THE IMPACT OF ENVIRONMENTAL MANAGEMENT PRACTICES ON FIRM FINANCIAL PERFORMANCE: A CASE STUDY OF SELECTED JSE SRI 2011 SOUTH AFRICAN MINING COMPANIES

by

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DEDICATION

I dedicate this dissertation to my loving parents, for all the countless amazing things that they have provided and continue to provide for me.

D E C L A R A T I O N

I declare that **THE IMPACT OF ENVIRONMENTAL MANAGEMENT PRACTICES ON FIRM FINANCIAL PERFORMANCE: A CASE STUDY OF SELECTED JSE SRI 2011 MINING COMPANIES** dissertation hereby submitted to the University of Limpopo, for the degree of Masters of Commerce in Accounting has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

Nyirenda, G (Mr) **12th September, 2014.**

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ABSTRACT

This study explored the impact of Environmental Management Practices on firm financial performance through a case study of selected JSE SRI South African mining companies. Previous studies focused more on disclosure or international research but none focused on this impact in JSE SRI South African mining firms hence this study attempted to fill this gap. Using a mixed methods approach, the study examined whether the firms' carbon emissions, energy usage and water usage had any impact on the firms' return on equity. The study concluded that Environmental Management Practices did impact firms' financial performance and offers many opportunities for academia, industry, managers, regulators and society to use these findings as a means for more research into and better understanding of these environmental management practices and their potential benefits to society.

KEY CONCEPTS

Environmental Management Practices; Firm financial performance; Carbon emissions; Energy usage; Water usage; Return on Equity, JSE SRI.

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CHAPTER 1

INTRODUCTION

1.1 Background

The mining industry contributes significantly to South Africa's Gross Domestic Product (GDP) (South African government, 2012). From the time diamonds were discovered in Kimberly, to the discovery of gold in Witwatersrand, the industry has gone through a process of evolution (South African Government, 2012). In these modern times, it is rare to hear of little or no regulation by the relevant authorities and a lack of Environmental Management Practices by the mining firms. In their study, Garvin, McGee, Smoyer-Tomic and Aubynn (2009) found that communities hold mining firms accountable for environmental, social and economic management in all aspects at community level. Furthermore, firms in all industries are feeling the weight of expectation to operate in a sustainable manner as a result of the Earth Summit in 1992; the World summit on Sustainable Development (WSSD) in Johannesburg in 2002 and the recent Earth Summit 2012 in Rio de Janeiro, Brazil. These events brought about the rapid growth of Environmental Management Practices, leading to more stringent monitoring by governments and watchdogs, and a need to adopt more inclusive policies regarding Environmental Management Practices' spending and sustainable development (Mutti, Yakovleva, Vasquez-Brust & Di Marco, 2011).

Studies related to Environmental Responsibility (ER) or Environmental Management Practices and mining companies in South Africa have been carried out by researchers, such as De Villiers and Barnard (2000), Wingard and Vorster (2001), Antonites and De Villiers (2003), Hamann (2004), Mitchell and Hill (2010) and Oberholzer and Prinsloo (2011). Different aspects of Environmental Management Practices in relation to the mining industry have been studied. De Villiers and Barnard (2000) carried out an in-depth study of environmental reporting in South Africa from 1994-1999. In their findings, it was discovered that mining companies reported more on their Environmental Management Practices than other companies due to a greater need to legitimise their operations as a result of their obvious and far reaching impact on the environment. Wingard and Vorster (2001) investigated

the possibility of a positive relationship between environmental responsibility and financial performance in South African listed firms. They discovered that a positive relationship did indeed exist between environmental responsibility and financial performance in the South African listed firms.

In their work, Antonites and De Villiers (2003) investigated the trends in Environmental Management Practices reporting in the South African mining industry with the aim of determining how disclosure of environmental information has changed over the years. Hamann (2004) argued that companies' institutional context was overruled by their business case when it came to Environmental Management Practices and that companies' perspective of Corporate Environmental Responsibility was merely that of making donations and supporting good causes. Mitchell and Hill (2010) analysed stakeholder perceptions of what they thought firms needed to include in their sustainability reports. They discovered that the stakeholders thought that areas such as the impact on the environment were inadequately reported and that the stakeholders believed that Environmental Management Practices should be included in the annual reports of firms and be externally reviewed and audited. Lastly, Oberholzer and Prinsloo (2011) studied the efficiency of sustainable development by mining firms in South Africa and discovered that significant differences existed between the relative efficiency of gold mines and the other mining firms.

The above previous environmental related research in the South African context focused on disclosure, efficiency and reporting and none had documented the effects of the impact of Environmental Management Practices on Return On Equity in the South African mining industry. In line with the need for Corporate Environmental Responsibility, other researchers have investigated the drivers for Corporate Environmental Responsibility (Lee & Hutchinson, 2005; Setthasakko, 2007; Zhang, Bi, Yuan, Ge, Liu & Bu, 2008; and Artiach, Lee, Nelson & Walker, 2010). Within this branch of enquiry, corporate financial performance came prominent as one of the motivating factors for Environmental Management Practices (Ngwakwe, 2009; and Artiach *et al.,*2010); but none of these researches dealing on the effect of Environmental Management Practices and firm financial performance has been conducted in the Republic of South Africa, especially with reference to

mining firms. Hence this research is motivated to fill this apparent gap in the literature.

In light of the above gap in research, this research focuses on Environmental Management Practices and their effect on firm financial performance as represented by Return On Equity in select South African mining firms.

1.2 Background to the Problem

There are contemporary environmental and ecological problems faced by mining firms within the communities they operate in (Evangelinos and Oku, 2006; Garvin *et al*., 2009; and Mutti *et al*., 2011). This has often resulted in corporate reactive measures to settle environmental problems meted to communities or in cleaning the environment (Garvin *et al*., 2009). However, what is required are proactive Environmental Management Practices to curtail the occurrence of environmental problems.

