacturing.

Keywords: environmental investment, shareholder value, carbon emissions, hazardous solid waste disposal, environmental performance.

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CHAPTER ONE: INTRODUCTION TO THE STUDY

1.1. Introduction

In recent years, there has been a growing demand for companies to improve their sustainability practices, environmental and good corporate citizenship initiatives (Leszczynska, 2012). According to De Villiers and Van Staden (2012), mounting pressure from stakeholder groups has led top executives of many companies to implement corporate environmental investments. This is premised on the fact that companies must give back to both the environment and community in which they operate (Busch & Hoffmann, 2011). Presently, environmental matters have received a much higher priority in business decisions requiring management to incorporate environmental variables in business operation decision-making. In this view, Leszczynska (2012) reveals that companies in the United State of America (USA) spent more than $120 billion to comply with environmental laws and regulations in addition to several billions spent on research and development. Fisher- Vanden and Thorburn (2011) also state that the top 10 American companies are now spending over $5 billion annually on research and development related to improving environmental and sustainability performance. It is argued that at a time when some companies are spending substantial amounts of resources to comply with environmental laws and regulations, other companies are voluntarily reducing their pollution levels beyond compliance (Leszczynska, 2012). To comply with these laws and regulations, mining companies invest substantial amounts in carbon emissions and hazardous solid waste disposal reduction. Substantial amounts are invested in research and development and environmental technologies aimed at reducing negative environmental impact emanating from carbon emissions and

hazardous solid waste disposal. The obvious question for any investor then would be: Is there a return on investment in carbon emissions reduction and hazardous solid waste?

Incidentally, management of companies has the fiduciary responsibility to manage the company's assets profitably and to create wealth for their shareholders. Part of this responsibility is to ensure compliance with all environmental regulations in their effort to create wealth. In most instances, balancing between environmental compliance and wealth creation often creates conflicts of interest. The conflict of interest arises as corporate investment in environmental technologies has traditionally been considered to drain a company's resources, thereby creating an inherent conflict between environmental and financial performance (Fisher-Vanden & Thorburn, 2011). This may be due to management and investors' lack of expertise to recognise the benefit of investing in environmental issues. Sebastianelli, Tamimi and Iacocca (2015) argue that some managers assume that investments to protect the natural environment provided few financial benefits to the company. Hence, corporate environmental investments are deemed an unnecessary cost burden to the company that negatively affects shareholder value (Raithel & Schwaiger, 2015).

Fisher-Vanden and Thorburn (2011) opine that potential gains from improved environmental performance can result from a differentiation of the product by signalling that the company is green. This may also help to reduce the risk of future environmental liabilities and lawsuits because of pollution reduction measures. Subsequently, Sebastianelli et al. (2015) assert that there exists a causal link between financial and environmental performance. They argue that pollution reduction provides future cost savings by increasing efficiency, reducing compliance costs and minimising future liabilities. But initiating environmental initiatives can spur

governmental regulation (Fisher- Vanden & Thorburn, 2011). This means that companies that voluntarily invest in environmental improvements benefits have a competitive advantage over their rivals who are forced to comply. As such, environmental initiatives may provide opportunities to build long term strategies that reduce costs, decrease liability exposure, increase efficiency, enhance shareholder relations and improve profitability (Flammer, 2013). This may imply that corporate environmental investments will likely enhance shareholders' value if managed properly. Therefore, corporate environmental investments can also be a platform for a company to enhance stakeholder relations, although shareholders may predominantly have a financial interest in the company, others stakeholders may value the environment, community and how the company is serving that value (Raithel & Schweaiger, 2015).

Large companies are involved in heavy industries and are likely to emit substantial quantities of toxic waste because of their operations (Sebastianelli et al., 2015). To curb this unsustainable practice, many national governments have in recent years introduced environmental laws and regulations to govern toxic pollution to protect the environment. This became necessary because managers have long associated environmental investment with marginal costs imposed by law and regulation as eroding a company's financial resources thereby reducing global competitiveness (Rexhäuser & Rammer, 2014). This belief is born out of the position that environmental investments that do not improve the company's financial resources are inefficient since it does not provide positive returns to shareholder value. However, most business executives know that the way they respond to the challenge of sustainability will largely affect global competitiveness and survival of their businesses (Lubin & Esty, 2010).

It has been reported that companies with a poor pollution control record have experienced more negative returns than those with efficient pollution control practices in place (Gans & Hintermann, 2013). Consequently, pollution reduction is expected to provide future cost savings through increased efficiency, reduction in compliance costs and minimising future liabilities and potential lawsuits (Sebastianelli et al., 2015). These cost savings will result in high profit margins for the practising company which will ultimately create shareholder wealth by increasing the share price (Steenkamp, 2017). In this regard, Busch and Hoffmann (2011) concur that it makes business sense to invest in environmental technology innovation and pollution reduction. For instance, Sebastianelli et al. (2015) found that some polluting companies lost market value in a one-day window, following the release of Toxic Release Information (TRI) in the United States of America (USA). Their study reported a positive relationship between investment in pollution reduction and financial performance.

There is an argument that environmental expenditure beyond the mandatorily required is not in the best interest of shareholders and will result in the degradation of the company's resources and value (Jacobs, Singhal & Subramanian, 2010). To support this argument, Fisher-Vanden and Thorburn (2011) found that companies that announced commitments to reduce greenhouse gas (GHG) emissions often experience a significant decline in share price. This argument assumes that in most cases investors do misinterpret companies' commitments to reduce greenhouse gas emissions as imposing significant costs on the company which may lead to a decline in shareholder wealth. The interpretation in the view of shareholders is that the cost of reducing the environmental impact may overshadow the resulting benefits that reduces organisational performance (Flammer, 2013). The above notion is premised on the fact that, corporate

environmental investments have an optimum level which derives positive returns, exceeding this optimum level result in degradation of shareholder value (Flammer, 2013). As such, company management should strive to ensure that environmental investments do not erode the benefits they are intended to create.

One industry fingered for generating a substantial quantity of hazardous solid waste is mining (Busch & Hoffmann, 2011). The way mining companies dispose hazardous solid waste is considered unsustainable. However, non-compliance with hazardous solid waste disposal may impede future mining licenses or result in cancellation of existing ones. Flammer (2013) acknowledge that the way companies handle environmental issues may offer opportunities for growth or place constraints on the future behaviour of the company. This is important because certain environmental investments set a precedent for how the company is expected to behave in the future (Flammer, 2013). The constraint is that environmental investments are believed to consume a substantial chunk of financial resources which could have been invested elsewhere and in most instances, it has a long payback period which makes it less favourable.

Investments to reduce hazardous solid waste disposal may result in the reduction of future environmental liabilities and a cut in production costs because of production efficiency (Fisher-Vanden & Thorburn, 2011). Efficiency in the production process reduces toxic solid waste disposal, idle time and the company will benefit from reduced disposal expenditure. Improving environmental performance beyond regulation could spur governmental regulatory action, giving the first mover companies a competitive advantage once their industry's rivals are forced to comply (Fisher-Vanden & Thorburn, 2011). Benefits of corporate investment to reduce hazardous solid waste include energy, raw materials and abatement costs reduction as well as

intangible benefits may improve consumer perception, community relations, promote employee morale and access to new markets (Jacobs et al., 2010). Increased social and environmental performance will attract resources to the company and expanded market opportunities (Gans & Hintermann, 2013). Deriving a basis from the stakeholder theory, it is evident that a reduction in solid waste disposal consolidates the relationship between companies and their stakeholders (surrounding community and environment) which is important for the survival of companies.

1.2. Research problem

Voluntary environmental initiatives and mere compliance with regulation has been the norm among companies' management because investment to reduce unsustainable business practices is seen to increase a company's cost structure resulting in low financial returns (Gans & Hintermann, 2013). This means that corporate environmental investments are considered only to be a cost to the company with no shareholders' value associated with them. However, little has been said about the benefits of undertaking such investments. Christopher, Hutomo and Monroe (2013) argue that good corporate environmental performance can be achieved through targeted environmental investments to attract resources to the company as well as to retain quality employees and expanded market opportunities. However, Gans and Hintermann (2013) argue that companies which had poor pollution control records experienced a more negative return than those with effective pollution control systems in place. This is premised on the fact that investors were discriminating between companies on the grounds of pollution control expenditure and past pollution control records. Despite this, investors still view environmental investments as a financial loss to the company, that is, an investment with no return. Such an investment often creates conflict between management and shareholders as the latter may view management not to

be acting in their best interest by investing to reduce negative environmental performance. This belief may result in shareholders' shying away from companies which embed environmental investments in their operations (Ioannou & Serafeim, 2015). Recently, most investors have started to discount the share prices of companies that are poorly positioned to a green economy since customers are increasingly considering environmental performance of companies when making purchasing decisions (Ioannou & Serafeim, 2015). Moreover, there is a need to enlighten shareholders of the gains accruable to the company from environmental investments. This need is further supported by the fact that there is no mechanism to translate costs incurred in environmental investment into shareholder value. To encourage environmental investments, a study done by Busch and Hoffmann (2011) shows that the stock market reacts negatively to the release of information about high polluting companies and that environmental awards result in positive stock returns. It therefore appears that there are benefits to be derived from corporate environmental investments. While this study is not meant to guarantee that corporate environmental investments always result in increased shareholder value, it seeks to determine whether there is a correlation between corporate environmental investment in carbon emissions and hazardous solid waste disposal and company share price.

1.3. Main objective of the study

The main objective of this research is to examine the correlation between corporate environmental investment in carbon emissions and hazardous solid waste disposal and company share price.

1.4. Research sub-objectives

This research seeks to investigate the relationship between corporate environmental investments and shareholder value, represented by the share price.

- To examine the effect of corporate environmental investment in carbon emissions reduction on company share price.
- To examine the effect of corporate environmental investment in hazardous solid waste disposal on company share price.

Resolving these objectives will help to answer the research problem identified for this study.

1.4.1. Research hypotheses

Research hypotheses were developed to solve the research problem. Investment in corporate investment is limited to investment in carbon emissions and hazardous solid waste disposal.

H_1 Corporate environmental investments in carbon emissions reduction have a significant effect on company share price.

H_2 Corporate environmental investments in hazardous solid waste disposal have a significant effect on company share price.

The null hypothesis is that there is a significant relationship between the variables under study. Testing these hypotheses will establish the nature and strength of the relationship between the variables under study.

1.5. Definition of terms

The following definitions are used in the context of the study.

Corporate environmental investments – they refer to all expenditure by companies in machinery and technology to reduce carbon gas emission and improve hazardous solid waste disposal (Fisher-Vanden & Thorburn, 2011)

Shareholder value –only increases or gains in the company's share price will be recognised as shareholder value (Fisher-Vanden & Thorburn, 2011).

Environmental performance – it refers to all efforts initiated by companies to reduce their environmental footprint in the community in which they operate (Fisher-Vanden & Thorburn, 2011).

Hazardous solid waste – refers to all waste, solid and liquid, with properties that make it potentially harmful to the environment and human life (Luo & Tang, 2014).

Carbon emissions – refer to all releases of carbon and other greenhouse gas emissions associated with the burning of fossil fuels into the atmosphere (Dhal, Thatoi, Das & Pandey, 2013).

1.6. Research methodology and design

The study used a casual research design. A quantitative research method was adopted for the study. The researcher conducted a detailed study of selected mining companies listed on the Johannesburg Stock Exchange (JSE) Social Responsibility Index (SRI). The mining industry was chosen because it is one of the sectors that contributes significantly to environmental impact in

South Africa and due to the availability of the required data for the study. The study preferred mining companies listed on the JSE SRI because, by their listing, they are required to publish integrated and sustainability reports annually making the required research data easily accessible. Moreover, the SRI listings mean the companies are expected to be leaders in environmental performance and disclosure of environmental information which is necessary for the study.

The JSE SRI mining index has a population of over 15 companies, however, the study chose a sample of 10 mining companies. These mining companies were chosen because they had been listed consistently from the year 2010 to 2015 which is the period of study. The consistency in their listing allowed research data to be gathered thereby avoiding gaps in data collection as they had all been listed continuously in the period under study. Research data in the form of share prices, amounts invested in carbon emissions reduction and hazardous solid waste disposal were collected from the respective companies' financial statements which are publicly available on the respective company's websites.

The study uses a quantitative research design to establish the relationship between investment in carbon emissions, hazardous solid waste disposal and share price. Panel data multiple regression was used to analyse the data. The study uses investment in carbon emissions reduction and hazardous solid waste disposal as independent variables whilst financial year end share price is the dependent variable. The leverage factor and cash flow adequacy ratio are used as control variables for the study. Since the independent variables are investments, the leverage factor assists to determine the percentage of such investments financed by debt. This helps to establish if the companies raised enough shareholders' funds to finance environmental investments.

The Cash flow adequacy ratio indicates a company's ability to cover capital expenditure, debt repayments and dividends from cash generated from operations. This control variable is essential to establish if the companies were generating enough cash flows to finance environmental investment. There are many models under panel data analysis, however, this study made use of the fixed effects and the random effects models. The random effects model assumes that differences between individual variables are random and uncorrelated opposed to being fixed. This allows the analysis of all time invariant economic variables that can influence the dependent variable to be included in the study. Thus, the random effects model produces a more practical result as it analyses the influence of all variables which is reflective in a real economic environment.

The fixed effects model is ideal for analysing the impact of variables that do not change over a period. A fixed effects model attempts to control the biasing effects of time invariant economic variables to better analyse the impact of the changing variables. With the fixed effects model, all economic influencers of the dependent variable are absorbed by the intercept. This allows a better analysis of the variables, including the control variables to give the true nature of their relationship without the biasing effects of other economic influences.

Due to the different approaches to analysis evident in the two models, the researcher performed the Hausman test to determine the appropriate model. The null hypothesis was that the random effects model is the appropriate model whilst the alternative is to reject the fixed effects model. The Hausman test basically tests whether the unique errors are correlated with the independent variables, the null hypothesis shows they are not correlated.

1.7. Limitations of the study

The study focuses on companies in the mining sector which are listed on the (JSE)(SRI). The mining industry is not the only industry which has a significant environmental footprint. Other industries such as the manufacturing sectors have significant environmental impact as well and could have been used in the study. The study limited environmental investment to carbon emissions and hazardous solid waste. Environmental investment is broad, and, therefore more variables could have been added to give a more comprehensive understanding of the relationship between corporate environmental investment and shareholder value.

1.8. Ethical considerations

This researcher complied with all the ethical considerations. All information from financial statements of sample companies will be solely used for the purposes of the study. This researcher respects the rights and confidentiality of all information of the target population and sample. This researcher will respect all data and information from other information sources by appropriately citing such information and fully recognising all sources in the referencing.

1.9. Significance of the research

This research is significant to investors, directors of companies, academia, society, and environment watch activists. By establishing the correlation between corporate environmental investment and shareholder value, this research provides the business community with a platform to set up an informed management evaluation mechanism. Management and those charged with the governance of companies may, through this research, get an understanding of the business

benefits of corporate environmental investment. An environmental business perspective is opened up outlining a differentiated approach to business, which hopefully will improve business opportunities and increase company value.

Furthermore, with the green revolution taking a great toll in the business world, it provides investors with a clear understanding of what and how they can benefit or lose by corporate environmental investment. Information about corporate environmental investment may also assist financial markets in ascertaining the true value of companies, not only considering financial factors, but also environmental factors. Based on the above, the local community and environment in which companies operate may benefit from the increased corporate social responsibility and environmental investment. This research hopes to improve co-existence relations between businesses and the society in which they operate. A sense of mutual existence and gain is established where both the society and business realise they need each other to exist (Harangozó & Zilahy, 2015). In a nutshell, this research seeks to coordinate, improve and consolidate relationships between the company and all its stakeholders.

1.10. Layout of study

The study layout is as follows:

Chapter 1 introduced the chapter by providing a brief description of the entire study.

Chapter 2 reviews the relevant literature providing a balanced review of the key issues in the study from other studies.

Chapter 3 provides the research methodology adopted for the study.

Chapter 4 provides the results and the discussion of results respectively.

Chapter 5 provides the summary, conclusion and recommendations for the study.

1.11. Summary of the chapter

The chapter introduces the study by identifying the research problem and research hypotheses. This is followed by a description of the main objectives of the study and the definition of key terminology used in the study. A brief discussion of the research methodology, limitations, ethical considerations and significance of the study are presented in the rest of the chapter. Chapter Two follows with a review of related literature, where the study underpins the stakeholder and legitimacy theories as the basis to define a company's engagement with its external environment and society.

CHAPTER TWO: LITERATURE REVIEW

2. Introduction

Chapter 1 provides an outline of this study. It gave a brief description of each stage of the study, beginning with the research problem, research objectives and to the methodology adopted and it concludes with the significance of this study. This chapter reviews the related literature and theoretical framework. Section 2.1 reviews the theoretical frameworks which consist of the legitimacy and stakeholder theories. Section 2.2 follows with a discussion of the relationship between each theory and shareholder value. Sections 2.4 and 2.5 presents an in-depth discussion of corporate environmental investment and its effects on shareholder value. A review of the impending carbon tax law is provided in section 2.6 and a review of practices of carbon emissions reduction and investments in other parts of the world is presented in section 2.7. Section 2.8 begins with practices of hazardous solid waste in South Africa, followed by a review of the law that govern its disposal, the Mineral and Petroleum Act 28 of 2002 in section 2.8.1. The relationship between hazardous solid waste disposal and shareholder value is present in section 2.8.2. Section 2.9 provides a summary of the chapter.