South Africa is one of the emerging economies in which resultant swift growth has been accompanied by severe environmental degradation, leading to illnesses and premature deaths (Shaw, 2012). Mining firms have been critiqued for apparent environmental impact, and corporate environmental neglect has been widely condemned for its negative impact on climate change, for which the BRICS (Brazil, Russia, India, China and South Africa) countries in which South Africa is a member has raised alarms (Shaw, 2012).

In their study, Evangelinos and Oku (2006); Ngwakwe (2009); and Lee (2012) found that the level of corporate apathy towards environmental responsibility is high. Consequently other researchers have engaged in discovering what makes firms to become environmentally responsible (Lee & Hutchinson, 2005; Setthasakko, 2007; Zhang *et al*., 2008; and Artiach *et al.,* 2010). Amongst other reasons, it is found that financial performance tend to motivate firms the more to embark on environmental management (McGuire, Sundgren & Schneeweis, 1988; Barnett, 2005; and Artiach *et al.,* 2010); but these studies were conducted overseas. Environmental related research in South African focuses more on disclosure such as (De Villiers & Barnard, 2000; Antonites & De Villiers, 2003; De Villiers, 2003; Hamann, 2004; and Mitchell &

Hill, 2010), but none of these earlier studies has looked into the effect of mining firms' Environmental Management Practices and its effect on Return On Equity in the Republic of South Africa. Hence this research has become important to fill this gap and thus motivate mining firms by unlocking potential financial benefits from Environmental Management Practices and in doing so, add to existing literature on Environmental Management Practices and firm financial performance.

1.3 Problem Statement

Drawing from the background to the problem, there is little prior research evidence regarding Environmental Management Practices [carbon emission reduction, energy usage and water usage] and their effect on firm financial performance as represented by Return On Equity (ROE) in the selected mining firms in the Republic of South Africa. Hence this study attempts to bridge this gap in literature.

1.4 Aims, Research Questions and Objectives

1.4.1 Aim

The aim of this research is to show the effect of Environmental Management Practices on firms' financial performance

1.4.2 Research questions

What is the impact of Environmental Management Practices on firms' financial performance?

- What is the impact of carbon emissions on firms' financial performance?
- How does energy usage affect firms' financial performance?
- What effect does water usage have on firms' financial performance?

1.4.3 Objectives

Drawing from the research questions, the objectives of this research are, namely:

- Show any impact of carbon emissions on firms' financial performance;
- Determine if energy usage impacts firms' financial performance; and
- Establish if water usage has an effect on firms' financial performance.

1.5 Significance of the Research

Five areas of significance are addressed by this study, namely, academia, industry, managers, regulators and society.

1.5.1 Academia

This research will hopefully spur further study in this particular area in South Africa. A new impetus to promulgate research in this critical area will hopefully be stoked and encourage researchers to unlock more avenues and bring about improved and different methods of carrying out similar research. It is hoped that the findings of this research will add to the existing literature in this area.

1.5.2 Industry

It is also hoped that the results of the research will motivate mining firms to further increase their overall engagement with stakeholders on all CSR matters, particularly environmental management. Another subsequent significance will be that the results of this research will hopefully trigger a thought process in the managers of the firms used that will drive them to further adopt sustainable Environmental Management Practices and contribute to the overall sustainable development of South Africa as a whole.

1.5.3 Managers

The study aimed to motivate managers to pursue Environmental Management Practices to promote environmental protection and preservation, while at the same time show any potential financial benefits resulting from these practices.

1.5.4 Regulators

Regulators can use the findings of the study to develop hybrid pieces of legislation that will provide more oversight into these Environmental Management Practices and can also use the findings as a basis to provide incentives for those firms that a strong in the area of Environmental Management Practices.

1.5.5 Society

The findings of this research will hopefully lead to a greater level of awareness by society to the role of Environmental Management Practices by mining firms and

induce a higher level of acceptance by society of the mining firms' activities. Society can thus be able to hold the mining firms accountable and follow up on environmental related matters related to the mining firms.

1.6 Methodology

This study makes use of both quantitative and qualitative research methods to answer the research questions. The study used panel data analysis and pooled regression to address the research questions quantitatively, while it adopted a approach to attempt to answer the research questions qualitatively.

Panel data analysis used the adjusted r squared and Durbin Watson tests as well as tests for Multicollinearity. Pooled regression used the p-values to test for any significant link between the firms' Environmental Management Practices and firm financial performance. A content analysis was then carried out, examining in depth the firms' Environmental Management Practices, any potential impact on firm financial performance and what motivated these firms to engage in these practices.

1.6.1 Population

The population for this study is the entire companies that are listed on the Johannesburg Securities Exchange (JSE)'s Socially Responsible Investment (SRI) index. There are currently twenty-two (22) firms that are listed on the JSE SRI for 2011. The researcher has decided to use this as the population because of the ease of obtaining reliable and comparable information from a highly reputable source (JSE). In addition, the nature of the research area calls for firms that are engaged in proactive environmental management. The firms listed on the JSE SRI 2011 best performing group are at the forefront in Environmental Management Practices and have a pool of environmental data that is critical in addressing the research questions raised.

1.6.2 Sample

The sample is selected from the mining firms under the JSE (SRI) index. There are currently nine mining firms that are represented on the SRI for 2011. The researcher has decided to use all the firms on SRI due to their high ranking and reputation with regard to matters of sustainability and environmental management. This enabled the

researcher to have access to the critical data on Environmental Management Practices that are prevalent in these firms. The nine mining firms that are listed within the SRI group of the JSE are, namely:

- Anglo American Plc
- AngloGold Ashanti Ltd
- Gold fields Ltd
- Merafe Resources Ltd
- Implats Ltd
- Kumba iron ore Ltd
- Exxaro Resources Ltd
- ArcellorMittal Ltd
- Lonmin Plc

For commercial confidence, these names were replaced with pseudonyms to keep the companies' identities in confidence.

1.6.3 Research instruments

The research instruments used in this study were the firms' annual integrated reports and sustainability reports and the excel spread sheet used to record the firms' Environmental Management Practices and firm financial performance.