2.1. Theoretical framework

The literature on the effect of corporate environmental investments on shareholder value is based on two theories, namely, the stakeholder theory and the legitimacy theory. The stakeholder theory is a necessary premise to this study as it emphasises the importance of the relationship between the company and all relevant parties who have direct or indirect claims on the operation of the company (Garcia-Castro & Aguilera, 2015). It is plausible for the management of

companies to satisfy the expectations of stakeholders by ensuring cordial existence and sustainable growth of their companies.

2.2. The stakeholder theory

Companies cannot operate in a vacuum and survival on an individual basis is near impossible without reliance on third parties, i.e. stakeholders (Strand & Freeman, 2015). Companies exist within an environment, community, and society which are also constituted of other businesses and should engage with all these groups at the relevant level and spectrum. Of interest to this study is the case for a sustainable environment. Although it is indispensable, it is at the epicentre of most, if not all, of the other stakeholders' concerns. To enable sustainable survival and growth, companies should ensure that their operations, services and products do not materially degrade the environment (Bridoux & Stoelhorst, 2014). Failure to behave in an environmentally friendly manner by companies often provokes governments and other stakeholders to introduce and enforce laws and regulations to protect the environment.

According to Jensen (2010), the stakeholder theory states that managers and those charged with governance should balance the interest of stakeholders including but not limited to shareholders but also employees, customers, communities and the government. Management should be able to balance the demands and expectations of all these stakeholders, and can make the necessary trade-offs and sacrifices. Due to their different nature, stakeholders have different and often conflicting interests (Freeman Harrison, Wicks, Parmar & De Colle 2010). Corporate managers have a fiduciary obligation to act in the best interest of shareholders, to consider all stakeholders, create more value for the shareholders. Freeman et al. (2010) stress that the stakeholder theory

requires that claims made by customers, suppliers, local communities and employees be taken into consideration, although they are generally subordinated to the claims of shareholders. This is necessary because different resources that are fundamental to the operation of the company are under the control of different stakeholders. Therefore, considering each stakeholder group may be essential to overall company performance since each has different power and influence on the company's business.

Meanwhile, Wagner Mainardes, Alves and Raposo (2011) support the idea that managers should be encouraged to consider the interest of all stakeholders because they are all concerned with the environmental performance of the company, regardless of their unequal power to influence the decisions of the company. But the stakeholder theory does not specify how to make the necessary trade-off among these competing interests. As such, managers are left to make decisions that will satisfy the various competing interests of the different stakeholders. As such, balancing stakeholder interests and making the necessary trade-off becomes the prerogative of management with all interested parties depending on management's discretion for satisfaction. In support, Freeman et al. (2010) state that business managers should manage and shape the diverse relationships amongst all stakeholders to create value for the company as well as manage the distribution of that value. Frynas (2015) affirms that this is necessary since corporate environmental investments are a form of value distribution and a means of reaching out to external stakeholders which creates more value for shareholders.

Furthermore, Wagner Mainardes et al. (2011) argue that although the different stakeholders have unequal power to influence the actions of the company, the survival of the company requires the support of all stakeholders rather than individually powerful stakeholders or groups. For

instance, Christopher et al. (2013) explain that stakeholders have differential power dependent on their degree of control over resources required by the company. Therefore, the more critical the resources provided by a stakeholder for the sustenance of the company, the greater the willingness of the company to satisfy that stakeholder's demands. In addition, Jensen (2010) affirms that a company cannot maximise its value if it ignores the interest of all stakeholders. Hence, corporate environmental investments by companies need to cater for the interest of all stakeholders including the non-financial stakeholders in the distribution of the company's value.

2.2.1. Stakeholder theory and value creation

Don, Buritt and Qian (2014) believe that human inflicted deterioration of the environment has heightened stakeholder expectations about environmental practices. This is largely common in mining companies which are arguably the heaviest polluters due to the nature of their operations. To improve its long-term visibility, the mining industry should increase its environmental performance towards cleaner production. According to Dong, Buritt and Qian (2014), different stakeholder groups weigh the company's environmental performance dimensions differently which indicates stakeholder heterogeneity. It is managements' obligation and duty to satisfy all stakeholder expectations to ensure the sustainable survival and growth of their company. Hence, it is important to know that the involvement of external stakeholders has a greater effect in affecting environmental policy as they cannot be influenced by the company. External stakeholders also control resources which the company has no or limited control over which give them power to negotiate environmental friendly business methods (Dong et al., 2014). Since companies cannot do business in a vacuum, it is their interaction with external stakeholders that create more value for the company as it provides products and services to them.

Garriga and Mele (2013) posit that stakeholder management has two fundamental principles it needs to achieve to remain useful, relevant and to be able to create wealth for the company. Firstly, it should facilitate for maximum cooperation between the objectives of a company and all its stakeholder systems. Secondly, for any stakeholder management to be efficient is should address the concerns and demands of a plethora of stakeholders opposed to individual stakeholders. In this view, Garriga and Mele (2013) suggest that stakeholder management should incorporate all company stakeholders into managerial and strategic decision-making as they are most affected by such decisions. The incorporation of external stakeholders in company decision-making allows them to be involved and attached to the company's success which increases their willingness to trade with the company thereby increasing profits and ultimately shareholder value. It is important to know that the success of the company's projects and investments are dependent upon the reaction of most of its stakeholders. There is a higher possibility of a strong positive response and greater value creation when all stakeholders work collectively for the company's success.

The integration of stakeholders into a company's decision and strategic management process does not only improve its sensitivity and responsiveness to its environment and community, but also increases the stakeholders' understanding of the dilemmas facing the company (Garriga & Mele, 2013). Therefore, the company avoids negative business effects such as strikes, government scrutiny and negative publicity which taints corporate image as stakeholders will be in a greater position to understand the reasoning behind little or no environmental investment as is incorporated in decision-making. Concerning environmental investments, Garriga and Mele (2013) posit that a company should invest in all environmental and community projects which

results in an increase of shareholder value. On the contrary, they advocate that any environmental investments which only impose costs on a company should be rejected. However, it is vital to understand that gains from environmental investments do not always immediately materialise into financial gains (Grieco, Michelini & Iasevoli, 2015). Hence, greater consideration should be given before rejecting any environmental investment. This makes it a necessity to set up mechanisms and /or frameworks to specifically recognise gains from environmental investments.

Incidentally, Stout (2012) concedes that with respect to the evolving nature of today's business world, viewing shareholders as the sole residual claimants of the benefits of the company is a significantly biased description of the actual relationship between a company and its various stakeholders. No longer can management assume that the primary concerns of those who own shares are return on investment (ROI). Managing all stakeholders effectively may be in the best interest of shareholders and ultimately grow the value of the company. In support, Freeman et al. (2010) contends that organisations that manage their stakeholder relationships survive longer and perform financially better compared to companies that do not. As such, corporate environmental investments tend to serve as a return on shareholders who prioritise environmentally friendly business models, therefore making the necessary trade-off between environmental and financial interests imbedded in shareholders (Stout 2012). Freeman et al. (2010) stresses that taking into consideration both environmental and financial interests tend to be more effective in growing company value than either of them individually. In agreement, Ioannou and Serafeim (2015) contend that market analysts are better positioned to appreciate environmental and stakeholder engagement and will consequently be reflected in their positive recommendations of the

company's share value. This is important as capital markets and the public at large are influenced by the recommendations of financial analysts.

Moreover, Papagiannakis, Voudouris and Lioukas (2014) argue that environmental investment decisions are influenced mostly by stakeholder pressures, the industry within which the company operates, and the values and environmental attitudes of decision makers. They claim no significant value, if any, can be created when companies are merely complying with stakeholder expectations and demands. In this regard, corporate environmental investment is regarded as a search for environmental legitimacy, embedded with a platform for giving appropriate response. Supporting the same claim, Husted, Allen and Kock (2015) posit that companies engage in environmental investments in response to stakeholder pressure. This is because stakeholders have influence on key resources of companies which can usually determine future sustainability of the companies. Any economic benefits from corporate environmental investments gained by the company are regarded as unintentional spill overs that accrue because of laudable environmental performance. In contrast, they view the stakeholder theory as a theory specifying the necessary interactions with different stakeholder groups facilitating compliance with stakeholder demands and expectations in order legitimise operations.

2.3. The Legitimacy theory

The government, as an influential stakeholder, has an oversight role on the business environment and is the custodian of all natural resources within a country (Dong & Xu, 2016). As the authority, it passes laws and regulations protecting the environment which all companies should comply with to be allowed to operate legitimately (Dong & Xu, 2016). Therefore, to become

legitimate, a company should comply with the environmental laws and regulations including other relevant laws within the economy and industry in which it operates. In addition, a company should comply with the needs of its immediate society and environment in what is termed a social contract, which is the fundamental basis of the legitimacy theory.

According to Deegan (2014), the legitimacy theory is defined as a social contract, explicit or implied, between an organisation and the society. It is a social contract based on the assumption that organisations have no inherent right to exist, but that the society gave the organisation the right of existence. The company is part of a greater societal system; perceptions derived from the legitimacy theory highlight that companies are not considered to have inherent rights even to resources which they need for production. The organisation will be given the right to exist when its operations and value system is congruent with the society's norms, values, beliefs and definitions (Patten, 2014). This indicates that all resources are owned and controlled by the society and companies are deemed foreign, therefore, they should prove their good faith in operating to be welcomed by the society.

Loate, Padia & Maroun (2015) affirm that the principal reason behind corporate environmental investment is to gain legitimacy. Therefore, companies should conform and align their objectives to incorporate the society to maintain cordial relations. The society controls resources which organisations require for the smooth operation of their businesses. On the other hand, the society depends on corporations for services, products and development. Companies supply products and services which the society cannot produce. Companies also spearhead infrastructure development in the form of road systems, buildings and accessibility to water and electricity (Loate et al., 2015). Companies have become the nucleus of development. It is therefore in the

mutual interest of both companies and the society to co-exist as it is more beneficial. In addition, Loate et al. (2015) claim that breaching the social contract results in society's expectation being unfulfilled, emanating to a legitimacy gap affecting the going concern of the organisation. A legitimacy gap occurs when the company's form of environmental investment or action is different from the society's expectations (Brown, Malmqvist & Wintzell, 2016). This conflict in expectations, often results in the company being deemed to be breaching the social contract. As such, if society is not satisfied with the contribution and environmental investments undertaken by the company, the society exerts pressure or legal action against the company forcing it to perform to the expectations.

Moreover, when companies take no heed of societal pressure, this will eventually result in the social contract being revoked. This results in consumers reducing or eliminating demand for the company's products and services, eliminating the supply of labour and financial capital to the company, consistently lobbying government for increased taxes, fines and laws to prohibit those actions which do not conform with the expectations of the society (Hummel & Schlick, 2016). Therefore, legitimacy is vital as organisations are an integral part of the society and its existence. Continuity and growth predominantly depend on the continuous support and co-operation of the society (Alrazi, De Villiers & Van Staden, 2015).

2.3.1. Legitimacy theory and value creation

Bhattacharyya (2015) explains that legitimacy is a status or condition which exists when the company's value system is congruent with the larger social system's values. Companies invest in the environment to align its operational values with that of the society in which it operates.

However, environmental investment by the company on the society is not without benefit, as the company tends to benefit financially because of such investments. Deegan (2014) concurs that the control premise of the legitimacy theory is that organisations can maintain their operations only to the extent that they have the support of the society. Consistent with the stakeholder theory, this assertion is premised on the assertion that companies do not do business in isolation but with the immediate society first and then the rest of the world.

Corporate environmental investments are necessary to ensure continued societal support for the company as well as serving as a signal that the entity's values are aligned with those of the society. In agreement, Patten (2014) states that the economic legitimacy of business organisations is monitored through the market place; the social legitimacy of these organisations is addressed through public policy processes. Economic benefits resulting from economic legitimacy may be in the form of more contracts to the company (Patten, 2014). The society is prone to be more comfortable doing business with a company which not only understands but supports its norms and values (Deegan, 2014). Bhattacharyya (2015) asserts this continued support will ultimately mature into brand loyalty and a bigger market share as a bigger part of the society will be comfortable in being associated with the company. As such, Patten (2014) states that environmental investments also allow the company to price their products and services higher than its competitors resulting in higher profit margins. The society feels the company is justified in charging more because of its involvement in environmental investments (Patten, 2014).

Organisations do not only have to invest in the environment, they should be seen in the society's perception as investing in the environment. Environmental investments should be adequate and

viewed considerably generous by the society for the company to receive and maintain its legitimacy. Therefore, corporate environmental investment serves as a tool to gain legitimacy from the society and ensures existence, growth and continuity of the business organisation (Alrazi et al., 2015). Although it comes at a substantial cost, the investment in environmental investment generates benefits which are enjoyed by the company for a longer period. Therefore, maintaining legitimacy ensures a sustainable access to important resources and most importantly existence of the company.

2.4. Corporate environmental investments

Mining operations result in significant environmental challenges as they generate large volumes of solid waste material, acid mine drainage, carbon emissions, tailings and other contaminants which are released into air, water and on land. As such, mining is at the epicentre of environmental watchdogs and activists who scrutinise mining operations to advocate minimised environmental impact and a more sustainable environment. Söderholm, Söderholm, Helenius, Pettersson, Viklund, Masloboev, Mingaleva and Petrov (2015) observe that environmental degradation emanating from mining is the reason why the industry is the focus of strict operating regulations, environmental impact assessments and mining permits which try to address negative environmental impact and promote more sustainable environmental friendly mining processes. However, most of these stringent mining regulations and permits increase the costs, time and more especially the risks of operating mines profitably.

Despite satisfying all the environmental regulations to commence operations, mining companies continue to invest in environmental technologies beyond compliance laws. Alves, Colombo,

Portela, Ferreira and Dalia (2015) observe that the continued investment in environmental technologies is associated with extraction and use of minerals which are non-renewable resources. Given the constraints relative to the availability of non-renewable resources in recent times, mining companies are more than ever expected to re-invent environmental strategies to ensure profitable sustainable operations (Alves et al., 2015). Environmental investments intend to correct the impact of companies' operations and to benefit external stakeholders especially the community and environmental protection groups. Recently it has been proven to be financially beneficial to the investing mining companies (Streimikiene, Navikaite & Varanavicius, 2016). However, companies' managements do not only have to satisfy the demands and expectations of external stakeholders, they also should cater for shareholders who expect them to create wealth for them on top of operating profitably.

2.4.1. Corporate environmental investments and its effect on company share price

Corporate investment in environmental technologies has traditionally been a drain on a company's resources, creating an inherent conflict between environmental and financial performance (Fisher- Vanden & Thorburn, 2011). More recently, there has been evidence of financial gains attributable to the investment in environmental technologies (Söderholm et al., 2015). Fisher- Vanden and Thorburn (2011) assert that the negative perception towards environmental investment can also emanate from management and investors' lack of expertise or a universally acceptable framework to recognise in financial terms the returns from environmental investment. Sebastianelli, Tamimi and Iacocca (2015) indicate that some managers assume that investments to protect the natural environment provided few financial benefits to the company. Corporate environmental investments are deemed to be an unnecessary

cost burden to the company and negatively affect shareholder value, therefore, any investment in this regard is deemed to be gratuitous and having no financial gain. Coincidentally, Söderholm et al. (2015) found that environmental investments result in an increase in operating cost with a subsequent decrease in revenue. As such, operating profit margins are diminished and shareholder value is eroded. Therefore, the company's management and shareholders are biased towards environmental investments as they view it as working against one of the principal reasons of venturing into business namely wealth creation. Some shareholders even discount the value of companies that announce their intention to invest in environmental friendly technologies as they deem it as exerting unnecessary pressure on a company's finance, and increasing company costs which will result in a decrease in share value (Ioannou & Serafeim, 2015). This results in corporate environmental investment being limited to compliance with relevant laws and regulations.

In contrast, proponents of financial benefits from corporate environmental investments such as Fisher-Vanden and Thorburn (2011) argue that potential gains from improved environmental performance can result from a differentiation of the product by signalling that the company is green, reducing the risk of future environmental liabilities and lawsuits and a cut in the production costs because of pollution reduction measures. With the advent of increased environmental scrutiny, companies tend to avoid the negative backlash and tainting of their corporate image by reducing environmental impact (Söderholm et al., 2015). Companies now avoid business partners or association with companies which are not environmentally friendly in their operations to protect their brand and corporate image (Goncalves, Robinot & Michel, 2016).

Moreover, Alves et al. (2015) concur that there is a significant increase in the awareness of the effect of negative environmental impact on corporate image and stakeholder association of the services, goods and products that has a negative impact on the environment. As such, investing in environmental technologies companies have the effect of product differentiation creating an extended market for the company. Alves et al. (2015) assert that by signalling that the company is green it will attract other environmentally sensitive companies for business and will increase the market base of the company as a larger portion of the world is becoming increasingly environmental sensitive. Engaging in corporate environmental investments will also reduce the likelihood of a company's facing environmentally related lawsuits in future (Yook, Song, Patten & Kim, 2017). Environmentally friendly operations often lead to reduced future liabilities and rehabilitation expenditure generating cost savings which result in positive gains to shareholder value.