1.6.4 Data collection

The data used in the study were collected directly from the firms' annual integrated reports and sustainability reports that were available to the public through the firms' websites.

1.6.5 Data analysis

1.6.5.1 The variables

This study evaluates possible relationship that exists between Environmental Management Practices and firm financial performance in the selected mining firms. There are many variables that constitute conventional Environmental Management Practices that have been employed in prior research such as in (Montabon, Sroufe

and Narasimhan (2007); Ngwakwe, 2009; and Liu, Liu, Shishime, Yu, Bi & Fujitsuka, 2010). However, this research uses carbon emission reduction measured in metric tons of CO_2 equivalent, energy usage measured in Giga Joules and water usage measured in million cubic metres as indicators of Environmental Management Practices in the selected mining firms.

These Environmental Management Practices were chosen primarily because a pilot study of Environmental Management Practices of the selected mining firms indicates that these practices are common to all the selected firms. Additionally, these variables are equally important given that South African mining firms have attracted long-standing attention regarding environmental impacts. This commonality in Environmental Management Practices thus enabled the researcher to have a common set of data to draw from.

On the other hand, measures of firm financial performance are many and different measures have been employed by previous researchers which have yielded different results (Al-Tuwaijri, Christensten & Hughes, 2004; Tsoutsoura, 2004; and Clarkson, Li, Richardson & Vasvari, 2008); this study shall use Return On Equity (ROE) to measure firm performance. This is because stakeholders are believed to have ultimate interest in their equity and thus concerned about corporate engagements, such as Environmental Management Practices that may make it to grow (Artiach *et al*., 2010).

Recent research in developed countries has established a linkage between ROE and firm's Environmental Management Practices (Moneva & Ortas, 2010). No research has employed ROE and Environmental Management Practices in South Africa. However this has become important because contemporary research has indicated that equity holders (investors) may influence Environmental Management Practices of their firm (Azapagic, 2004; Jenkins & Yakovleva, 2006; and Sumiani, Haslinda & Lehman, 2007). Hence to motivate South African stakeholders towards supporting mining firms' Environmental Management Practices, it is important to demonstrate to them the values that may likely accrue to their equity if mining firms employ Environmental Management Practices. In addition, using ROE would as well

bridge the existing gap in literature as no previous research in South Africa has used this variable.

There are many variables that may affect Return On Equity such as profit margin, asset turnover and leverage ratio (Teitelbaum, McDonald and Brown, 1996). Other factors include industry, firm size and operational risk (Ullmann, 1985; and Tsoutsoura, 2004).

1.6.5.2 Operational definition of variables

In this study, Environmental Management Practices will constitute the independent variable and will be represented by carbon emission (CE), energy usage (EU) and water usage (WU). On the other hand, the dependent variable will be Return On Equity (ROE). Thus the regression equation may be stated as follows:

1.6.5.3 Variables:

Dependent variable: Y: Return On Equity (ROE)

Independent variables: X_1 Carbon emission reduction (CE)

X_2: Energy usage (EU)

X_3: Water usage (WU)

Hence regression equation: $y=a+b_1x_1+b_2x_2+b_3x_3$

Where:

y= Return On Equity; x_1= Carbon emission reduction; x_2=energy usage; x_3= water usage; a= intercept and b= slope

This method has been used in other research such as (Tsoutsoura, 2004; and Moneva & Ortas, 2010). Tsoutsoura (2004) used regression in her study. The aim was to address the question whether corporate social responsibility (CSR) and firm performance are linked and found a positive link between the two variables. Moneva and Ortas (2010) evaluated the significance of the link between corporate environmental and firm performance in order to show managers how an adequate management of environmental factors could contribute to the financial success of the firm.

1.6.6 Limitations and Scope of the study

1.6.6.1 Limitations of the Study

The mining firms used in this research are only limited to mining firms that are listed on the JSE under the SRI. The measures used for this study are only limited to four variables, which are common to all the mining firms being used in the study. There are a number of other unlisted mining firms that are operating in South Africa and thus, the findings of this study therefore may not be fully representative of the entire mining industry in South Africa. Environmental reporting is still in its infancy from a South African mining perspective hence finding an extensive range of data proved extremely difficult.

1.6.6.2 Scope of the study

This study is based on the South African mining firms that are listed on the JSE SRI. These firms, whilst South African listed, may have operations based outside the borders of South Africa. The study focuses on these mining firms' Environmental Management Practices as reported by them that represent their efforts with regards to voluntary environmental self-regulation. This is limited to those mining firms that are listed on the JSE.

1.7 Structure of the Dissertation

The dissertation first begins with this introduction, followed by a section on literature. An overview of the legislation affecting South African mining firms is given followed by a theoretical framework, concepts and related literature. The methodology chapter follows next, setting out the research methods and design appropriateness. A clear description and justification of the research methods is then set out. The analysis and findings follow afterwards, detailing the test done with the relevant results shown in tables and explained. Lastly, the dissertation ends with conclusions and recommendations based on these findings and their different implications for different users of this study.

CHAPTER 2
LITERATURE REVIEW

Introduction

This section reviews related theory and literature. The first section discusses legislation applicable to mining firms and their Environmental Management Practices (EMP) followed by related theories, namely: Legitimacy and Stakeholder theories. A section on the concept of Environmental Management Practices, international frameworks, policies, standards, guidelines and Return On Equity follows and then the related literature is discussed. The last section of the literature summarises the discussions.

2.1 Brief Overview of Environmental Regulation on South African Mining Firms

Mining and other extractive activities in the Republic of South Africa fall under the Department of Mineral Resources. The department is principally responsible for overseeing mining related activities and works in ensuring that mining firms comply with the applicable laws as set out in the acts. The Acts that enforce environmental related measures in the mining sector amongst others are the National Environmental Management Act (South Africa, 1998), Minerals and Petroleum Resources Development Act (South Africa, 2002) and the Minerals and Petroleum Resources Development Amendment Act (South Africa, 2008).