Environmental management law in South Africa requires all mining companies to rehabilitate the environment to its prior state before mining operations commenced (Department of Mineral Resources, South Africa, 2002). This has often resulted in mining companies having to incur increased future rehabilitation liabilities by the nature of their operations. Alves et al. (2015) posit that production costs are deemed to be minimised as a direct result of investing in environmental technologies and environmental technologies reduce pollution and ultimately environmental impact. By focusing on the end goal of reducing environmental pollution, retrospectively, wastage within the production process is minimised. In addition, Sebastianelli et al. (2015) defend the proponents of a causal link between financial and environmental

performance and argued that pollution reduction provides future cost savings by increasing efficiency, reducing compliance costs and minimising future liabilities.

By focusing on a greener operational process, a company will benefit from reduced operational costs emanating from reduced wastage within the production process. Moreover, Jorge, Madueño, Martínez-Martínez and Sancho (2015) reflect that the improvement and protection of environmental implications are social concerns and have become a key strategic factor for the achievement of corporate competitiveness, with its relevance increasing rapidly with the social and environmental concerns of the society. Reduced wastage within the production process ultimately increases the competitiveness of the company on the open market, where it would benefit from the increased profit margin from suppressed costs. In addition, Fisher-Vanden and Thorburn (2011) report that initiating environmental initiatives can spur governmental regulation. Thus, companies that voluntarily invests in environmental improvements benefit from a competitive advantage over their rivals who are forced to comply. Hence, environmental initiatives may provide opportunities to build long term strategies that reduce costs, decrease liability exposure, increase efficiency, enhance shareholder relations and improve profitability (Flammer, 2013). Therefore, corporate environmental investments will likely enhance shareholders' value if managed properly. As such, corporate environmental investments can also be a platform for a company to enhance stakeholder relations, although shareholders may predominantly have a financial interest in the company, others stakeholders may value the environment, community and how the company is serving that value.

2.5. Corporate environmental investment in carbon emissions reduction and the effect on company share value

In Sebastianelli et al. (2015), environmental performance is referred to as the extent to which a company emits toxic pollution, given its size. Companies involved in heavy industries such as mining emit substantial quantities of toxic waste because of their operations. Thus, governments have in recent years introduced environmental laws and regulation to govern toxic pollution, and more recently carbon emissions to protect the environment. For mining companies to remain competitive in an economic environment clouded by environmental regulations, they should be innovative enough to formulate methods in which they reduce carbon emissions and remain sustainably profitable (Sebastianelli et al., 2015). As such, reduction of carbon emissions signifies an efficient production process which ultimately results in increases to shareholder value.

Studies by Jacobs (2014), show that even before any actual investment in carbon emissions reduction has begun, mere announcing the intention to reduce carbon emissions creates value for the company. Market reaction from the signals about the company's adaptability to carbon emissions target levels and capability to operate within or below set regulatory levels create value from the sustainability of its operations. There is a more significant positive market reaction to carbon emissions reduction announcements specifically to those that are pledges or statements of intent (Jacobs 2014). Pledges and statements of intent reveal the level of commitment and seriousness by a company's management about the decision being made that instils confidence in the market triggering positive market returns (Kunapatarawong & Martínez-Ros, 2016).

Matsumura, E.M., Prakash, R. and Vera-Muñoz (2013) posit that companies concerned about carbon emissions and environmental impact will enforce a redistribution of value from companies that do not control or regulate carbon emissions to companies that do. The value redistribution in the form of share price gains results from the interpretation of the company's adaptability to the current environmental and economic status by market forces. Having no concern over the volume of carbon emissions signals to potential investors the extent and nature of future costs, fines and penalties the company is likely to face (Matsumura et al., 2013). Such a signal reduces the market demand of a company's shares degrading its value whilst redistributing it to carbon conscious companies because of the increased demand. Consequently, Ioannou and Serafeim (2015) state that at the advent of the 21st century, investors have started discounting the share price of companies that are poorly positioned in an ever-greening economy. Therefore, companies which are poorly positioned environmentally, that is, companies which fail to control or reduce their carbon emissions over time will lose their shareholders' value to those companies which can.

The ability of a company to reduce its carbon emissions becomes a key tool in creating shareholder value (Zhang, Peng, Ma & Shen, 2017). The capability to introduce carbon emissions reduction technology in mining operations becomes a significant value builder through increased global competitiveness and operational efficiency. Complementing this assertion, Chapple, Clarkson and Gold (2013) observe that any operation that will increase a mine's carbon emissions will in turn increase the carbon liability. In contrast, any asset with the potential to reduce carbon emissions will add value in the form of suppressed compliance burden. In that context, Chapple et al. (2015) state that any investment in carbon emissions reduction assets

ceases to be only a cash outflow but begins to generate value by reducing future liabilities. From an investment perspective, investment to compact carbon emissions begins to generate returns, making it attractive for investors.

According to Gans and Hintermann (2013), companies which had a poor pollution control record experienced more negative returns than those with efficient pollution control practices in place. Poor pollution controls especially on carbon emissions signals an inefficient production or mining process, as it emanates from significant wastages in fuel conversion. Carbon emissions release by a mining company translates to the amount of fuel lost in the mining process. Large volumes of metric tonnes in carbon emissions equal the extent of the inefficiencies of the mining process and it results in the burning of more fuel with less production run time (Gans & Hintermann, 2013). A reduction of any sort in carbon emissions tonnage results in increased efficiency in the production process, less fuel for a longer production run time and less wastage within the mining process which are all drivers of shareholder value. In addition, Sebastianelli et al. (2015) claim that pollution reduction, especially in carbon emissions, provides future cost savings by increasing efficiency, reducing compliance costs and minimising future liabilities and potential lawsuits. These cost savings will result in high profit margins for the practising company which will ultimately create shareholder wealth by increasing the share price. Busch and Hoffmann (2011) concur that it makes business sense to invest in environmental technology innovation and pollution reduction. As the world progresses with the green revolution, global competitiveness is also evolving towards environmental compatibility. Consequently, it is environmental investments that allow companies to realise double dividends in the form of a better environment and greater competition (Murovec, Erker & Prodan, 2012). In that sense,

investment to reduce carbon emissions contributes to economic growth and competitiveness which filter down to benefit companies.

The ability to adapt sustainable practices within mining does not only secure the survival of the company, but creates broader market opportunities to secure future operations. Likewise, it is evident that corporate environmental investments do not only benefit the community and environment but generate increased value for investors. Sebastianelli et al. (2015) found that some polluting companies lost market value in a one-day window, following the release of Toxic Release Information (TRI) in the United States of America (USA). Their study supported the notion of a positive relationship between some means of pollution reduction and financial performance.

Diverging from a positive relationship, Lubin and Esty (2010) found that most business executives report that the manner they respond to the challenge of sustainability will largely affect global competitiveness and survival of their businesses. Lubin and Esty (2010) focused only on the response to the challenge of sustainability, to manage a mine in a way which allows future generations to live safely within the same environment. In this regard, investment in carbon emissions reduction is not at the core of business, if at all, it is an investment (Sebastianelli et al., 2015). The focus will be on being able to realise the importance of the environment in which the mines operate, being able to respect and devise a method to co-exist with the natural environment. Lubin and Esty (2010) assert that company managements do not consider specific investments in carbon emissions reduction to yield or generate any positive results or gains to shareholder value.

For mines to commit to investment in carbon emissions reduction, there should be government intervention stimulating growth and encouraging carbon reduction. In support, Fakoya (2014) posit that for low carbon industrialisation to be achievable, government should establish a secure long term investment that will increase production output, infrastructural developments and installation of low carbon technology. Investment in carbon emissions should have an inducement from the government for it to be attractive enough to be persuasive for private companies. More importantly its investment in carbon emissions reduction and installation of low carbon technology should result in increased production to be worth investing.

To begin with, investment in carbon emissions reduction and low carbon technology requires tremendous financial commitments which may not always be readily available (Fakoya, 2014). With the myriad of investment options available to companies, and the possible higher returns thereof, there is not much financial resources reserved for low carbon technology. To add, heavy duty low carbon emissions mining equipment costs more and requires more service costs than regular machinery (Fakoya, 2014). Therefore, for mines to financially commit to the reduction in carbon emissions there should be substantial significant positive returns and benefits being derived from such investment, or at the least, considerable potential to generate shareholder value.

It has been said that even companies with substantial financial reserves do not invest in carbon reduction because of the excess availability of finance (Fakoya, 2014). From an investment perspective, all investments should yield a return to be worth considering. Fakoya (2014) stated, a company that can guarantee an assurance that these investments will be commercially viable independently, is the reason financially able companies commit substantial sums of money

investing in carbon emissions reduction considering that investors expect a return from the utilisation of their money. In any circumstance, for investment towards reducing the carbon footprint to be successful, such carbon emissions reduction should significantly contribute towards reducing the total global emissions and more specifically in relation to the investing companies, moreover, can generate significant shareholder value for shareholders. In addition, Jacobs et al. (2010) recognise that any environmental expenditure beyond that mandatorily required by law is not in the best interest of shareholders and will result in the degradation of the company's resources and value. There is recognition of the value of environmental investment to comply with environmental laws and regulations to reduce carbon emissions. However, the benefit remains in compliance and does not proceed to investment beyond compliance. Therefore, if the company invests in compliance with environmental laws and regulations it can generate shareholder gains from reduced penalties and other future liabilities. Hence, any investment beyond compliance does not yield any further returns and results in the degradation of shareholder value.

In the same context, managements often link corporate environmental investment to the marginal costs imposed by environmental laws and regulations on a company's financial resources (Rexhäuser & Rammer, 2014). This has the effect of eventually eroding a company's financial resources and negatively impacting on its global competitiveness. Because of management's performance appraisals being predominantly financial, management view environmental investment as diverging from the core business of the company and especially their responsibilities as managers. The reasoning is premised on the school of thought that corporate environmental investments do not improve the company's resource efficiency thereby failing to

generate positive returns to shareholders. This negativity results in management undertaking to reduce or eliminate environmental investment and focusing on company growth and global competitiveness (Rexhäuser & Rammer, 2014). That fundamental change to business operations is used to persuade investors of the non-existence of a nexus between corporate investment in carbon emissions reduction and shareholder value.

According to Sullivan and Gouldson (2012), there is no existing universal formula of incorporating environmental investment management into corporate investment decisions. This assertion is supported by the inability of carbon emissions reporting information provided by companies to influence the investment decision making of potential investors (Sullivan & Gouldson, 2012). Environmental investment information as reported by corporates is inadequate by its nature of being subjective to the needs of reporting management to independently influence or change the focus of investment decision making among potential investors (Rexhäuser & Rammer, 2014). In another study, a company's announcement of its intention to reduce carbon emissions resulted in a significant decline in its share price (Fisher-Vanden & Thorburn, 2011). Investors tend to associate such announcements by management as imposing significant costs on a company's financial structure leading to decline in shareholder value. The real concern among investors is that the costs of reducing carbon emissions may overshadow the potential shareholder benefits expected to be gained resulting in the company's financial performance declining. The above notion is premised on the fact that corporate environmental investments have an optimum level at which positive returns are realised, exceeding this optimum level results in the degradation of shareholder value (Flammer, 2013).

2.6. The effect of a carbon tax

The South African government proposes to introduce the carbon tax bill with implementation effective from January 2017 (National Treasury, 2013). The carbon tax policy was preferred because of its straightforward implementation, low transaction costs, adaptive effectiveness in giving a permanent incentive to reduce carbon emissions and the ability to recycle carbon tax revenues back into the economy (Fakoya, 2013). The proposed bill is aimed at reducing the national carbon footprint through reduction in both carbon and greenhouse gas emissions. The proposed carbon tax bill is premised on the fact that South Africa is among the world's leading carbon-intensive industrial nations. This is because of the availability of substantial coal reserves and subsidised coal generated electricity which has led to an over-reliance on energy intensive mining and heavy industry as the historical drivers of economic development.

The carbon tax policy is designed to reduce carbon emissions and greenhouse gas emissions especially from the use of fossil fuels which is predominant in the South African mining sector (Fakoya, 2013). It intends to incentivise consumers and companies to move from carbon intensive energy sources to energy sources with low carbon intensity. When implemented, this policy will provide the external pressure on companies, especially in mining, to innovate and transform towards carbon reduction technology outside the boundaries and scope of shareholder value creation but focusing more on compliance. In addition to compliance, the focus will be more on the reduction of carbon tax payments as these will be an expenditure not aligned to revenue or production capacity.

The financial implication of the carbon tax policy is that it becomes an expenditure which cannot be matched to any revenue for that period. This has the implications of imposing significant adjustment costs on the financial performance of a company such as reduced export competitiveness and high energy prices (Alton, Arndt, Davies, Hartley, Mokrelov & Ubogu, 2014). Alton et al. (2014) state that increased costs induced by the payment of carbon taxes will increase costs of production and will affect profit margins gained from exports. Most mineral prices are determined by international market forces of demand and supply on international commodities' markets and do not respond to individual policies of countries. Therefore, a carbon tax may likely result in more corporate environmental investments to reduce carbon emissions with no corresponding financial benefits leading to shareholder value degradation.

Although the introduction of a carbon tax may induce corporate environmental investment to reduce carbon emissions, mining companies in South Africa may lose its international competitiveness as not all countries have or will be implementing carbon tax policies by January 2017. According to Alton et al. (2014), the introduction of carbon tax will result in high energy prices and the shift from high carbon emissions energy will increase the demand for green energy or alternative energy sources with low carbon emissions. This development will increase the costs structure significantly specially for mining companies due to their high-energy consumption nature of the operations. This increased energy prices will result in high energy costs which ultimately leads to low profitability and degradation of shareholder value.

In complement, Luo and Tang (2014) posit that in countries where carbon tax was introduced, stock market valuations of the companies' share value were negatively correlated with the intensity of carbon emissions and or volume of greenhouse gas (GHG) release. Investor

perception will view the emission per metric tonne as an impeding cash outflow in the form of carbon tax and will shun away from such company shares decreasing their demand resulting in the company losing shareholder value (Luo & Tang, 2014). To avoid such negative investor perceptions of their company shares, management will be forced to invest in corporate environmental technologies to reduce carbon emissions and ultimately their carbon tax expenditure. This investment in most instances will lack the innovativeness to generate enough revenue to cover investment costs as it is aimed at reducing carbon tax expenditure.

Alton et al. (2014), state that in the long run, due to reduced export and international competitiveness and increased costs of alternative energy, carbon tax results in degradation of shareholder value regardless of the company's investment to reduce carbon emissions. Therefore, in any country with a carbon tax policy, corporate environmental investments may not emanate to shareholder value as they focus more on compliance rather than innovation. In addition, Luo and Tang (2014) assume that a carbon tax law will tend to highlight emissions released by companies to the public and this will negatively affect the mining industry which has high emission levels by nature of its operations. Management will then be forced to reduce their carbon emissions which may not always be done in a profitable manner resulting in negative gains to shareholder value.

2.7. Carbon emissions reduction and investment in other parts of the world

As South Africa makes significant inroads towards implementing a carbon tax system to reduce its carbon footprint, the rest of the world is implementing carbon emissions trading systems. South Africa preferred the carbon tax system because of its straightforward implementation, low

transaction costs and deemed ability to recycle tax revenues though this method has little inducement for corporate investment which stimulates shareholder value (Charitou, 2015). In an emission trading system, a regulatory body is set up to issue emission permits to companies authorising them to legally emit carbon emissions corresponding to the quantity of emission permits they hold (Li & Gu, 2012). Charitou (2015) concedes that carbon emissions permits are tradable among companies creating a market for carbon emissions permits. Companies are also allowed to reallocate the carbon emissions permits among different carbon sources within the company itself (Li & Gu, 2012). Companies which have low carbon emissions and those which invest in low carbon emissions technology are given carbon emissions credits which are tradable therefore incentivising corporate investment in carbon emissions reduction.

The establishment of a carbon emissions market transforms carbon emissions reduction efforts as it now encourages corporate environmental investment in low carbon technology. Laing, Sato, Grubb and Comberti (2013) comment that over and above its primary cause of capping carbon emissions, the carbon emissions system can impact on investment decision making concerning low carbon technology. It is this impact that the carbon emissions system has on investment decision making that creates innovation in corporate environmental investment to reduce carbon emissions in a profitable and sustainable manner generating shareholder value. Investment in carbon emissions reduction becomes profitable as companies generate carbon emissions credits which become a tradable financial investment with a market value.

Using a multivariate regression analysis, Fakoya (2013) found that carbon tax could lead to a slow growth in carbon intensive industries although it is advantageous to low carbon emissions industries. Therefore, introducing carbon tax may not be an appropriate measure to incentivise

corporate environmental investment in carbon emissions reduction given its likelihood of slowing industrial growth which is a generator of shareholder value. In complement, Laing et al. (2013) state that the failure of the carbon tax policy in France in 2010 for similar reasons further reinforces the notion that carbon emissions trading systems are a more feasible and sustainable route compared to a carbon tax policy. An emission trading system through tradable carbon emissions permits enables an imbedded carbon emissions reduction into investment decision making therefore creating value for shareholders whilst complying with the relevant laws and regulations.