2.1.1 Policies, legislation and frameworks governing environmental management in South Africa

There are many policies, legislative and strategic frameworks governing environmental management in South Africa (Enviropaedia 2012). According to Enviropaedia (2012), South Africa has numerous Acts that affect environmental management and related issues. Some of these Acts in question include:

- The Hazardous Substances Act (Act 5 of 1973)
- The Occupational Health and Safety Act (Act 85 of 1993)
- The South African Constitution (Act 108 of 1996)
- The Municipal Structures Act (Act 117 of 1998)
- The National Environmental Management Act (Act 107 of 1998)
- The National Water Act (Act 36 of 1998)

- The Municipal Systems Act (Act 32 of 2000)
- The Mineral and Petroleum Resources Development Act (Act 28 of 2002)
- The Health Act (Act 63 of 2003)
- The Air Quality Act (Act 39 of 2004)
- The National Environmental Management: Waste Act, 2008 (Act 59 of 2008)

Other appropriate frameworks include the Draft White Paper on Integrated pollution and Waste Management for South Africa issued in 1998. Of relevance to this paper are the South African Constitution (Act 108 of 1996), Draft White Paper on Integrated Pollution and Waste Management for South Africa (1998), National Environmental Management Act (Act 107 of 1998), Mineral and Petroleum Resources Development Act (Act 28 of 2002), Air Quality Act (Act 39 of 2004) and the National Environmental Management Waste Act 59 of 2008 and the National Waste Management Strategy (2011). However, the acts that have a direct bearing on this study are briefly discussed below.

2.1.2 The South African Constitution (Act 108 of 1996)

The supreme law of South Africa, the constitution sets out under the Bill of Rights in sub-section 24 that South Africans have a right to an environment that is not detrimental to their health and well-being and that this environment ought to be preserved for current and future generations through legislation and other means.

2.1.3 National Environmental Management Act (South Africa, 1998)

The National Environmental Management Act (NEMA) is the key act that has led to the development of legislation, policies and self-regulatory frameworks regarding environmental management. As stipulated by the constitution in Chapter 2, South Africans have a right to a healthy environment. This Act ensures that they indeed enjoy the right to a healthy environment by promoting environmental management as a means of having a healthy environment. The act further provides for the creation of environmental management plans, which set out in detail the policies, plans, practices and priorities that an organisation uses as a guideline to maintain and protect the environment from possible degradation. It also calls for an integrated approach to environmental management, acknowledging that all aspects of the

environment are intertwined and that the best possible decisions must be made with regards to evaluating potential environmental choices. South African mining firms hence use the act to enact their own environmental self-regulation. Together with international benchmarks, this leads them into adopting Environmental Management Practices that are at the heart of this study.

2.1.4 The Minerals and Petroleum Resources Development Act (act No.28 of 2002) [as amended.]

Of relevance to this research is the Minerals and Petroleum Resources Development Act (South Africa, 2002). Under Chapter 2, part III of this act, sections 51 and 52 call for mining firms to have an environmental management programme and environmental management plan respectively. A key area under these sections is the need for mining firms to provide for financial costs to rehabilitate the environment after cessation of mining operations as well as providing for costs to mitigate environmental disasters should they occur. Section 54 stipulates the quantum for financial provisions and has stipulated that the following costs need to be provided for, subject to the department's revision from time to time:

- Premature closure costs;
- Decommissioning and final closure costs; and
- Post closure management of residual and latent environmental impacts.

These aforementioned costs weigh heavily on the nature and management of the mining firms' environment and hence govern strategy on how these mining firms treat environmental management.

2.2 Theoretical framework

The study is anchored on two theories, namely, the Legitimacy theory and the Stakeholder theory. The figure below depicts Legitimacy theory in the context of Environmental Management Practices:

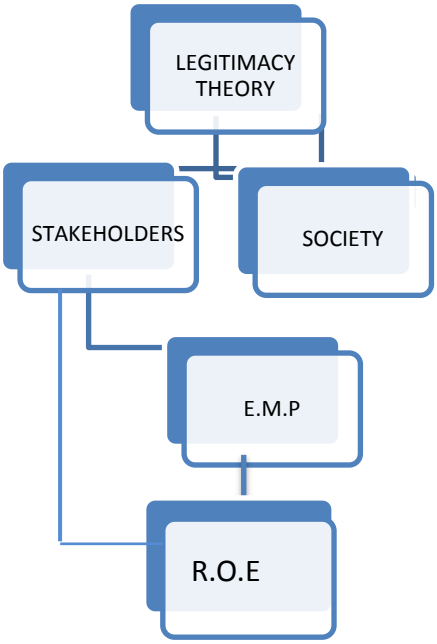

Figure 1: Legitimacy theory in the context of Environmental Management Practices

2.2.1 Legitimacy theory

This theory states that firms cannot continue to exist and thrive if their thinking and methods are contrary to those of the society in which they operate (Deegan & Rankin, 1996; Campbell, 2000; Wilmshurst & Frost, 2000; O'Donovan, 2002; and Antonites & De Villiers, 2003). According to Suchman (1995:574), legitimacy is defined as "a widely held view that an organisation's actions are acceptable and done in good faith within a socially constructed system of beliefs, norms, values and definitions." Suchman (1995); Tilling and Tilt (2010); and Mahadeo et al., (2011) argue that legitimacy is viewed as a critical tool that has an inherent value which has to be preserved and maintained to guarantee acceptance and support from stakeholders.

Owen (2008) contends that a major number of studies related to corporate social and environmental reporting have used legitimacy theory as their primary explanatory impetus. Organisations are in an on-going quest to show that their operations are in conformity with society's expectations and norms. High risk organisations whose activities are likely to have an impact on the environment, such as mining and industrial companies, are strong proponents of legitimacy. This enables these firms to have society's acceptance of their activities (LIM, Wilmshurst & Shimeld, 2010). According to Buhr (1997), organisations and their related

accounting systems carry out their activities with an economic, political and social context.

In order to continue their existence, it is argued that the organisations have to acquire and sustain social approval within the communities that they operate in (Shocker & Sethi, 1974; Dowling & Pfeffer, 1975; Pfeffer & Salancik, 1978; Sethi, 1979; Richardson, 1987; Lindblom, 1993; and Buhr, 1997). Legitimacy theory is seen to be a systems-oriented concept, in which an organisation is assumed to be inclined towards satisfying the local communities and in turn influences the community in which it operates (Gray, Owens & Adams, 1996; and Deegan, 2002). Deegan (2002) further argues that legitimacy theory places organisations as a fraction of the greater society, and have no intrinsic privileges to access resources or to carry on existence. These organisations can only exist to the degree that the particular sections of society can allow them to, granting them the legitimacy to exist. Legitimacy is also viewed as a social contract between an organisation and the society in which it operates.

The operations and existence of an organisation is dependent on how the organisation maintains this contract and may threaten the organisation should the society deem a breach in this contract (Matthews, 1993; and Deegan, 2002). If there is dissatisfaction with how organisations carry out their operations, society can revoke this contract and hamper an organisation's ability to continue existing (Matthews, 1993; and Deegan, 2002). Deegan, Rankin and Tobin (2002) argued in line with previous authors such as (Gray et al., 1996; Deegan, 2002; Bebbington, Larrinaga-González & Moneva-Abadía, 2008; and Cho, Freedman & Patten, 2012) that Legitimacy theory represented the idea of a social contract between an organisation and society. They were of the view that organisational managers utilised strategies that showed an organisation's efforts towards conforming within the accepted norms of society.

Deegan, Rankin and Tobin (2002) further argued that the relationship between society and organisations was dynamic; thereby requiring organisations to be cognizant of the expectation placed by this implied 'social contract and had to always operate with full responsibility. As a result of increased community scrutiny,

cognizance and concern for environmental impacts as a result of organisational operations, legitimacy inclines organisations towards taking the appropriate measures that will ensure that their operations are in line with broader societal views (Ahmad & Sulaiman, 2004).

In their work, Mobus (2005) explored compulsory environmental disclosures in a legitimacy theory perspective. They showed that organisational legitimacy was a much broader concept, within which aspects like environment management contributed to the concept. Mobus (2005) further argued that the concept of legitimacy was more generalised than narrowed down to any particular circumstance and that legitimacy could not be sustained without consistent adherence to specific ideals, norms and values. Once lost, regaining legitimacy is a tedious task on the part of organisations, who may have lost their acceptance and standing in society (Mobus, 2005). Echoing other authors, Magness (2006) views legitimacy as a social contract existing between communities and organisations; placing the burden on organisations to act in accordance with acceptable norms and ideals. Legitimacy theory argues that managers in organisations use reporting to form an impression on the part and obligation of the organisation to stakeholders (Magness, 2006). Tilling and Tilt (2010) examined the legitimacy theory with regards to CSR reporting in a tobacco firm. They argued that legitimacy as a theory is used to explain corporate behaviour. Given the nature of the industry under study, threats to organisational legitimacy are regarded as high and as a result, the evolving nature of legitimacy as a concept is studied (Tilling & Tilt, 2010).

Legitimacy is a seen as an integral resource to an organisation (Hearit, 1995; and Tilling & Tilt, 2010). Certain activities and actions are closely related to it and have a direct impact on the levels of legitimacy. They can either increase or decrease this resource with direct consequences for an organisation. High legitimacy is good for an organisation, increasing acceptance with society and improved reputation for the organisation. Low levels of legitimacy on the other hand present a danger to the good standing of organisation in the eyes of society and a direct threat to their continued operations (Tilling & Tilt, 2010). Mäkelä and Näsi (2010) linked the concept of social contract to legitimacy. As previously stated by other previous researchers, such as Matthews (1993) and Deegan (2002), legitimacy was viewed

as a social contract between organisation and society, with a weight of expectation placed highly on the organisation to conform to accepted norms and ideals. Mäkelä and Näsi (2010) therefore argued that legitimacy and social contracts were essential for the good standing of organisations in societies.

This theory is applicable to this study given that selected mining firms appear to have realised that they cannot operate without attending to the yearnings of society. Organisational legitimacy is increasingly adopting Environmental Management Practices as a critical component. Perceptions and norms from communities are increasingly taking into account any detrimental actions as a result of an organisation's activities. One way of maintain the social contract that is legitimacy is by engaging in voluntary Environmental Management Practices (Mobus, 2005). Thus mining firms in South Africa have a duty to legitimise their operations by engaging in Environmental Management Practices such as carbon emission reduction, efficient energy use and efficient water usage.

2.2.2 Stakeholder theory

According to Mutti *et al.,* (2011), the Stakeholder theory stipulates that firms are obliged to distribute benefits to all stakeholders, rather than to only the shareholders and customers. Elijido-Ten (2007) contends that Stakeholder theory posits that a firm's success is dependent how successfully it manages the relationships that it forms with a variety of stakeholders. Other researchers such as Donaldson and Preston (1995); Jamali, Safieddine and Rabbath (2008); and Mahadeo, Oogarah-Hanuman and Soobaroyen (2011) argue that Stakeholder theory posits an alignment of two disparities; an ethical and an instrumental branch. These two branches are relevant in the theoretical framework governing this research. The ever-evolving nature of the business world has led to an increasing need for organisations to acknowledge their responsibility to a host of stakeholders other than the owners/investors and to provide solutions to problems that may arise due to company activities. This is an area that the Stakeholder theory is applied (Elijido-Ten, 2007).

According to Polonsky (1995), firms must be cognizant of their duty to numerous internal and external stakeholders. They cannot operate without putting the needs of

these stakeholders at the forefront. Given the diverse needs of different stakeholders, the theory suggests that firms must take into account these needs and meet the minimal expectations required of them by the stakeholders. In their critique of Stakeholder theory, Key (1999) argued that Stakeholder theory was an all-encompassing model that could be used to explain organisational behaviour. Freeman (1984) saw Stakeholder theory in the form of an actor/environment relationship. He argued that that the actors, both internal and external were directly affected by the operating environment of the firm which resulted in the theory that organisations had to perform to the expectations of all stakeholders rather that the traditional economic approach focussing on shareholders alone (Freeman, 1984; and Key, 1999).