In a study of the European Union, Laing et al. (2013) found that their carbon emissions trading system had positively impacted management's investment decisions. The financial impact of the tradable carbon emissions permits ensures that carbon emissions reduction is viewed as an investment and becomes part of the investment appraisal processes. Carbon emissions credits then become financial assets which can be used to match corresponding investments in carbon emissions reduction. Reinforcing the above, Martin, Muŭls and Wagner (2012) found that the European Union's carbon emissions system increased profits in companies, and there was no evidence of the system weakening net exports into unregulated countries and no evidence of adversely affecting local and international competitiveness. The European Union's carbon emissions system increased shareholder value by inducing innovation and encouraging investment in carbon emissions reduction. Unlike the carbon tax policy which reduced export competitiveness, the carbon emissions system did not disadvantage companies operating in a regulated country on the international market.

The carbon emissions system had a minimal impact on investment in Germany but managed to imbed carbon emissions reduction as part of investment appraisal, especially in the power sector (Laing et al., 2013). The carbon emissions system allows companies to strategically invest in carbon reduction enabling the sustainable creation of shareholder value. Laing et al. (2013) assess those case studies performed in Germany, France, the Netherlands and the United Kingdom and found that innovation, driven by the carbon emissions trading system which has the potential to sell and offset carbon credits into the scheme, was driving innovation for investment in profitable reduction methods. In conclusion, the design and framework of carbon emissions trading systems generate shareholder value. For capping off carbon emissions, and stimulating economic growth through creating an enabling environment for companies to create shareholder value, the carbon emissions trading system has proved to be more effective.

2.8. Hazardous solid waste in South African mining companies

Historically, the natural environment has been viewed as a sink for all waste material produced by human mining activities (White, Drake & Hindle, 2012). Waste material, especially from mining activity, has been released into the atmosphere, water bodies or used for landfills and has been left to dilute and disperse into the natural environment. However, at minimised levels of waste material disposal, the natural biochemical and geochemical processes of the natural environment can accommodate and absorb such disposals without transforming the natural environmental conditions. White et al. (2012) state that due to the increased levels of solid waste disposal caused by the exponential increase in mineral exploitation through mining, the natural environmental processes do not have a sufficient absorption rate to prevent the transformation of the natural environment.

Mining companies by nature of their operations produce as a by-product tonnes of hazardous solid waste material which they should release into the surrounding natural environment. Lack of regulation or public scrutiny concerning the manner of solid waste disposal by mining companies can alter the natural environment thereby affecting human, plant and animal life in the process. Mining companies often use highly poisonous chemicals and heavy liquid metals in the purification of their mineral ores which is often disposed along with their solid waste material which usually has life threatening consequences on the ecosystem of the immediate environment. White et al. (2012) identify that the overloading of the natural environment with hazardous solid waste discharge may result in a complete breakdown of natural biochemical and geochemical processes resulting in a complete transformation of the natural environment.

According to Dhal et al. (2013), hazardous solid waste from mining operations can negatively impact on the quality of the surrounding soil and water bodies depending on the chemical composition of the ores and waste dump materials disposed. Open cast mining operations result in overburdened solid waste dumps which can do immensely more harm to the natural environment than reducing forest yields. Dhal et al. (2013) assert that mining involves the excavation of substantial land mass and disturbance of the natural order of soil particles which result in excessive leaching and washing away of natural soil nutrients affecting surrounding plant life and ultimately animal life. Disturbed land masses can also lead to heavy siltation of the nearby river systems, which negatively affects other economic sectors such as agriculture and other ecosystems downstream.

Moreover, Dhal et al. (2013) claim that solid waste overburden dumps are hostile to plant and animal survival due to the existence of many hostile conditions such as low nutrient content, pH

(potential of hydrogen) imbalance coupled with hazardous and heavy metal accumulation and poor water holding capacity. Hazardous solid waste material often has a high acid content from the various ore purification processes that upset the soil pH levels creating a hostile environment for plant growth (Dhal et al., 2013). The hazardous solid waste overburdened dumps also constitute substantial volumes of acids and liquid metals which then leach into water bodies and are fed into and contaminate the underground water source which has far reaching damage implications to the natural environment.

In other parts of the world, Dhal et al. (2013) found that in Kemi, Finland, mining operations resulted in heavy material concentrations in pine tree bark from the surrounding plantation. Although no studies are presented to show the impact of such contamination of the environment, it reinforces the need to have effective solid waste disposal management. In Zimbabwe, ferrochrome dust emitted from a smelter stack polluted soils with chromium even up to 700m away and the furnace emitted an average of 54.6 tonnes of chromium annually (Dhal et al., 2013). It is evident from the substantial volumes of heavy metals a mine can dispose, the corresponding contamination and damage to the environment is immense and that alone justifies the need to efficient solid waste management.

Dhal et al. (2013) found that in the Hunan of China, a ferroalloy mine plant disposed slag directly onto the nearby land, and discharged contaminated waste water into the sewage system that ran through agricultural land. This resulted in the long-term contamination of the soil and more especially agricultural produce which had life threatening effects on the health of consumers. In the Sakinda valley of the Jajpur district, in Orrissa, India, open cast mining operations in this region generate an average of 7.6 million tonnes of hazardous solid waste in

the form of rejected minerals, overburden waste rock material and low grade mineral ore (Dhal et al., 2013). The leaching of this hazardous solid waste material resulted in all water bodies surrounding the mining area being contaminated depriving the local community and animal life of safe drinking water.

To promote a mutual existence between mines and their surrounding natural environment, there should be controlled solid waste disposal and it should be treated to a standard that allows it to be safely usable or harmless to the environment. According to White et al. (2012), the first step to effective hazardous solid waste management is source reduction of hazardous solid waste. This approach appeals to the core of any efficient solid waste management strategy as it results in reduced waste to dispose which is a fundamental prerequisite to curb contamination. When solid waste has been minimised, the next hierarchy will constitute a series of options as to the method of treatment of disposal aimed at reduction of the contamination ability of solid waste.

White et al. (2012) suggest that re-using, recycling, composting, waste to energy, landfills and chemical treatment are some of the methods which can be used to reduce contamination capabilities of hazardous solid waste disposal. The mentioned options will ultimately reduce the future liabilities of the mine in the form of reduced rehabilitation costs. Eddine (2012) emphasise that it is of fundamental importance to the sustainable profitability, survival and growth of the mining industry to manage the disposal of hazardous solid waste. Failure to effectively manage this portfolio has a far-reaching impact on the survival and growth of shareholder value due to the exorbitant fines and penalties that it attracts which has the potential to degrade company value (Funari, Bokhari, Vigliotti, Meisel & Braga, 2016).

In South Africa, mining companies are required by environmental law to rehabilitate the natural environment in which they operated to an acceptable standard which allows the land or surrounding water bodies to be safely usable. Therefore, hazardous solid waste disposal should be managed efficiently throughout the lifespan of the mine (Eddine, 2012). Mining companies should come up with financial strategies or make provisions which will financially enable them to rehabilitate the environment when mining operations are completed. Incidentally, solid waste material is disposed of daily during the operational life span of the mine, and mine management should effectively and continuously manage such disposal to avoid fines and penalties and more especially increased future liabilities in the form of lawsuits and rehabilitation costs.

Guerrero, Maas and Hogland (2013) indicate that hazardous solid waste management affects all the fundamental aspects of the company which facilitates the financial performance of the business. Negligence or improper handling of hazardous solid waste upsets the natural environment attracting legal attacks from environmental regulators and the government which sways management to focus from profitability and ultimately degrades shareholder value. White et al. (2012) argue that just as raw materials and minerals are not in infinite supply, the natural environment is not an infinite sink for hazardous solid waste. This reinforces the need to secure the future viability of the mining industry by ensuring that mutual existence through effective solid waste management will enable the profitable survival of mineral exploitation into the foreseeable future (Jones, Vijayasrinivasan & Parker, 2017).

2.8.1. The Legislative framework governing hazardous solid waste in South Africa

Hazardous solid waste from mining companies is regulated by the government under the Mining and Petroleum Act 28 of 2002 (bill number 23922). Section 37 of the Act stipulates that any mining operation within the Republic must be conducted within the confines of generally accepted principles of sustainable development. Nleya and Simate (2015) posit that the section advocates for all mineral companies to incorporate sustainable development by imbedding social, economic and environmental factors in the exploitation of mineral resources to serve present and future generations. This legislation provides a guideline within which mining companies must operate in terms of environmental impact and damage (Nlyeya & Simate, 2015).

However, section 38(d) of the Mineral and Petroleum act 28 of 2002 governs hazardous solid waste specifically. The section states that "the holder of a reconnaissance permission, prospecting right, mining right, mining permit or retention permit must as far as is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to generally accepted principles of sustainable development". This section builds responsibility for mining companies to rehabilitate the environment to its natural state or any equivalent form which removes the notion of corporate environmental investment as an investment decision but more of a need to comply with regulatory requirements (Nlyeya and Simate, 2015). Mining companies are then required, regardless of the profitability or return on investment of such rehabilitation, to set aside provisions or mobilise resources to comply with these statutes of this regulation.

Moreover, section 38(e) stipulates that "the holder of a mining permit is responsible for any environmental damage, pollution or ecological degradation because of his or her reconnaissance, prospecting or mining operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates.". This subsection creates an obligation towards solid waste which may be disposed within and outside the mine premises. It also includes responsibility towards secondary effects such as leaching of hazardous solid metals, acid mine drainage or the pollution of ground water sources as a direct or indirect result of mining operations (Nlyeya and Simate , 2015).

Nleya and Simate (2015) concede that hazardous solid waste management may not be profitable but should be carried out as a compliance measure. They allude that toxic waste such as acids which may be solid waste can be extracted using various processes such as rectification, membrane separation, solvent extinction and the acid then sold generating revenues which can be used to offset the costs of extracting the acid and disposing of the hazardous solid waste. Waste materials signify inefficiencies and misallocation of resources in the mining process (Al-Hwaiti, Brumsack & Schnetger, 2016). Therefore, the mining process should be designed in a way which minimises waste, especially toxic waste. A more effective way of minimising hazardous solid waste is to reduce the generation of the waste (Al-Hwaiti et al. 2016).

The Witwatersrand is a mineral reef in the Gauteng province, rich in gold and uranium deposits since its discovery in the 18th century (Durand, 2012). The uranium is not economically extractible; therefore, it is then disposed as solid waste into landfills which causes rampant eradication of the surrounding animal and plant life. This is due to the sulphuric acid and iron hydroxide which is produced when the various metals and rejected ore encounter water and

oxygen. Durand (2012) discovered the decimation of animal and plant life around the water bodies at Robinson Lake in Randfontein on the West Rand because of the high concentrations of salts in the surrounding water bodies. Plants are by nature of their organic structure sensitive and struggle to survive in salty or acidic environments.

In Tweelopiespruit, South Africa, rocks, soils and the plants on the river banks are coated with salts and acids from the mine's toxic waste leaching from the landfill or acid mine drainage (Durand, 2012). This has affected the ecosystem of the area and especially animals and plants in Krugersdorp's nature reserve which is in the vicinity. However, Harmony mine in Randfontein has invested in a water treatment plant which is designed to neutralise water acidity by elevating the PH of the water before it is released (Durand, 2012). This investment to reduce environmental impact has no guaranteed direct returns, but will create a sustainable environment for present mining operations and hopefully future alternative use of the land involved. However, investments are meant to generate returns in any profit oriented company, and the next section will review the various relationships between environmental investment and shareholder value.

2.8.2. Corporate environmental investment in hazardous solid waste reduction and its effects on share prices

In a study about mining companies, Busch and Hoffmann (2011) note that they dispose substantial quantities of hazardous solid waste which should be disposed of properly if sustainable mining operations are to be continued or established. The way companies dispose of hazardous solid waste dictates on its future business opportunities and survival. Hazardous solid waste should be in a state where it will not transform the natural biochemical and geochemical

process of the surrounding ecosystems (Busch & Hoffmann, 2011). This may ensure minimal harm to the natural environment and will reduce possible future liabilities for the company.

White et al. (2012) posit that overloading the natural environment with hazardous solid waste attracts penalties from regulators which may threaten the very existence of the company. Non-compliance on hazardous solid waste disposal may impede granting of future mining licenses or result in cancellation of existing ones. While Flammer (2013) acknowledges that environmental issues offer opportunities for growth, he notes that they also place constraints on the future behaviour of the company. White et al. (2012) argue that strategic and environmentally friendly methods of disposing hazardous solid waste can benefit the companies as they may receive more mining permits from the government and would be allowed to mine in environmentally volatile areas. A good hazardous solid waste management profile builds up confidence in the regulators and government that the company is a good corporate citizen. However, a negative hazardous solid waste management profile portrays a reckless management style which may impede on future strategic joint ventures the company may require (Guerrero et al., 2013). A good business reputation is important to most companies and investors and they will whenever possible avoid business connections with companies which has a negative business reputation. This will negatively affect the shareholder value as mining is a capital-intensive industry which requires substantial amounts of capital to recapitalise operations making the possibility of joint ventures, loan and equity financing a reality in future. Ioannou and Serafeim (2015) affirm that as the business world becomes increasingly aware of its impact on the natural environment, shareholders have started discounting the share price of companies poorly positioned to adapt to a greening economy. Therefore, to create a sustainable shareholder value, companies should

effectively dispose hazardous solid waste in an environmentally acceptable manner to continuously attract investments.

Investments to reduce and treat hazardous solid waste is likely to consume a large chunk of financial resources which could have been invested elsewhere and in most instances, it has a long payback period which makes it less favourable. Dangelico and Pujari (2010) state that companies which are not environmentally clean are viewed to have substantial impending costs and are less favourable for investment. Although hazardous solid waste management may not yield immediate financial results, they open the company to long term business opportunities which will ultimately increase shareholder value.

Investments to reduce hazardous solid waste disposal result in a reduction of future environmental liabilities and a cut in production costs because of production efficiency (Fisher-Vanden & Thorburn, 2011). To reduce the impact on the natural environment, a company should minimise the quantity and the level of toxicity of hazardous solid waste. High levels of toxicity reveal high wastage in the mineral purification processes as lots of chemicals, which could still be usable, are lost along with the waste. Effectively managing mineral exploitation will result in efficient use of the chemicals resulting in low toxic content in the hazardous solid waste. Although the quantity of hazardous solid waste may be attributed to levels of production, an efficient production process results in less waste. Flammer (2013) shows that efficiency in the production process reduces hazardous solid waste disposal, idle time and the company will benefit from reduced disposal expenditure.

Moreover, Fisher-Vanden and Thorburn (2011) found that improving environmental performance beyond regulation could spur governmental regulatory action, giving the first mover companies a competitive advantage once their industry rivals are forced to comply. Finding new methods of hazardous solid waste management may create a competitive advantage for companies as they could have substantial costs savings in the form of disposal and rehabilitation expenditure. This innovation allows the company to benefit from pioneering the technology and then selling it to the rest of the mining industry.

Guerrero et al. (2013) state that some corporate environmental investments do not necessarily grow to gains in shareholder value but create the enabling environment for the profitable exploitation of minerals. Some environmental expenditure to preserve and maintain the natural status of the environment is not necessitated by profit but because the entire business operation is dependent on the availability of a safe operating environment. Therefore, investing in the natural environment in this instance is not intended to generate shareholder value, but is meant to acquire the required licenses and permits for mining to legally commence.

In conclusion, Jacobs et al. (2010) and Ioannou and Serafeim (2015) found that other benefits of corporate environmental investment to reduce hazardous solid waste include energy, raw materials and abatement costs' reduction as well as intangible benefits such as improved company reputation, good community relations, high employee morale and access to new markets. Hence, Gans and Hintermann (2013) assert that good social and environmental performance attract resources to the company, including better quality employees and expanded market opportunities. Deriving a basis from the stakeholder theory, reduction in solid waste

disposal consolidates the relationship between companies and their stakeholders (surrounding community and environment) which is important for the survival of companies.

2.9. Summary of the chapter

Chapter Two presents an in-depth review of the related literature of the study. The chapter begins by providing a critical analysis of the theoretical framework, the stakeholder and legitimacy theories which provide a premise on which the research is based. This is followed by a review of literature on carbon emissions reduction and hazardous solid waste and their various relationships with shareholder value. The literature provides a basis to respond to the pertinent questions posed by the research hypothesis in Chapter One. Moreover, a legal framework analysing the impending carbon tax law and the Mineral and Petroleum Act 28 of 2002 is also presented. Chapter Three presents the research methodology used for this study. The research method and design are outlined and more especially the appropriateness of the research methodology chosen is explained.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

The previous chapter reviewed literature on the effect of corporate environmental investment on shareholder value. Chapter Two outlined the various relationships between carbon emissions, hazardous solid waste disposal and shareholder value. The nexus between corporate environmental investment and shareholder value was reviewed in synchronisation with the stakeholder and legitimacy theories which form the basis of the study. Chapter Three outlines the research methodology adopted to establish the relationship between carbon emissions, hazardous solid waste disposal and share price. Section 3.2 describes the research paradigms and further justifies the paradigm adopted for this study. The research design and design appropriateness to suit this study is explained in Section 3.3. Section 3.4 presents the research method performed for this study, it explains the population, sample, data collection to the data analysis models adopted. Measures to mitigate research bias are present in Section 3.7 and the ethical considerations performed by the researcher are presented in Section 3.8. The chapter is summarised in Section 3.9.

3.2. Research paradigm

According to Antwi and Hamza (2015), research has three major paradigms, namely: positivism, constructivism and critical theory. A research paradigm is a collection of common beliefs and understanding portrayed between scientists about how research problems should be understood and how they should be addressed (Antwi & Hamza, 2015). The research paradigm explains the various approaches, quantitative or qualitative, a researcher undertakes to objectively resolve the

research problem (Wahyuni, 2012; Antwi & Hamza, 2015). Each paradigm has a definite set of research methods which can be used in performing a scientific investigation. This study adopted the positivist paradigm. Antwi and Hamza (2015) state that positivism asserts a deterministic and empiricist philosophy where effects emanate from causes, and targets to observe, quantitatively measure and predict objectively relationships between variables. In that regard, positivism emphasise an objective approach to scientific investigation and gives preference to research methods focusing on quantitative analysis (Wahyuni, 2012). As such, causal research design and a quantitative research method were adopted to respond to the research problem identified in this study.

3.3. Research design

A causal research design was used to respond to the research questions posed in this study. The design allowed the researcher to examine the effect of public pronouncements to reduce greenhouse gas emissions by companies. The causal research enabled the researchers to establish a relationship between corporate environmental initiatives and shareholders' wealth represented by company share price.

3.4. Research method

The researcher adopted a quantitative research method to establish the relationship between the environmental investment and shareholder value in selected mining companies. Furthermore, Creswell (2013) states that a quantitative research is ideal when studying a group of similar characteristics and behaviour. The quantitative research method proved useful as the study used quantitative data collected from the annual integrated and sustainability reports of the selected

companies. The quantitative research method was ideal for this study as it allows the researcher to make decisions purely derived from statistical tools giving room for controlling variables which could influence the result negatively. The use of the quantitative research method was also necessitated by its ability to adjust for bias and error when deriving research results.

The researcher studied 10 mining companies which had been continuously listed on the Johannesburg Stock Exchange Social Responsibility Index (JSE SRI) from the period 2010 to 2015. The 10 companies were chosen because of their adherence to the stringent listing requirements of the JSE SRI for the entire period under study. The year 2010 was the ideal starting point because it was the time when mandatory integrated and sustainability reports were required for all listed companies on the JSE SRI. Moreover, integrated and sustainability reports were fundamental in furnishing the researcher with the necessary qualitative and quantitative data required for the study. Research data were collected from the companies integrated and sustainability reports which are publicly available on the respective companies' websites. Data collected included the companies' share prices and environmental investment expenditure in carbon emissions and hazardous solid waste reduction. Multiple regression analysis was used to analyse the research data to establish the nature of the relation between the variables under study. The quantitative method adopted by the researcher proved useful as it managed to provide a deep understanding of the research problem allowing the researcher to answer all pertinent questions relating to the study.

3.4.1. Population

The population of this research constitutes all companies listed on the Social Responsibility Index (SRI) of the Johannesburg Stock Exchange (JSE). Bryman and Bell (2015) define a population as the entire group, class of objects or other variables to be investigated. The values and standards associated with the JSE listing requirements motivated the researcher to prefer their constituency as a target population to ensure the gathering of reliable and accurate data. The companies listed on the SRI JSE are engaged in various environmental investments thereby satisfying the contemporary nature of this study. As part of their listing requirements on the JSE SRI, the companies are required to publish integrated and sustainability reports which provided the researcher with appropriate documents to perform a content analysis. Moreover, the companies listed on the JSE SRI have taken the lead in environmental investment and disclosure; hence they have a considerable pool of environmental data necessary to answer the research questions of this study.

3.4.2. Sampling

Bryman and Bell (2015) define a sample as a constituent of a population to which research findings will be applied. The sample of this study constituted all mining companies which were consistently listed on the JSE SRI from the period 2010 to 2015. This was necessitated by the need to gather comparable information. The nature of the sample also allowed for the analysis of trends and provided impeccable information on the selected environmental investments.

3.4.3. Sample

The study sample constituted of 10 mining companies which have been listed continuously on the JSE SRI for the entire period of study. As all the companies are listed on the JSE, all the financial, integrated and sustainability reports are in the public domain, therefore, the companies' names have been written in full. The mining companies selected for the study are: Anglo American plc; Anglo Platinum; Anglo Gold Ashanti; African Rainbow Minerals; Exxarro Resources; BHP Billiton; Impala Platinum; Kumba Iron ore; Northam Platinum; and DRD Gold. These companies where chosen based on their compliance with the strict listing requirements of the JSE SRI, which also display their leading role in environmental and sustainability practices which was fundamental for this study.

3.5. Data Collection

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated study questions, test hypotheses and evaluate outcomes (Bryman & Bell, 2015). Secondary data were used to perform this study. Quantitative data were collected from the annual integrated reports available from the respective companies' websites. Data on the various environmental investments to reduce carbon emissions and hazardous solid waste disposal undertaken by the selected companies were collected from the integrated and sustainability reports.

Financial data collected contained the share prices of the respective companies. The researcher used the share price provided in the year end annual financial statements. This was found in the integrated annual reports on the respective company's websites. Environmental data on

expenditure in carbon emissions reduction and hazardous solid waste disposal were collected from the integrated reports. These were represented by stated amounts invested by individual companies against the selected environmental variables.

Control variables constituting of the cash flow adequacy ratio and the leverage factors were also collected from the respective companies' financial statements. The cash flow adequacy ratio analyses a company's ability to pay for capital expenditure, long term liabilities and dividends from cash generated from operations. Cash flow adequacy ratio will ensure that any gains or losses in the share price are supported by real cash flows and are not because of accounting policies. The leverage factor analyses the extent to which a company is financed by debt. This control variable will analyse the extent to which environmental investments in carbon emissions and hazardous solid waste are being financed by debt capital. The share price as the dependent variable is influenced by a lot of factors over and above investment in carbon emissions reduction and hazardous solid waste. Therefore, control variables were necessary to neutralise any bias and error from the influence of the other influencing factors which impact the share price.

3.6. Data Analysis

Bryman and Bell (2015) state that data analysis assists in investigating variables as well as their effect, relationship and pattern of involvement within our world. This study used a statistical method of data analysis using the panel data multiple regression analysis. This was done to get a comprehensive examination of the various relationships among the variables under study. Regression analysis is a general method for estimating the relationship between a response

variable and one or more explanatory variables (Draper & Smith, 2014). On the quantitative approach, the study used a panel data multiple regression analysis method to examine the effect of investments in carbon emissions reduction, hazardous solid waste disposal and share price. There many models available under panel data multiple regression, this study used the fixed and random effects models. The Hausman test was performed to determine the most appropriate model.

3.6.1. Regression Analysis

To analyse data empirically, the researcher used the panel data multiple regression analysis method. This method was appropriate as it can establish the nature of the relationship between the variables under study. The study utilised two models namely; the fixed and random effects models. The fixed effects model absorbs all other economic influencers of the dependent variable in the intercept thereby attempting to control the biasing effects of time invariant variables to better assess the impact of the independent variables under study. In doing so, the fixed effects model holds all other variables constant and analyses the effect of only the variables under study. This gives a more realistic perspective of the actual relationship between the variables under study.

The random effects model assumes that differences between individual variables are random and uncorrelated rather than fixed. Therefore, the random effects model includes time invariant economic influencers of the dependent variable in the analysis rather than absorbing them in the intercept as in the fixed effects model. Thus, the random effects model analyses all economic influencers of the share prices giving a more realistic result that is representative of the actual

relationship between the independent and dependent variables. Because of the different approaches of the two models used, it was necessary to determine the most appropriate model to adopt for this study. The Hausman test was performed to determine the most appropriate model for this study. A probability below the confidence level of 0.05 would result in the model being rejected and a probability above the confidence level will result in the model being accepted.

The regression equation used: $y=a+b^1x^1+b^{2x2}$

Where y = share price

X_1= investment in carbon emissions reduction

X_2 = investment in hazardous solid waste disposal

a = intercept

b = slope

3.7. Reliability, validity and objectivity

According to Bryman and Bell (2015), reliability refers to the extent to which a measurement gives results that are consistent and validity refers to the extent to which a concept, or conclusion or measurement is well founded and corresponds accurately to the real world. Reliable data collection method is one that is relatively free from measurement error (Noble & Smith, 2015). Data used in the study will be collected from the respective companies' financial, integrated and sustainability reports which are available on the JSE website. This ensured reliability of the data

collected from integrated and sustainability reports. These are regulated reports whose content is audited for fair presentation of the state of the company before publication.

The study adopted quantitative methods to analyse data. This allowed for the use of statistical models in data analysis which controls for error and other unknown eventualities thereby increasing the reliability and validity of the study. The fixed effects and the random effects models were adopted in a panel data multiple regression analysis used in this study. Moreover, the use of panel data multiple regression allows control variables to be included in the analysis thereby controlling for other variables that may negatively influence the results. Thus, the reliability, validity and objectivity of the study is ensured. The researcher employed all the necessary measures and steps to ensure that data is reliable, valid and objective.

3.7.1. Bias

According to Bryman and Bell (2015), research bias refers to a systematic error which is introduced into sampling by selecting or encouraging one outcome over other outcomes. The study used two models namely the fixed effects and the random effects model. The study will perform a Hausman test to determine the most appropriate model to adopt for this study. Therefore, bias is minimised as the result to be adopted is chosen by statistical methods rather than human judgement.

3.8. Ethical considerations

The researcher complied with all the ethical considerations. All information from financial statements of sample companies were used solely for the purposes of the study. All the data used

in this study were collected from the JSE and company websites which are all in the public domain. This researcher respected the rights and confidentiality of all information on the target population and sample. This researcher ensured that all data and information from other information sources were appropriately cited and fully recognised in the referencing of the dissertation.

3.9. Summary of the chapter

The chapter discusses the research methodology adopted for this study. It began with a brief discussion on research paradigms and the suitability of the research paradigm for this study. The causal research design and its appropriateness are then described. This was followed by the research method which explained the population, sampling, data collection and analysis performed in the study. The chapter also explains the measures taken to enhance reliability and validity; moreover, measures to mitigate research bias were also presented. Ethical considerations by the researcher are presented last. The next chapter, Chapter Four, presents the results and discussions of the results, the interpretation of the results and an overview of the research findings.

CHAPTER FOUR: DISCUSSION, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1. Introduction

The previous chapter outlined the research methodology adopted for this study. Chapter Three explained the research design and method used to perform this study. Moreover, the data analysis models were also explained. Chapter Four presents the discussion, presentation and interpretation of the research findings. Section 4.3 presents the results from the fixed and random effects models and the Hausman test performed in this study. An extensive discussion of the research findings is presented in section 4.4. Section 4.5 concludes the chapter with a summary of all the sections in the chapter.

4.2 Data management and analysis

Research data such as share prices, investment in carbon emissions and hazardous solid waste were collected from the INET.BFA website. The share prices collected were at the close of the respective companies' trading period for the periods under review and are readily available on their websites. Investment in carbon emissions reduction and hazardous solid waste reductions expenditure amounts were collected from the respective companies' sustainability reports which are also readily available on the INET.BFA website.

The control variables namely the leverage factor and cash adequacy ratio were collected from the general ratios and cash ratios respectively which are also readily available on the companies' website. The leverage factor assesses how much of the capital used to finance environmental

investments by the company emanates from debt financing and about the company's ability to meet its debt obligations. This control variable is appropriate because it controls the growth in share price by considering the ratio of debt used to finance investments (including environmental investments). The cash adequacy ratio measures the company's ability to pay for capital expenditure, dividends and debt repayment from cash generated from operational activities. This was important because of the need to ensure that any growth in share price is substantiated by actual cash resource growth and is not necessarily an accounting growth.

Collected data were captured on a Microsoft Excel spread sheet from where it was imported to the SPSS STATA software for analysis. Data are analysed using two models which are the Fixed-effects and Random-effects panel data multiple regression models. The Fixed-effects model is ideal for controlling biasing effects of time-invariant variables to better analyse the impact of changing variables. The fixed effects model is ideal when analysing the impact of data variables that remain constant over a period. In this study, the fixed-effects model is appropriate since it limits the analysis of investment in carbon emissions and hazardous solid waste reduction to the share price whilst holding all other economic influencers of the share price constant.

Given the data used in the study, another appropriate panel data multiple regression model would be the Random-effects model. The Random-effects model assumes that differences between individual variables are random and uncorrelated (Hatz & Nicholas, 2011). This assumption allows the time-invariant economic influencers of the share price to be included and analysed compared to the Fixed-effects model where they are absorbed by the intercept and are thus ignored. The inclusive character of the random effects model reveals a more practical impact of investment in carbon emissions and hazardous solid waste reduction on the share price which

includes in the analysis all economic influencers of the share price thereby reflecting a more realistic approach.

Because of the fundamental differences between the Fixed-effects and Random-effects models, they are bound to provide differing results. Therefore, it is necessary to conduct tests that will assist in deciding which model is best suited for the study. Once both the Fixed-effects and Random-effects panel data multiple regression models are performed, a Hausman test is performed to determine the appropriate model to use. A Hausman test with a probability higher than the confidence level of 0.05 accepts the random effects model while rejecting the fixed effects model and a probability lower than 0.05 accepts the fixed effects model while rejecting the random effects model (Creswell, 2013). Therefore, the null hypothesis is that the most appropriate model is the Random-effects model compared to the Fixed-effects model. The data for both carbon emissions and hazardous solid waste were first tested on the fixed effects model and the estimates saved, this is followed by a second test on the random estimates model, finally, the Hausman test is performed using the saved estimates from both models. The Hausman test will then be used to either accept or reject the Random-effects model which has a reciprocal effect on the Fixed-effects model.

4.3 The results

The study found contrasting results from the Fixed-effects and Random-effects models that were performed. Panel data multiple regressions were first tested on the Fixed-effects model. The model was used to establish the nature of the relationship between share price and investment in carbon emissions reduction. The result shows an insignificant relationship tested at 95%

confidence level between investment in carbon emissions reduction and share price including the control variables of leverage factor and cash adequacy ratio.

The following table shows a summary of observations for the fixed effects model of carbon emissions and share price. Table 4.1 presents the Fixed Effects Regression Model summary.

Table 4. 1: The Fixed Effects Regression Model Summary

Fixed-effects (within) regression	**Number of observations**	**60**
Group variable: Company code	Number of groups	10
R-sq	Observations per group	
Within = 0.0177	Min	6
Between =0.1426	Avg	6.0
Overall = 0.0456	Max	6
	F(3.47)	0.28
Corr(u_i, xb) =0.1576	Prob > F	0.8384

Table 4.1 shows at total of 60 observations from 10 companies. The correlation between the two variables is 0.1576 which is closer to zero meaning that there is no relationship in the movement between carbon emissions and share price. The summary of observations shows a probability of 0.8384 which is above the 0.5 showing the significance of the correlation result that there is no correlation between variables under study. Table 4.2 shows a fixed effects regression model of carbon emissions and share price. The table shows the coefficient for the main variables under study and the control variables of leverage factor and cash flow adequacy ratio.

Table 4. 2: Fixed Effects Model of investment in carbon emissions reduction

Share price	Coef.	Std.Err	t	P > |t|	95% Conf.	Interval
Inv in CE	-4.80e-09	4.88e-08	-0.10	0.922	-1.03e-07	9.33e-08
Leverage Factor	-.0780774	.3795149	-0.21	0.838	-.841563	.6854082
Adequacy ratio	-.0551606	.0603898	-0.91	0.366	-1766492	.0663279
_cons	203.2279	18.31161	11.10	0.000	166.3897	240.0661
Sigma_u	128.0957					
Sigma_e	98.988765					
rho	.62610488 (fraction of variance due to u_i)					

F test that all u_i = 0: F(9, 47) =9.06

Prob > F =0.0000

The fixed effects multiple regression model of investment in carbon emissions reduction in Table 4.2 shows a negative relationship between company share price and investment in carbon emissions reduction. This is evidenced by the negative coefficient of -4.80e-09 in Table 4.2. The result shows that for every one unit investment in carbon emissions reduction, the share price of the companies will lose a value equal to the coefficient. Moreover, the fixed effects model has a T-statistic of -0.1, which is less than 1.96 when tested at 95% confidence level. A T-statistic of such a size shows that investment in carbon emissions reduction is not significant enough to influence the share price. In addition, investment in carbon emissions reduction has a P-value of 0.922 which is greater than the significance level 0.05 (model tested at 95% confidence) which further explains the inability of investment in carbon emissions reduction to significantly influence the share price.

The control variables of leverage factor and cash adequacy ratio (see Table 4.2) also indicate a negative relationship with company share price as evidenced by a negative coefficient of -

0.780774 and -0.0551606 respectively. The T-statistic of both the leverage factor and adequacy ratio is -0.21 and -0.91 respectively which are all smaller than 1.96 when tested at 95% confidence level. Therefore, the control variables cannot in any significant way influence the share price. The P-value for the leverage factor is 0.838 and cash adequacy ratio is 0.366 are both greater than the confidence level of 0.05 (tested at 95% confidence) making both control variables insignificant to explain the movements in share price. Therefore, for the fixed effects multiple regression model, after controlling for leverage and cash adequacy, investment in carbon emissions reduction generates a negative relationship with share price. Table 4.3 shows the summary of observations for the random effects regression model of carbon emissions and share price.