The figure below shows Stakeholder theory in the context of these Environmental Management Practices. Based on what is in the above literature, Stakeholder theory can be within two branches; ethical and instrumental branch (Donaldson & Preston, 1995; Jamali, Safieddine & Rabbath, 2008; and Mahadeo, Oogarah-Hanuman & Soobaroyen, 2011). Ethical branch relates to the moral obligations of organisations towards their environment resulting in these Environmental Management Practices. Instrumental branch refers to the role that management has as both custodians of firms' financial performance (equity) and the environment (Environmental Management Practices).

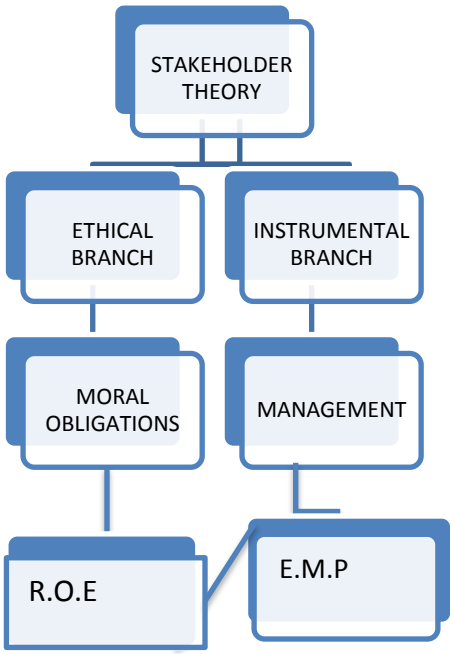

Figure 2: Stakeholder theory in the context of Environmental Management Practices

Therefore, the role of stakeholders cannot be ignored in organisational activities. The mining firms are obliged to spend on Environmental Management Practices so as to benefit the local communities in which they operate hence there is a need to show how these Environmental Management Practices impact firm financial performance in the South African mining industry.

2.3 The Concept of Environmental Management Practices (EMP)

The concept of Environmental Management Practices (EMP) has been on the agenda of the corporate world since a series of significant events in the sustainability arena; the Bruntland Report (1987), the Earth Summit in Rio de Janeiro, Brazil in 1992, the World Summit on Sustainable Development in Johannesburg in 2002 and the recent Earth Summit 2012 in Rio de Janeiro, Brazil. In various literature, Environmental Management Practices (EMP) has been interchangeably used with Corporate Environmental Responsibility (CER), Corporate Environmental Management (CEM), Corporate Environmental Engagement (CEE) and Corporate Social Responsibility (CSR). Montabon *et al.* (2007) defined Environmental Management Practices (EMP) in their paper as the techniques, policies and procedures a firm uses that are targeted at monitoring and controlling the impact of its operations on the natural environment.

Whilst there may be many aspects of Environmental Management Practices as can be noted from the literature (Evangelinos & Oku, 2006; Montabon *et al*., 2007; and Liu *et al*., 2010); in this research, Environmental Management Practices (EMP) refers to the action taken by mining firms to remedy environmental pollution vis-à-vis carbon emissions reduction, efficient energy use and efficient water usage.

2.4 International Policies, Frameworks and Standards Governing Environmental Management Practices

There are a few international standards and policies with regards to Environmental Management Practices worth mentioning. These include the Carbon Disclosure Project (CDP), the Global Reporting Initiative (GRI) guidelines and framework and International Organisation for Standardisation (ISO) 14001: 2004 (Environmental Management Systems) and the Millennium Development Goals (MDGs).

2.4.1 Carbon Disclosure Project (CDP)

The Carbon Disclosure Project (CDP) is a voluntary self-reporting project initiated to allow for companies to address the issue of climate change and investors to address the risks involved with their investments. The CDP envisages a situation of efficient resource utilisation to ensure long-term sustainable development with environmental protect at the forefront (CDP, 2013).

The CDP uses measurement and disclosure to advance the managing of environmental threats and through leveraging investors, customers and authorities, it has been able to give incentives to organisations across the largest global economies to report and measure their environmental data. The CDP holds the largest global collection of reports on climate change, forest and habitat risk and water data. This is all based on voluntary self-reports by the companies that ascribe to this initiative. This allows investors and other stakeholders to be better informed to make sound investment decisions that have a long way in providing for a sustainable world going into the future (CDP, 2013).

The CDP has a climate change program whose aim is to encourage firms to reduce on the greenhouse gas emissions and mitigate climate change. Improving corporate awareness on climate change is seen as important for enhance the measurement and disclosure of data, such as carbon emissions; hence reduce the overall risks associated with climate change. In South Africa, the mining firms used in the study are signatories of the CDP and provide their Environmental Management Practices data to the CDP (CDP, 2013).

The CDP also has a water project. This project aims to stoke a global thought process in corporations to work towards effective water management and safeguarding of this precious commodity. The CDP shows that more and more investors are interested in the global usage of water and this necessitates the need for organisations to report more on their water usage (CDP, 2013). The CDP sends out a water questionnaire to firms that have water intensive operations and these firms fill in the questionnaire providing the CDP with their water data. This is also used by the firms in this study.

2.4.2 Global Reporting Initiative (GRI) guidelines and framework

Founded in 1997, the non-profit Global Reporting Initiative (GRI) was established to help foster sustainable development and transparency in all aspects of economic, social and environmental development. The G3.1 guidelines are the most recent guidelines issued by the Global Reporting Initiative (GRI). These sustainability reporting guidelines are the bedrock of the GRI's reporting framework (GRI, 2012). Organisations are expected to voluntarily use these performance indicators to measure their individual sustainability reporting areas of economic, social and environmental disclosures. The Key environmental indicators are set out in the table below. South African mining firms have used these guidelines as the basis for disclosing their own Environmental Management Practices.

PERFORMANCE INDICATOR	**ASPECT MEASURED**
EN1	Materials used by weight or volume
EN2	Percentage of materials used that are recycled input materials
EN3	Direct energy consumption by primary energy source.
EN4	Indirect energy consumption by primary source.
EN5	Energy saved due to conservation and efficiency improvements.
EN6	Initiatives to provide energy-efficient or renewable energy-based products and services, and reductions in energy requirements as a result of these initiatives.
EN7	Initiatives to reduce indirect energy consumption and reductions achieved
EN8	Total water withdrawal by source.
EN9	Water sources significantly affected by withdrawal of water.
EN10	Percentage and total volume of water recycled and reused.
EN11	Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas.
EN12	Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.
EN13	Habitats protected or restored.
EN14	Strategies, current actions, and future plans for managing impacts on biodiversity
EN15	Number of IUCN Red List species and national conservation list species with habitats in areas affected by operations, by level of extinction risk.
EN16	Total direct and indirect greenhouse gas emissions by weight.
EN17	Other relevant indirect greenhouse gas emissions by weight.
EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved.
EN19	Emissions of ozone-depleting substances by weight.
EN20	NOx, SOx, and other significant air emissions by type and weight.
EN21	Total water discharge by quality and destination.
EN22	Total weight of waste by type and disposal method.
EN23	Total number and volume of significant spills.
EN24	Weight of transported, imported, exported, or treated waste deemed hazardous under the terms of the Basel Convention Annex I, II, III, and VIII, and percentage of transported waste shipped internationally.
EN25	Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff.

EN26	Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation.
EN27	Percentage of products sold and their packaging materials that are reclaimed by category.
EN28	Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations.
EN29	Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce.
EN30	Total environmental protection expenditures and investments by type

Table 1: GRI guidelines courtesy of GRI

The environmental guidelines are shown above and are quite numerous but this study focused on those applied by the JSE SRI 2011 South African mining firms. These standards included EN3, EN4, EN5, EN6 and EN7 for energy; EN8, EN9 and EN10 for water; EN16, EN17, EN18, EN19 and EN20 for emissions (GRI, 2012). The South African mining firms used in this study applied these guidelines when measuring their carbon emissions, energy usage and Water usage as shown in the analysis and findings section.

2.4.3 ISO 14001:2004

This standard, prepared by a specialised technical committee within the ISO aims to standardise environmental management systems worldwide (ISO, 2004). Within the standard, there is a call for organisations to adopt an integrated environmental management system that allows organisations to meet increasingly stiff legislation while also meeting their economic and environmental objectives (ISO, 2004). This standard is intended to be applied by all organisations that look to enhance their self-regulation and provides an understandable and comparable mechanism that can be adopted at an operational level. This can allow for organisations to develop Environmental Management Practices and be able to consistently apply the standard, resulting in clear, understandable and reliable data on the Environmental Management Practices.

2.4.4 JSE SRI

Founded in May 2004, the JSE, socially responsible index (SRI) to respond to the growing concerns with regards to climate change and sustainable development. It was an innovative idea for an emerging economy like South Africa and the first time that an exchange launched such a bold idea (JSE, 2013). The JSE developed a set

of criteria used to measure firm performance in areas of economic, environmental and social. This was then used to compile the idea based on those firms that had ascribed to the criteria (JSE, 2013).

Every year, the JSE recognises those firms that are consistent performers based on the criteria (JSE, 2013). Hence for 2011 those nine (9) mining firms used in this study are included on the index. These firms are highly ranked due to their ever consistent reporting on all aspects of economic, environmental and social performance.

2.4.5 Millennium Development Goals (MDGs)

As a means to further understand the basis of this study, it was necessary to conceptualise Environmental Management Practices in the context of the MDGs. According to the UN (2013), the September 2000 millennium summit resulted in the adoption of the United Nations Millennium Declaration, which placed a commitment on leaders of UN member states to engage in a global partnership whose major aim was to reduce extreme global poverty by half. This was to be done through a standardised time-frame with a deadline set for 2015. As the years went by, more objectives were added hence this evolved into what is now termed as the Millennium Development Goals (MDGs).

In 2002, the UN Millennium Campaign was launched and this supported and inspired people from UN member states to throw their weight and act towards achieving these MDGs. In the same year, the UN Millennium project was launched by the UN Secretary-General. This project set out to establish a sound action plan for the world to achieve the MDGs. New commitments towards achieving these MDGs were announced in 2008 and in 2010, the global MDG conference ended with the approval of a global plan of action and new initiatives towards meeting the MDGs.

The current Millennium Development Goals are, namely:

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women

- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria and other diseases
- Ensure environmental sustainability
- Global partnership for development (UN 2013).

With this brief background, it can be seen that ensuring environmental sustainability is a global goal that aims to contribute to overall sustainable development. Hence governments and private organisations are mandated to act with care for the environment. The current Environmental Management Practices of these mining firms are a giant leap towards meeting these MDGs.

2.5 Return On Equity (ROE)

Return On Equity (ROE) has been defined and conceptualised differently by various authors and researchers. Investopedia (2012) defines ROE as "the amount of net income returned as a percentage of shareholders equity". It is further stated that Return On Equity (ROE) "measures a firm's profitability by revealing how much profit a firm generates with the money invested by shareholders" (Investopedia, 2012). Teitelbaum *et al.* (1996) defined ROE as profits divided by the shareholders equity and stated that it is a useful tool for investors to measure managerial performance in the firms.

Vigario (2005:237) indicated that the ROE shows how much of profit generated by the company belongs to the shareholders. He further alluded to the fact that shareholders are always expectant of increases in this measure as it has a direct impact on their investments. ROE has been used in similar research internationally such as (Tsoutsoura, 2004; and Moneva & Ortas, 2010). This study used Return On Equity (ROE) to measure firm performance. This is because stakeholders are believed to have ultimate interest in their equity and thus concerned about corporate engagements, such as Environmental Management Practices, that may make it to grow (Artiach *et al*., 2010).