Table 4. 3: Random Effects Regression Model Summary

Random effects GLS regression	**Number of observations**	**60**
Group variable: Company code	Number of groups	10
R-sq	Observations per group	
Within = 0.0161	min	6
Between = 0.2499	avg	6.0
Overall = 0.0841	max	6
	Wald chi2(3)	1.34
Corr(u_i,x) = 0 (assumed)	Prob > chi2	0.7190

There were a total of 60 observations from 10 companies. Carbon emissions and share price have a correlation of zero meaning there is no relationship between the movement of two variables. The probability of 0.7190 is above 0.5 which means the zero correlation is significant.

This table shows the random effects regression model of carbon emissions and share price. It shows the coefficients relationship of investment in carbon emissions, control variables of leverage factor and cash flow adequacy ratio to company share price.

Table 4. 4: The Random Effects Model of investment in carbon emissions

Share price	Coef.	Std. Err	Z	P >|z|	95% conf.	Interval
Inv in CE	8.68e-09	4.08e-08	0.21	0.831	-7.12e-08	8.86e-08
Leverage factor	-.1530256	.3713166	-0.41	0.680	-.8807927	.5747415
Adequacy ratio	-.0663427	.0590975	-1.12	0.262	-.1821717	.0494862
_cons	202.3499	44.05368	4.59	0.000	116.0062	288.6935
Sigma_u	129.431					
Sigma_e	98.988765					
rho	.63094737 (fraction of variance due to u_i)					

The random effects multiple regression model of investment in carbon emissions reduction in Figure 4.4 shows a positive coefficient of 8.68e-09. The result indicates that every unit of investment in carbon emissions reduction will result in the share price increasing by 8.68e-09 units. Therefore, the random effects model has generated a positive relationship between carbon emissions reduction and company share price. However, the control variables show negative coefficients of -0.1530256 and -0.0663427 for leverage factor and adequacy ratio respectively.

Table 4.5 shows a statistical test performed to determine the most appropriate model between the fixed effects and the random effects model. Both regressions model where utilised in the determining the relationship between carbon emissions and share price and the Hausman test was used to choose between the two models.

Table 4. 5: hausman Test of investment in carbon emissions

	- Coeffients-			
	(b)	(B)	(b-B)	Sqrt(diag(V_b-V_B)
	Fixed	Random	Difference	S.E.
Inv in CE	-4.80e-09	8.68e-09	-1.35e-08	2.67e-08

Leverage factor	-.0780774	-.1530256	.0749482	.0784575
Adequacy ratio	-.0551606	-.0663427	.0111821	.0124262

b = consistent under H_0 and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under H_0; obtained from xtreg

Test H0: difference in coefficients not systematic

$$Chi(^2)^2 = (b-B)'[(V\_b-V\_B)'(-1)](b-B)$$

$$= 1.07$$

$$Prob > chi^2 = 0.5855$$

Table 4.5 presents a Hausman test on investment in carbon emissions reduction to determine which multiple regression model is appropriate for this study. The Hausman test shows a probability of 0.5855 which is greater than the confidence level of 0.05. Such a high probability accepts the null hypothesis which is the random effects model. Therefore, a probability of 0.5855 on the Hausman test states that the results of the random effects model are significant and cannot be rejected; as a consequence, the random effect model results showing a positive relationship between investment in carbon emissions reduction and share price were accepted. Table 4.6 shows the summary of observations for the fixed effects regression model of hazardous solid waste and share price. Table 4.6 shows the relationship of the movement between variables under study and the strength of that relationship.

Table 4. 6: The Fixed Effects Regression Model

Fixed-effects (within) regression	**Number of observations**	**60**
Group variable: Company code	Number of groups	10
R-sq:	Observations per group:	
Within = 0.0207	Min	6
Between = 0.1009	Avg	6.0
Overall = 0.0390	Max	6
	F(3.47)	0.33
Corr(u_i, xb) = 0.1277	Prob > F	0.8031

There are a total of 60 observations from 10 companies. The correlation between hazardous solid waste and share price is 0.1277 which is closer to zero meaning the movement of hazardous solid waste is not related to the movement in company share price. The probability of 0.8031 is greater than 0.5 meaning the relationship in the movement of the variables is not significant to dilute the result of the regression model.

Table 4.7 shows the fixed effects model of hazardous solid waste and share price. The model also includes the control variables of leverage factor and cash flow adequacy ratio. The coefficient shows the nature of the relationship between share price and all the other variables.

Table 4. 7: The Fixed Effects Model of investment in hazardous solid waste reduction

Share Price	Coef.	Std.Err.	t	P>|t|	95% Conf.	Interval
Inv in HSW	-1.30e-09	3.31e-09	-0.39	0.696	-7.95e-09	5.35e-09
Leverage factor	-.0792088	.3789428	-0.21	0.835	-.8415433	.6831257
Adequacy ratio	-.0560536	.0603362	-0.93	0.358	-.1774343	.0653271
_cons	203.7406	15.77232	12.92	0.000	172.0108	235.4704
Sigma_u	128.31899					
Sigma_e	98.836595					
rho	.62763931 (fraction of variance due to u_i)					

F test that all u_i = 0: F (9, 47) = 9.31

Prob > F = 0.0000

Table 4.7 shows the result of the fixed effects multiple regression model for investment in hazardous solid waste reduction. Hazardous solid waste generates a negative coefficient of -1.30e09 to the share price. One unit of investment in hazardous solid waste results in the share price losing 1.30e-09 units. In addition, hazardous solid waste has a T-statistic of -0.39 which is less than 1.96 when tested at 95% confidence level. This T-statistic stipulates that hazardous solid waste is not significant enough to materially influence the movements in the company share price. The P-value of 0.696 is greater than the confidence level of 0.05 further showing the inability of hazardous solid waste to explain any movements in the share price.

The controlling variables of leverage factor and cash adequacy ratio show negative coefficients of -0.0792088 and -0.0560536 respectively. Both control variables have T-statistics which are greater than 1.96 at 95% confidence level, and P-values greater than the confidence level. Thus, after controlling for leverage factor and cash adequacy ratio, investment in hazardous solid waste reduction generates a negative relationship with share price using the fixed effects model.

Table 4.8 shows the summary of observations between hazardous solid waste and share price using the random effects regression model.

Table 4. 8: Random Effects Regression Model Summary

Random-effects GLS regression	**Number of observations**	**60**
Group variable: Company Code	Number of groups	10
R-sq:	Observations per group:	
Within = 0.0197	min	6
Between = 0.1769	avg	6.0
Overall = 0.0575	max	6
	Wald chi2(3)	1.37
Corr(u_i,x) = 0 (assumed)	Prob > chi2	0.7125

A total of 60 observations were recognised from 10 companies. The correlation is zero meaning there is no relationship between the movement in hazardous solid waste and share price. The probability of 0.7125 is greater than 0.5 meaning the movements in the variables under study are not significant.

Table 4.9 shows the random effects multiple regression model of hazardous solid waste and share price. The model includes control variables of leverage factor and cash flow adequacy ratio. The nature of the relationship between the variables is shown by the coefficient.

Table 4. 9: Random Effects Multiple Regression Model for hazardous solid waste

Share price	Coef.	Std.Err.	z	P>|z|	95%Conf.	Interval
Inv in HSW	-8.67e-10	3.19e-09	-0.27	0.786	-7.11e-09	5.38e-09
Leverage factor	-.1546813	.3711062	-0.42	0.677	-.8820362	.5726736
Adequacy ratio	-.0669436	.0591066	-1.13	0.257	-.1827903	.0489032
_cons	205.1485	43.47226	4.72	0.000	119.9444	290.3525
Sigma_u	129.59961					
Sigma_e	98.836595					
rho	.63226909 (fraction of variance due to u_i)					

Table 4.9 shows the result of the random effects panel data multiple regression for investment in hazardous solid waste reduction. The coefficient of hazardous solid waste shows a negative of -8.67e-10 meaning there is an inverse relationship between hazardous solid waste and share price. The controlling variables of the leverage factor and cash adequacy ratio also show negative coefficients of -0.1546813 and -0.0669436 respectively stipulating a negative relationship with share price. As a model, after controlling for leverage and cash adequacy, investment in hazardous solid waste generates a negative relationship with company share price.

Table 4.10 shows the statistical test used to determine the most appropriate regression model to adopt for this study. The fixed and random effects regression models were applied on the data and the Hausman test was used to determine an appropriate model to use for this study.

Table 4. 10: The Hausman Test for investment in hazardous solid waste reduction

	coefficients			
	(b)	(B)	(b-B)	Sqrt(diag(V_b-V_B)
	Fixed	Random	Difference	S.E.
Inv in HSW	-1.30e-09	-8.67e-10	-4.33e-10	8.76e-10
Leverage factor	-0.0792088	-.1546813	.0754725	.076666
Adequacy ratio	-0.0560536	-.0669436	.01089	.0121188

b = consistent under H_0 and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under H_0; obtained from xtreg

Test: H_0: difference in coefficients not systematic

$Chi^{2(2)}$ = (b-B)' [(V_b-V_B) '(-1)](b-B)

= 1.10

Prob >chi^2 = 0.5772

Table 4.10 shows the Hausman Test that was utilised to determine the appropriate model between the fixed-effects and random-effects models for investment in hazardous solid waste. In Figure 4.6, the Hausman Test shows a probability of 0.5772 which is greater than the confidence level of 0.05. As a result, accordingly the Hausman test rejects the fixed effects model and

accepts the random effects model of hazardous solid waste reduction which reflects a negative relationship with share price.

Table 4.11 shows a summary of statistical tests performed on the data. The statistical tests identified the mean, standard deviation, minimum and maximum amounts of the observations.

Table 4. 11: Summarised Data of observations

Variable	obs	Mean	Std.Dev	Min	Max
Share price	60	194.8547	153.3765	2.25	648.7
Inv in CE	60	2.06e+08	6.21e+08	354000	3.72e+09
Inv in HSW	60	1.07e+09	4.97e+09	1123000	3.72e+10
Leverage factor	60	6.858405	37.75967	-1.5349	291.6838
Adequacy ratio	60	124.1313	236.6571	-131.099	1836.75

Table 4.11 shows the data from the summary statistics performed in the study. The study identified 60 observations on each individual variable. The mean, an average used to generate the central tendency in the data shows the share price with the largest average of 194.8547 followed by the cash flow adequacy ratio with an average of 124.1313 while the remaining variables have significantly smaller averages. The standard deviation which shows the degree of dispersion in the distribution has cash flow adequacy and share price as the most spread variables. This is largely due to the different company sizes studied in this research. The minimum and maximum figures which measure the range between the smallest and the largest amount in a data set are also significantly substantial. The wide range is also attributed to the different company sizes which influence their financial resources.

Table 4.12 shows the correlation matrix which is a measure of the relationship between the movements of all the variables with each other.

Table 4. 12: Correlation Matrix

	Share price	Inv in CE	Inv in HSW	Leverage factor	Adequacy ratio
Share price	1.000				
Inv in CE	0.1411	1.000			
Inv in HSW	0.0710	0.5479	1.000		
Leverage factor	-0.1620	-0.0509	-0.0326	1.000	
Adequacy ratio	-0.2158	-0.0275	-0.0445	-0.0520	1.000

Table 4.12 presents a correlation matrix to establish the nature of the one to one relationships between the variables that were tested. The correlation is between 0.0 and 1.0, with 0.0 stipulating the absence of a relationship and 1.0 being the presence of a relationship. The closer the number is to 1.0, the stronger the relationship. A positive correlation stipulates a direct relationship where an increase in independent variable results is an increase in the dependent variable, and an inverse relationship for the negative correlation. In Figure 4.8 both independent variables, investment in carbon emissions and hazardous solid waste have positive correlations of 0.1411 and 0.0710 respectively. This shows that any investment in carbon emissions and hazardous solid waste is likely to result in an increase equal to the correlation in the share price. However, the controlling variables of leverage and adequacy ratio show a negative correlation to share price of -0.1620 and -0.2158. Nonetheless, all these relationships are not strong since they are not close to 1.0.

4.4 Overview of research results

The aim of this study was to establish the nature of the relationship between corporate environmental investment in carbon emissions reduction, hazardous solid waste reduction and company share price. This motivation came from the recent rise in green business initiatives and

due to pressures by environmental watch groups on businesses to be more conscious about the effect of their operation on the natural environment. On the other hand, business executives globally have been paying attention to improving sustainability practices in their operations especially in the mining sector. The study seeks to establish if mining companies create value for their shareholders as a result of their investment in environmental impact reduction especially in carbon emissions and hazardous solid waste. This section discusses the results found in this study. The results from the fixed effects panel data multiple regression model are discussed first and it is followed by discussions on the Random effects regression model. Finally, a discussion of the Hausman test performed to determine an appropriate model is provided.

Model 1: Fixed effects model of investment in carbon emissions reduction

The fixed effects model analysis of investment in carbon emissions reduction and share price yielded a negative relationship. The fixed effects model absorbs time invariant economic influencers of the share price in the intercept, thereby holding them constant whilst analysing only the impact of change in the independent variables under study. This allowed the study to hold all other economic variables constant whilst analysing the impact of the change of investment in carbon emissions reduction and the control variables of leverage and cash flow adequacy ratio.

After controlling for leverage and cash flow adequacy ratio, the fixed effects model produced a negative relationship between investment in carbon reduction and share price. These are consistent with results of Jacobs et al. (2010), Sullivan and Gouldson (2012), Flammer (2013), and Rexhäuser and Rammer (2014). The negative relationship derives from the failure by

management to determine and maintain an optimal level of carbon emissions reduction investment which is able to generate returns for the company. Management should find a balance between where investment to reduce carbon emissions is profitable, and where investing beyond that optimal level begins to erode shareholder value.

The stakeholder theory stipulates that management should not view the shareholder as the supreme stakeholder (Jenson, 2010). Although, shareholders have a financial interest to the company and therefore have the ability to appoint management, their interests are not supreme. The stakeholder theory encourages management to balance the interests of all stakeholders because this has the ability to maximise company value. Therefore, failure to strike the right balance between the interests of the various stakeholders will yield negative returns on the share price as shown by the results. The interests of non-financial stakeholders should be considered and environmental investment may be an option to achieve that, nevertheless, it should not be at the expense of value creation.

The negative relationship between share price and investment in carbon emissions reduction found by the fixed effects model can also be as result of management investing beyond regulatory compliance. Investment in carbon emissions reduction should be limited to the level of compliance with laws and regulations. Full compliance with set laws and regulations will eliminate any possible liabilities which may be levelled against the company whilst concurrently avoiding fines and penalties from the government and other regulatory bodies. From an investment perspective, returns from investment in carbon emissions reduction are maximised when compliance with laws and regulations is accomplished. Any investment beyond

compliance, regardless of how it may be interpreted, generates negative returns to the share price and may be the cause of the negative relationship.

The negative relationship between investment in carbon emissions reduction and share price can also derive from the fact that there is no universal method to imbed environmental investments in the operation of companies (Sebastianelli et al., 2015; Goncalves et al., 2016). This is more apparent in the mining sector, where geographical factors which vary from area to area influence the method of mining. Moreover, the mineral being extracted also has an influence on the method of mining, machinery required and the operational process that has to be implemented. Therefore, investment in carbon emissions reduction comes as a marginal cost to operations thereby increasing both investment and operational cost which degrades company value.

From the legitimacy perspective, while investment in carbon emissions reduction can be used as a way to gain the right to operate from the community, it does not negate the need to do a proper investment analysis (Fisher-Vanden & Thorburn, 2011; Martin et al., 2012). Businesses need to attain the right to operate, the legitimacy to operate and to attain it; they need to align their values, norms and beliefs to that of the society. Attaining legitimacy is necessary as the community has control over resources that the company needs such as land and human capital, legitimacy cannot be attained at the expense of value creation. Therefore, management has to make the necessary trade-off between legitimacy and investment in carbon emissions reduction in order to generate positive returns (Martin et al., 2012). Moreover, what good is there in attaining legitimacy for a profitably unsustainable business? If management ignores economic factors and investment in carbon emissions reduction for the sole purpose of gaining legitimacy, then negative returns will be realised and demonstrated by the results.

Moreover, after including the control variable of the leverage factor, which determines the extent of debt capital in a company, the negative relationship between investment in carbon emissions reduction and share price was maintained (Grubb & Comberti, 2013; Alves et al., 2015). Since investment in carbon emissions reduction requires substantial amounts of financing, it is important to assess which portion of such investments is financed by debt.

Borrowing to finance investment in carbon emissions reduction would require management to first determine the potential returns from such investment. Therefore, any investment would have to yield returns which are higher than the costs of borrowing for shareholder value to be created (Grubb & Comberti, 2013). Nonetheless, even if carbon emissions reduction can be financed by shareholders' capital, there are costs associated with raising such capital added with the expected return investors expect to receive from their investment. Therefore, if the return generated by investment in carbon emissions reduction does not exceed the costs of capital or the cost of borrowing then negative returns are generated (Flammer, 2013; Madueno et al., 2015).

The cash flow adequacy ratio was also utilised in deriving the negative relationship between share price and investment in carbon emissions reduction (Flammer, 2013; Gans & Hintermann, 2013). Cash flow adequacy measures a company's ability to pay for capital expenditure, debts repayments and dividends from cash generated from operations. The inclusion of the cash flow adequacy ratio enabled the study to establish a relationship beyond accounting principles since it determines whether a company can generate enough hard cash to pay for capital expenditure that includes investment in carbon emissions reduction. Therefore, all investments, including carbon emissions reduction, need to generate enough cash flows to sustain more investments in order for the investments to generate positive returns (Sõderholm et al., 2015; Charitou, 2015). However,

the negative relationship shown by the results occur when an investment fails to generate enough cash flows to finance itself thereby requiring the utilising cash flows from other performing investments.

Although the fixed effects model generated a negative relationship, the relationship is not significant. The fixed effects model was performed at 95% confidence level, meaning a T-statistic above 1.96 would deem the relationship significant. The coefficient of -4.80e-09 has a T-statistic -0.1 which is less than 1.96 indicating that the relationship between investment in carbon emissions reduction and share price is insignificant. Moreover, the P-value of investment in carbon emissions reduction is 0.922 which is less than the confidence level of 0.05. This shows that investment in carbon emissions reduction is too insignificant to possess any meaningful influence on the share price. Therefore, the negative relationship shown by the fixed effects model is insignificant for any generalised results to be derived to explain the same relationship over the whole mining industry.

Fixed effects model on hazardous solid waste

The fixed effects model analysis of the relationship between investment in hazardous solid waste and share price generated a negative relationship (Eddine, 2012; Dhal et al., 2013; Nleya & Simate, 2015). This multiple regression model analysed the impact of hazardous solid waste on share price whilst controlling for leverage and cash flow adequacy. Therefore, all other time invariant economic variables were held constant to fully understand the impact of only the variables under study. Thus, the bias effects from other economic variables which may dilute the multiple regression results, are eliminated.

The random effects model of hazardous solid waste disposal which included all the time invariant economic influencers of the share price in addition to the controlling variables also produced a negative relationship. The reasons for this negative relationship are similar and are further discussed in this section. These results are similar to those found by Dangelico and Pujari (2010) and Guerrero et al. (2013) as discussed in extant literature where they found negative relationships between financial performance and various kinds of environmental investment.

Mining operations by the nature of their extractive process pollute everything including water used for cleaning mineral ore, added with the different chemicals which are used to separate different minerals and dissolves other unwanted materials (Dhal et al., 2013). All of these, including the extracted soil, have to be disposed-off to allow mining operations to continue. Moreover, certain mines which extract radio-active minerals such as uranium produce very sensitive radio-active solid waste which has to be disposed in a sustainable manner which does not negatively affect the environment (Eddine, 2012). Therefore, the sustainable disposal of such materials requires substantial investments in specialised equipment and specialised environmental rehabilitation programmes which all have significant costs. The economic benefit of the equipment is often enjoyed over a long period of time. As a result, analysing such a long term investment with a share price at the end of the financial period will result in a negative relationship as shown in the study.

The negative relationship derived from this analysis can be attributed to a wide range of financial and non-financial factors. In the mining sector, the total cost of hazardous solid waste disposal is incurred throughout the economic life of the mine; however, some of its major costs are incurred when the mine closes and when rehabilitation costs are incurred (Guerrero et al., 2013; Nleya &

Simate, 2015). This creates a dissonance between costs and returns because on top of the actual expenditure to reduce hazardous solid waste, the returns from such investment still have to be offset against the future liabilities which often result in a negative relationship.

In addition, from a financial reporting perspective, there is no specific standard that seeks to incorporate environmental investment including those to reduce hazardous solid waste disposal in financial statements (Busch & Hoffmann, 2011). Investments to reduce environmental impact do not have a stand-alone line item on the face of financial statements. This results in these investments being consolidated along with other purely financial investments. As a result, their actual financial impact analysis is often diluted by other investments (Jacobs et al., 2010). Therefore, singling out investment in hazardous solid waste disposal for analysis against share price produced a negative relationship as it becomes inappropriate to analyse investment in hazardous solid waste disposal as a stand-alone variable.

The negative relationship between investment in hazardous solid waste disposal and share price can also derive from investing beyond regulatory requirements (Dangelico & Pujari, 2010). Positive gains from investments in hazardous solid disposal are derived when the company complies with all set laws and regulations. At the level of compliance, the company is free from penalties, fines and all its future liabilities are accounted for (White et al., 2012). Any investment over and beyond the level of compliance generates negative returns as there is no potential gain or benefit for the company and investor.

However, the negative relationship found between investment in hazardous solid waste disposal and share price is insignificant. Although the result showed a negative coefficient of -1.30e-09,

the T-statistic was -0.39 which is less than 1.96 at 95% confidence level. This meant that investment in hazardous solid waste is too insignificant to influence the share price. In addition, the P-value of 0.696 is greater than the confidence interval of 0.05 stipulating the insignificance of any change in investment in hazardous solid waste disposal to have any meaningful impact on the share price. Therefore, after controlling for the control variables, the fixed effects model produces a negative relationship although insignificant.

Model 2: Random effects model of investment in carbon emissions reduction

The random effects model assumes that differences between individual variables are random and uncorrelated. This assumption allows time-invariant economic influencers of the share price to be included and their overall impact analysed. The random effects model allowed the analysis of the impact the all-time invariant has on variables including, but not limited to, the independent and control variables. This allowed the result generated to portray a more practical scenario equivalent to the real business world. The random effects model of investment in carbon emissions reduction produced a positive relationship with company share price. These results were consistent with those found by Murovec et al. (2012), Matsumura et al. (2013), Chapple et al. (2013), and Sebastianelli et al. (2015).

This positive relationship was generated after controlling for leverage and cash flow adequacy ratio. The leverage factor allowed the study to establish the source of the capital being invested in carbon emissions reduction. Leverage gave an indication of the percentage of the capital investment which was financed by debt, also noting that returns from the investment in carbon emissions would have to be higher than the cost of capital. Cash flow adequacy ratio measures a

company's ability to finance capital expenditure, debt repayments and dividends from cash generated from operations. This allowed the study to ascertain if a company was actually generating enough from its own operations to finance environmental investment (Goncalves et al., 2016). Therefore, after controlling for leverage and cash flow adequacy ratio, the random effects model of investment in carbon emissions reduction produced a positive relationship with company share price.

Basing on theory, the stakeholder theory stipulates that only management should balance the interest of all stakeholders to maximise value for the company (Fisher-Vanden & Thorburn, 2011). Considering shareholder interests as supreme over other interests does not maximise value for a company.

Therefore, a company's engagement in investment to reduce its carbon footprint creates value as it incorporates the interests of non-financial stakeholders such as the community, government and environmental activists (Martin et al., 2012). Even though there may not be immediate financial gain, the company will generate positive gains in the long run though cultivating a sound working relationship with all its stakeholders.

In addition, the legitimacy theory states that a company does not have an inherent right to exist. The community gives a company the right to exist, legitimacy, when it aligns it values, norms and beliefs with those of the society (Grubb & Comberti, 2013). Therefore, companies can invest in carbon emissions reduction as an avenue to align its values to those of the community in which it operates. Hence, the right to operate that a company receives from the community becomes the first positive return that it gains from such an investment. This will also be a very

important return as all future benefits or profits are premised to the basis that the company is operational (Martin et al., 2012; Matsumura et al., 2013). Moreover, financial statements are prepared based on the going concern assumption, investment in carbon emissions reduction guarantees the right to operate and ultimately achieve going concern.

Investment in carbon emissions reduction can generate future cost saving from reduced future liabilities. With the global economy increasingly focusing on reducing environmental impact, and new environmental impact reduction targets being frequently set, investing in carbon emissions reduction reduces the possibility of future costs such as penalties and fines (Sebastianelli et al., 2015; Goncalves et al, 2016). Moreover, with the introduction of carbon tax in South Africa, not investing in carbon emissions reduction may likely increase the carbon tax burden of the company in future. The positive relationship derives from the reduced future liabilities and tax credits the company will enjoy in future from its investment in carbon emissions reduction.

A positive relationship can also generate from the market perception that a company receives by deciding to invest in carbon emissions reduction (Matsumura et al., 2013; Alves et al., 2015). With the stringent environmental laws and regulations surrounding the mining industry and with new laws being continuously passed, the stock markets respond negatively to companies which are not properly positioned for greening in the global economy. Investing in carbon emissions reduction signals to the market that the company is competitively positioned environmentally and its shares are preferable on the market (Stout, 2012). Therefore, market forces create increase demand for the shares which increase the price thereby creating positive gains.

Not investing in carbon emissions reduction may signal a reckless management team which is resistant to change (Luo & Tang, 2014). This may likely make the company unattractive to investment, more mining rights and possible joint ventures which are all necessary in a capital intensive industry such as the mining sector.

However, investing in carbon emissions reduction may portray good governance, responsible management practices and make the company attractive to investors due to its reduced risk (Luo & Tang, 2014; Charitou, 2015). Positive gains to the share price will be derived from the accessibility of more mining rights, more capital from investors and good management reputation that will benefit the company both in the short and long term.

Investing in carbon emissions reduction also means the company will be forced to invest in new green technologies which are aimed at reducing environmental impact (Ioannou & Serafeim, 2015; Madueno et al., 2015). This new technology equipment, does not only reduce carbon emissions but has other benefits such as low energy usage, more operational efficiency and lower running costs. Therefore, by committing to such investments companies gain from other secondary costs savings. These costs savings reduce operational costs in the long run thereby generating more profits to which the positive relationship between investment in carbon emissions reduction and share price can be attributed.

The Hausman Test

Due to the different treatment of time invariant economic variables with a potential to influence the share price, the fixed and random effects models of multiple regression are bound to produce different results (Sebastianelli et al., 2015). The study performed a Hausman test for both models

to determine the most appropriate results to accept. The null hypothesis is that the most appropriate model is the random effects model thereby rejecting the fixed effects model.

The Hausman test for investment in hazardous solid waste disposal model produced a probability of 0.5772 (57.72%). The probability is higher than 0.05 (5%) which means the random effects model was accepted. Although both models produced a negative relationship, the fixed effects model had an insignificant negative relationship. However, the random effects negative result emphasises the significance of the negative relationship. Therefore, after performing the Hausman test to determine an appropriate model, the negative relationship between investment in hazardous solid waste disposal and share price is insignificant.

The fixed effects model produced an insignificant relationship as it held constant all other economic influencers of the share price while analysing the impact of change in the independent and controlling variables. In this model, all other time invariant variables that can influence the share price are absorbed by the intercept and thereby ignored. This allowed the study to analyse only the variables under study and everything else was held constant. Adversely, the random effects include the all-time invariant economic influencers of the share price resulting in a more practical approach as the share price is influenced by a lot of variables. Therefore, the random effects model produced a significant negative relationship between investment in hazardous solid waste disposal and share price.

For investment in carbon emissions reduction, the fixed effects model produced a negative relationship while the random effects model produced a positive relationship. The Hausman test for investment in carbon emissions reduction produced a probability of 0.5855 (58.55%) which

is above 0.05 (5%), as a result the random effects model is accepted as the appropriate model. Moreover, the fixed effects model produced an insignificant negative relationship by interpretation of the T-statistic and P-values. Adversely, the random effects model had a significant positive relationship.

The insignificant relationship obtained from the fixed effects model derives from the inability of the model to include and analyse all economic variables that affect the share price. By absorbing all other variables in the intercept, the fixed effects model ignores various variables that are important to the overall interpretation of the relationship between investment in carbon emissions reduction and share price. In support, the T-statistic and P-value of -0.1 and 0.922 respectively stipulate the insignificance of investment in carbon emissions reduction to influence share price. In addition to being insignificant, the fixed effects model was also rejected by the Hausman test.

However, the random effects model produced the more appropriate result as it does not limit economic variables that have an impact on the share price by absorbing them in the intercept. The random effects model therefore produces a more practical analysis of the relationship by portraying a more realistic approach in analysing the relationship between carbon emissions reduction and share price. Moreover, the Hausman test accepted the random effects model as the appropriate model in analysing investment in carbon emissions reduction and share price.

4.5 Summary of the chapter

This chapter detailed how data were managed and analysed in the study. The statistical software and tools used on the data were also explained. This section also interpreted the results generated by the study. The study found that there is a negative relationship between investment in

hazardous solid waste disposal and share price whilst there is a positive relationship between investment in carbon emissions reduction and share price. This was followed by a discussion explaining the possible reasons for the various relationships that were produced by the results. The next chapter concludes the study by giving a brief explanation of the overall study. Chapter Five also outlines the recommendations, and the contributions of the study are also presented.

CHAPTER FIVE: SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1. Introduction

The previous chapter described the results produced by the two models utilised to analyse research data in this study. Chapter Four also presented an extensive discussion explaining the various relationships produced by the results. This chapter provides a synthesis of the key sections of this study. Section 5.2 presents a brief summary of the research findings. Section 5.3 provides a summary of the important areas of thought on which this study is based and conveys to a larger extent the importance of this study. A discussion of the study's unique contributions follows in Section 5.3.1. Moreover, Section 5.4 provides recommendations based on the results and for future research, it also outlines the major contributions of this study as well as the limitations the researcher faced during the study. Section 5.5 presents the concluding remarks of the study.

5.2. Summary of research findings

The objective of this study was to investigate the impact of corporate environmental investments on shareholder value. To achieve this objective, the study investigated the effect of corporate investments in carbon emissions and hazardous solid waste on company share price. The study generated contrasting results from the fixed and random effects models panel data multiple regression analysis. The fixed effects model produced a negative relationship between investment in carbon emissions reduction and company share price. These results are consistent with those found by Jacobs et al. (2010), Sullivan and Gouldson (2012), Flammer (2013), and Rexhäuser and Rammer (2014. Moreover, after including the control variables of leverage factor

and cash flow adequacy ratio, the model maintained a negative relationship. However, analysis of the T-statistic and P-values show that the negative relationship was insignificant. This was caused by the fixed effects model absorbing other economic influencers of the share price in the intercept thereby holding them constant. Holding other economic influencers of the share price constant allows the model to effectively analyse the impact of change only in the variables under study. Nevertheless, the negative relationship between share price and investment in carbon emissions reduction results from the models' assumption that only the variables under study influence the share price. Moreover, the Hausman test performed to determine appropriate model rejected the fixed effects model.

In contrast, the random effects model used to analyse investment in carbon emissions reduction and share price produced a positive relationship. These results are similar to those found by Murovec et al. (2012), Matsumura et al. (2013), Chapple et al. (2013), and Sebastianelli et al. (2015). The random effects model assumes that differences between variables are random and uncorrelated; therefore the model includes all time invariant variables that influence the share price in its analysis. Therefore, in addition to the control variables of leverage factor and cash flow adequacy ratio, other economic influencers of the share price were included into the analysis instead of being absorbed by the intercept as in the fixed effects model. As a result, the random effects model shows a more realistic result which is reflective on the actual relationship between investment in carbon emissions reduction and share price. In addition, analysis of the T-statistic and P-values show that the positive relationship generated by the random effects model is significant. Moreover, the Hausman test performed to determine the appropriate model to be

used produced a probability greater than the confidence interval of 0.05 thereby accepting the random effects model and rejecting the fixed effects model.

The fixed effects model analysis of investment in hazardous solid waste disposal and share price generated a negative relationship. Although the analysis of the T-statistic and P-value show that the negative relationship was insignificant, it concurs with the significant negative result produced by the random effects model. The negative result derived from the long term nature of the investment in hazardous solid waste disposal and lack of accounting standards to integrated environmental investment in financial statements. The Hausman test performed accepts the random effects model which shows a significant negative result between investments in hazardous solid waste disposal and share price and rejected the fixed effects model's result which shows an insignificant relationship.

5.3. Conclusions

The study found a significant positive relationship between investment in carbon emissions reduction and share price. This result was produced by the random effects model which was accepted as the appropriate model by the Hausman test which was performed to determine an appropriate model. On investment in hazardous solid waste disposal and share price, both the fixed effects and random effects model produced a negative relationship. However, the Hausman test which was performed to determine an appropriate model accepted the random effects model. Moreover, the random effects model produced a significant negative relationship which further supports the negative relationship between investment in hazardous solid waste disposal and share price. Establishing the nature of the relationship between investment in carbon emissions

reduction, hazardous solid waste disposal and share price contributes immensely to investors' knowledge of the company, the company's management decision-making, policy makers and academia. The study reveals that corporate investment in carbon emissions does not degrade company value but generates shareholder value. Hence, investors can support initiatives to invest in environmental technologies with an understanding that ultimately they will earn a return on their investment through share holder gains to the share price.

The result of the study will assist companies' management to strike a balance between competing interests of stakeholders and the community through corporate environmental investment in carbon emissions reduction which generates more value for companies compared to only satisfying the interests of shareholders. The result of the study shows that environmental investments can assist companies to gain and maintain a global competitive edge especially in a world that is continually gaining environmental consciousness.

Therefore, this study indicates that companies tend to gain financially and generate shareholder value when they invest in environmental friendly technologies aimed at reducing carbon emissions and hazardous solid waste. Corporate environmental investments to reduce carbon emissions and hazardous solid waste are likely to result in positive gains in the share price through cost savings inherent in investments to reduce the environmental impact. As a result, this study will contribute to the decision-making process of those charged with the governance of companies on environmental investments as analysed in this study.

5.3.1. Contributions of the study

This study contributes to knowledge by providing evidence from the South African mining industry, which is one of the major contributors of carbon emissions and hazardous solid waste. Moreover, previous studies by Fisher-Vanden and Thorburn (2011), Busch and Hoffmann (2011), Martin et al (2012), Gans and Hintermann (2013) Luo and Tang (2014) and Charitou (2015) analysed company profitability as a measure of financial performance; the share price used in this study brings forth a different perspective which shows the direct impact of environmental investment on shareholders and investors. This different view point relationship contributes greatly to the mutual understanding between company management and the shareholders whose interests they represent. The study brings forth supporting evidence from the South African mining sector thereby adding to the global notion which encourages the reduction of negative environmental impacts. The study adds to the African perspective supporting that companies should reduce negative environmental impacts, not only as corporate social responsibility by as investments as the study has shown that they create company value.

5.4. Recommendations

This study examined the relationship between investment in carbon emissions and hazardous solid waste disposal and share price. In business practice, company management and those charged with governance should embed corporate environmental investment aimed at reducing carbon emissions and hazardous solid waste disposal through share price gains. Companies create more value through environmental investments and can be better positioned competitively in a global business environment that has become increasingly conscious of the importance of

sustainable business practices. This study recommends the formulation of environmental friendly legislation in the mining sector such as the introduction of carbon tax and penalties for discharging solid hazardous waste into the natural environment. Results of the study show that incorporating environmental investments to reduce carbon emissions and hazardous solid waste in mining operations has no negative effect on shareholder wealth. Therefore, company management can make informed decisions aimed at reducing carbon emissions and hazardous solid waste.

Environmental investments are not limited to carbon emissions and hazardous solid waste disposal; therefore, more studies can be conducted incorporating more, or other types of environmental investments. Shareholder value can be measured by share price and dividends growth. Since this study focused on share price as a measure of shareholder wealth, more studies can be conducted using dividends as a measure of shareholder value. Further studies can be done by examining corporate environmental investments and company profitability or by analysing the impact of environmental investments in relation to sustainability performance. Other studies can be conducted in other industries such as energy generation and manufacturing sectors which also have a potentially negative impact on the environment through their operations.

5.5. Concluding remarks

This study established the relationship between corporate environmental investment and shareholder value. The study used panel data multiple regression to analyse the relationship between investment in carbon emissions, hazardous solid waste and share price. The results show that there is a significant positive relationship between investment in carbon emissions

reduction and share price. However, the study produced a negative relationship between investment in hazardous solid waste reduction and share price. The study showed that reducing carbon emissions enables companies to attain global competitiveness and generate shareholder gains from various cost savings. Adversely, even though the study showed a negative relationship between hazardous solid waste reduction and share price, the study shows that sustainable hazardous solid waste disposal measures should be adopted. As such, company management is encouraged to embed measures to reduce their environmental footprint in their operations as this increases shareholders' wealth. Therefore, the study contributes to business and the body of knowledge by bringing forth unique results generated by using share price as a measure of financial performance which is contrary to most previous studies which focused on profitability as a measure of financial performance.

REFERENCES

Al-Hwaiti, MS, Brumsack, HJ & Schnetger, B. 2016. Suitability assessment of phosphate mine waste water for agricultural irrigation: an example from Eshidiya Mines, South Jordan. *Environmental Earth Sciences,* 75(3): 1-17.

Alrazi, B, de Villiers, C & Van Staden, CJ. 2015. A comprehensive literature review on, and the construction of a framework for, environmental legitimacy, accountability and proactivity. *Journal of Cleaner Production,* 5(2): 44-57.

Alton, T, Arndt, C, Davies, R, Hartley, F, Makrelov, K & Ubogu, D. 2014. Introducing carbon taxes in South Africa. *Applied Energy,* (116): 344-354.

Alves, W, Colombo, CR, Portela, CR, Ferreira, P & Dália, R. 2015. *Environmental strategies of a mining corporation.* Guimaraes,Portugal, University of Minho, 2-8.

Antwi, SK & Hamza, K 2015. Qualitative and Quantitative Research Paradigms in Business Research: A Philosophical Reflection. *European Journal of Business and Management,* 3(2): 291-315.

Bhattacharyya, A. 2015. Corporate Social and Environmental Responsibility in an Emerging Economy: Through the Lens of Legitimacy Theory. *Australasian Accounting Business & Finance Journal,* 9(2): 79.

Bridoux, F & Stoelhorst, JW. 2014. Microfoundations for stakeholder theory: Managing stakeholders with heterogeneous motives. *Strategic Management Journal,* 35(1): 107-125.

Brown, N, Malmqvist, T & Wintzell, H. 2016. Owner organizations' value-creation strategies through environmental certification of buildings. *Building Research & Information,* 44(8): 863-874.

Bryman, A & Bell, E. 2015. *Business research methods.* USA: Oxford University Press.

Busch, T & Hoffmann, VH. 2011. How hot is your bottom line? Linking carbon and financial performance. *Business & Society,* 50(2): 233-265.

Chapple, L, Clarkson, PM & Gold, DL. 2013. The cost of carbon: Capital market effects of the proposed emission trading scheme (ETS). *Abacus,* 49(1): 1-33.

Charitou, A. 2015. Discussion of The Association Between Energy Taxation, Participation in an Emissions Trading System, and the Intensity of Carbon Dioxide Emissions in the European Union. *The International Journal of Accounting,* 50(4): 418-426.

Christopher, T, Hutomo, S & Monroe, G. 2013. Voluntary environmental disclosure by Australian listed mineral mining companies: an application of stakeholder theory. *The International Journal of Accounting and Business Society,* 5(1): 42-66.

Corbin, J & Strauss, A. 2014. *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Los Angelos: Sage publications.

Creswell, JW. 2013. *Research design: Qualitative, quantitative, and mixed methods approaches.* New York: Sage publications.

Dangelico, RM. & Pujari, D. 2010. Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics,* 95(3): 471-486.

de Villiers, C. & van Staden, C. 2012. New Zealand shareholder attitudes towards corporate environmental disclosure. *Pacific Accounting Review,* 24(2): 186-210.

Deegan, C. 2014. An overview of legitimacy theory as applied within the social and environmental accounting literature.,. *Sustainability Accounting and Accountability,* 12(5):248-261.

Department of Mineral Resources, South Africa, 2002. *MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT(MPRDA) No. 28 of 2002.* [Online] Available at: http://www.dmr.gov.za/publications/summary/109-mineral-and-petroleum-resources-development-act-2002/225-mineraland-petroleum-resources-development-actmprda.html
[Accessed 30 May 2017].

Dhal, B, Thatoi, HN, Das, NN & Pandey, BD. 2013. Chemical and microbial remediation of hexavalent chromium from contaminated soil and mining/metallurgical solid waste: a review. *Journal of Hazardous Materials,* 250: 272-291.

Dong, S, Burritt, R & Qian, W. 2014. Salient stakeholders in corporate social responsibility reporting by Chinese mining and minerals companies. *Journal of Cleaner Production,* 84: 59-69.

Dong, S & Xu, L. 2016. The impact of explicit CSR regulation: evidence from China's mining firms. *Journal of Applied Accounting Research,* 17(2): 237-258.

Draper, NR & Smith, H. 2014. *Applied regression analysis.* UK: John Wiley & Sons.

Durand, JF. 2012. The impact of gold mining on the Witwatersrand on the rivers and karst system of Gauteng and North West Province, South Africa. *Journal of African Earth Sciences,* 68: 24-43.

Eddine, BT. 2012. Solid waste as renewable source of energy: current and future possibility in Algeria. *International Journal of Energy and Environmental Engineering,* 3(1): 1-12.

Fakoya, M. 2014. On carbon emission reduction through investments in renewable energy in South Africa. *Environmental Economics,* 5 (3): 88-91.

Fakoya, M. B. 2013. Proposed carbon tax policy in South Africa: learning from the experience of other countries and effect on consumer price index. *Environment and Ecology,* 4(4): 65-74.

Fisher-Vanden, K & Thorburn, KS. 2011. Voluntary corporate environmental initiatives and shareholder wealth. *Journal of Environmental Economics and management,* 62(3): 430-445.

Flammer, C. 2013. Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Academy of Management Journal,* 56(3): 758-781.

Freeman, RE, Parmar, BL, Harrison, JS, Wicks, AC, Purnell, L. 2010. *Strategic management: A stakeholder approach.* UK: Cambridge University Press.

Frynas, JG. 2015. Strategic CSR, value creation and competitive advantage. *The Routledge Companion to Non-Market Strategy,* 245-262.

Funari, V, Bokhari, SNH, Vigliotti, L, Meisel, T & Braga, R. 2016. The rare earth elements in municipal solid waste incinerators ash and promising tools for their prospecting. *Journal of Hazardous Materials,* 301: 471-479.

Gans, W & Hintermann, B. 2013. Market effects of voluntary climate action by firms: Evidence from the Chicago Climate Exchange. *Environmental and Resource Economics,* 55(2): 291-308.

Garcia-Castro, R & Aguilera, RV. 2015. Incremental value creation and appropriation in a world with multiple stakeholders. *Strategic Management Journal,* 36(1): 137-147.

Garriga, E & Melé, D. 2013. Corporate social responsibility theories: Mapping the territory. *Journal of Business Ethics,* 53(1-2): 69-90.

Goncalves, O, Robinot, E & Michel, H. 2016. Does it pay to be green? The case of French ski resorts. *Journal of Travel Research,* 55(7): 889-903.

Grieco, C, Michelini, L & Iasevoli, G. 2015. Measuring value creation in social enterprises: A cluster analysis of social impact assessment models. *Nonprofit and voluntary sector quarterly,* 44(6): 1173-1193.

Guerrero, LA., Maas, G & Hogland, W. 2013. Solid waste management challenges for cities in developing countries. *Waste Management,* 33(1): 220-232.

Harangozó, G & Zilahy, G. 2015. Cooperation between business and non-governmental organizations to promote sustainable development. *Journal of Cleaner Production,* 89: 18-31.

Hatz, I & Nicholas, C. 2011. Panel data analysis of fuel price elasticities to vehicle-miles traveled for first year participants of the national evaluation of a mileage-based road user charge study. *University of Iowa,* 4:2-15.

Hummel, K & Schlick, C. 2016. The relationship between sustainability performance and sustainability disclosure–Reconciling voluntary disclosure theory and legitimacy theory. *Journal of Accounting and Public Policy,* 35(5): 455-476.

Husted, BW, Allen, DB & Kock, N. 2015. Value creation through social strategy. *Business & Society,* 54(2): 147-186.

Ioannou, I & Serafeim, G. 2015. The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal,* 36(7): 1053-1081.

Jacobs, BW. 2014. Shareholder Value Effects of Voluntary Emissions Reduction. *Production and Operations Management,* 23(11): 1859-1874.

Jacobs, BW, Singhal, VR & Subramanian, R. 2010. An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management,* 28(5): 430-441.

Jensen, MC. 2010. Value maximization, stakeholder theory, and the corporate objective function. *Journal of Applied Corporate Finance,* 22(1): 32-42.

Jones, JN, Vijayasrinivasan, A & Parker, JP. 2017. From Waste to Value: Business Opportunities in Solid Waste Management. *Research-Technology Management,* 60(1): 3.

Jorge, ML, Madueño, JH, Martínez-Martínez, D & Sancho, MPL. 2015. Competitiveness and environmental performance in Spanish small and medium enterprises: is there a direct link? *Journal of Cleaner Production,* 101: 26-37.

Krippendorff, K. 2012. *Content analysis: An introduction to its methodology.* New York: Sage.

Kunapatarawong, R & Martínez-Ros, E. 2016. Towards green growth: How does green innovation affect employment?. *Research Policy,* 45(6): 1218-1232.

Laing, T, Sato, M, Grubb, M & Comberti, C. 2013. Assessing the effectiveness of the EU Emissions Trading System. *Grantham Research Institute on Climate Change and the Environment Working Paper,* 21(16):106.

Leszczynska, A. 2012. Towards shareholders' value: an analysis of sustainability reports. *Industrial Management & Data Systems,* 112(6): 911-928.

Li, S & Gu, M. 2012. The effect of emission permit trading with banking on firm's production–inventory strategies. *International Journal of Production Economics,* 137(2): 304-308.

Loate, B, Padia, N & Maroun, W. 2015. Acid mine drainage in South Africa: A test of legitimacy theory. *Journal of Governance and Regulation,* 4(2): 5-12.

Lubin, DA & Esty, DC. 2010. The sustainability imperative. *Harvard Business Review,* 88(5): 42-50.

Luo, L & Tang, Q. 2014. Carbon tax, corporate carbon profile and financial return. *Pacific Accounting Review,* 26(3): 351-373.

Martin, R, Muûls, M & Wagner, U. 2012. *An evidence review of the EU Emissions Trading System, focussing on effectiveness of the system in driving industrial abatement,* UK: Department of Eenrgy and Climate Change.

Matsumura, EM, Prakash, R & Vera-Muñoz, SC. 2013. Firm-value effects of carbon emissions and carbon disclosures. *The Accounting Review,* 89(2): 695-724.

Murovec, N, Erker, RS & Prodan, I. 2012. Determinants of environmental investments: testing the structural model. *Journal of Cleaner Production,* 37: 265-277.

National Treasury, South Africa, 2013. Carbon Policy Paper, Reducing greenhouse gas emissions and facilitating the transition to a green economy. [Online] Available at : www.treasury.gov.za. Accessed: 30 May 2017.

Nleya, Y & Simate, GS. 2015. Sustainability assessment of the recovery and utilisation of acid from acid mine drainage. *Journal of Cleaner Production,* 113:17-27.

Noble, H & Smith, J. 2015. Issues of validity and reliability in qualitative research. *Evidence Based Nursing,* 18(2): 34-35.

Papagiannakis, G, Voudouris, I & Lioukas, S. 2014. The road to sustainability: exploring the process of corporate environmental strategy over time. *Business Strategy and the Environment,* 23(4): 254-271.

Patten, DM. 2014. *Environmental disclosure as legitimation: Is it in the public interest?. In Accounting for the Public Interest.* Netherlands: Springer.

Raithel, S & Schwaiger, M. 2015. The effects of corporate reputation perceptions of the general public on shareholder value. *Strategic Management Journal,* 36(6): 945-956.

Rexhäuser, S & Rammer, C. 2014. Environmental innovations and firm profitability: unmasking the Porter hypothesis. *Environmental and Resource Economics,* 57(1): 145-167.

Sebastianelli, R, Tamimi, N & Iacocca, K. 2015. Improving the quality of environmental management: impact on shareholder value. *International Journal of Quality & Reliability Management,* 32(1): 53-80.

Söderholm, K, Söderholm, P, Helenius, H, Pettersson, M, Viklund, R, Masloboev, V, Mingaleva, T, Petrov, V, 2015. Environmental regulation and competitiveness in the mining industry: Permitting processes with special focus on Finland, Sweden and Russia. *Resources Policy,* 43:130-142.

Song, Q, Li, J & Zeng, X. 2015. Minimizing the increasing solid waste through zero waste strategy. *Journal of Cleaner Production,* 104: 199-210.

Steenkamp, JB. 2017. *Global Brands and Shareholder Value. In Global Brand Strategy.* UK: Palgrave Macmillan.

Stout, LA. 2012. *The shareholder value myth: How putting shareholders first harms investors, corporations, and the public.* San Francisco, Califonia: Berrett-Koehler Publishers.

Strand, R & Freeman, RE. 2015. Scandinavian cooperative advantage: The theory and practice of stakeholder engagement in Scandinavia. *Journal of Business Ethics,* 127(1): 65-85.

Streimikiene, D, Navikaite, A & Varanavicius, V. 2016. Company's Value Creation Via Customer Satisfaction and Environmental Sustainability Influence. *Montenegrin Journal of Economics,* 12(4): 19.

Sullivan, R & Gouldson, A. 2012. Does voluntary carbon reporting meet investors' needs?. *Journal of Cleaner Production,* 36: 60-67.

Wagner Mainardes, E, Alves, H & Raposo, M. 2011. Stakeholder theory: issues to resolve. *Management Decision,* 49(2): 226-252.

Wahyuni, D. 2012. The research design maze: Understanding paradigms, cases, methods and methodologies. *Journal of Applied Management Accounting Research,* 10(1): 69-80.

Wang, L, Li, S & Gao, S. 2014. Do greenhouse gas emissions affect financial performance?–an empirical examination of Australian public firms. *Business Strategy and the Environment,* 23(8): 505-519.

White, P, Dranke, M & Hindle, P. 2012. *Integrated solid waste management: a lifecycle inventory*. UK: Springer Science & Business Media.

Yin, RK. 2013. *Case study research: Design and methods.* Los Angelos: Sage publications.

Yook, KH, Song, H, Patten, M. & Kim, IW. 2017. The Disclosure of Environmental Conservation Costs and Its Relation to Eco-efficiency: Evidence from Japan. *Sustainability Accounting, Management and Policy Journal,* 8(1): 9-28.

Zhang, YJ, Peng, YL, Ma, CQ & Shen, B. 2017. Can environmental innovation facilitate carbon emissions reduction? Evidence from China. *Energy Policy,* 100: 18-28.