Recent research in developed countries has established a linkage between ROE and firm's Environmental Management Practices (Moneva & Ortas, 2010). However, no research has employed ROE and Environmental Management Practices in South Africa. This has become important because contemporary research has indicated that equity holders (investors) may influence Environmental Management Practices of their firm (Azapagic, 2004; Jenkins & Yakovleva, 2006; and Sumiani *et al*., 2007). Hence to motivate South African stakeholders toward supporting mining firms' Environmental Management Practices, it is important to demonstrate to them the values that may likely accrue to their equity if mining firms employ Environmental Management Practices.

In addition, using ROE would as well bridge the existing gap in literature as no previous research in South Africa has used this variable. There are many variables that may affect Return On Equity such as profit margin, asset turnover and leverage ratio (Teitelbaum *et al.,* 1996). Other factors include industry, firm size and operational risk (Ullmann, 1985; and Tsoutsoura, 2004). However, in this research these variables shall be held constant to enable the researcher to focus attention on whether Environmental Management Practices had an impact on ROE during the years of study.

2.6 Other Related Literature

2.6.1 Overview of previous studies on firms' Environmental Management Practices

In their work, Mutti *et al.* (2011) explored the perceptions of stakeholders with regard to Environmental Management Practices (EMP) contribution to their communities in mining areas and the socio-economic development that the mining firms brought about and the future in terms of sustainable development that the communities had to look forward to. This study was carried out on a national level in the Republic of Argentina. De Villiers and Van Staden (2011) investigated where firms choose to disclose their Environmental Management Practices (EMP) the most and discover that the firms tend to disclose more of their environmental information in websites and in their annual reports. The studies by the researchers showed that stakeholders where one of the driving forces behind Environmental Management Practices (EMP).

The study carried out by De Villiers and Van Staden (2011) developed two key hypotheses that raise questions on firms and Environmental Management Practices (EMP). The first hypothesis was that firms with bad long-term environmental reputations will disclose environmental information in their annual reports than other firms. Due to the fact that mining operations are a potential environmental hazard, their findings indicate that the mining firms thus put more emphasis on disclosure of environmental information and Environmental Management Practices than other firms. The second hypothesis stated that firms experiencing an environmental crisis will disclose more information on their websites than non-crisis firms. Evidence that supported this assertion was based on the numerous environmental disasters that had befallen mining and other extractive industries, most notoriously the BP oil spill in the Gulf of Mexico in 2010. Laurence (2011:284), in his paper, states that: "a sustainable mine is one that is safe, demonstrates leading practice in environmental management and community engagement, is economically robust and which, very importantly, efficiently uses the mineral resource". This gives more justification on why mining firms ought to increase their Environmental Management Practices (EMP).

In their study, De Villiers and Barnard (2000) showed that Environmental Management Practices (EMP) were more prevalent in the South African mining sector than other industries. Another study carried out indicated that most managers of South African companies listed on the Johannesburg Securities Exchange (JSE) had a positive attitude towards Environmental Management Practices (EMP) while the results from analysing their annual reports indicated otherwise (De Villiers, 2003). Mining companies continued to dominate Environmental Management Practices (EMP) than industrial and other companies, perhaps due to accounting policies and legislation directly aimed at them (Antonites & De Villiers, 2003).

An in-depth study of the Nigerian manufacturing sector was carried out by Ngwakwe (2009). The paper investigated a possible relationship between firm performance and three selected indicators of sustainable business practice: Employee Health and Safety (EHS), Waste Management (WM), and Community Development (CD). The paper concluded that, in the Nigerian setting at least, Corporate Environmental Performance (CER) affects corporate performance and that Environmental

Management Practices (EMP) may be a possible tool for corporate conflict resolution as evidenced in the reduction of fines, penalties and compensation (Ngwakwe, 2009). A case study was carried out amongst 50 Malaysian firms to investigate the level of disclosure of environmental information and the challenges in environmental information management (Sumiani *et al.,* 2007). The study established that the level of environmental information disclosed, in the corporate annual reports of Malaysian companies was rather low, suggesting a low level of Environmental Management Practices (EMP) by these companies.

The study carried out by Garvin *et al*., (2009) was aimed at examining the impact of gold mining at the community level in the Wassa West District of Ghana. An interesting observation that was made was that the local community had agreed in unison that that the overall built environment had improved due to the mining firm's activities. However, the overall environmental effects were reported as mainly negative, with the respondents noting that the mining activities were noisy and disrupted water, air and land, thus resulting in environmental quality decreases and an increase in diseases. Vintro, Fortuny, Sanmiquel, Freijo and Edo (2011) investigated whether Environmental Management Practices (EMP) was possible in the mining sector amongst mining firms in Catalonia, Spain. Their research showed that the majority of socially responsible practices among these firms were related to environmental issues and, therefore, they concluded that there is a relation between Environmental Management Practices (EMP) and the application of environmental management systems. Vintro *et al*., (2011) also found that 63% of the mining companies surveyed were familiar with environmental management systems and many of the firms had at a certain point taken some level of action with regard to the environment. Scholtens (2006) studied the effects of finance as a driver towards Environmental Management Practices (EMP) and found no single direct relationship between finance and Environmental Management Practices (EMP) but several indirect linkages existed.

Oberholzer and Prinsloo (2011) studied the efficiency of sustainable development by mining companies in South Africa. The main thrust of the study was to develop a model in order to estimate the efficiency of South African listed mining firms in their efforts to convert environmental impact into economic and social gains for

shareholders and other stakeholders. This study found that significant differences between the relative efficiency of gold-mining firms and the efficiency of all the other mining firms, where gold-mining companies proved to be the most inefficient in converting their environmental impacts to economic and social gains.

2.6.2 Drivers of Environmental Management Practices (EMP)

As highlighted in a previous section, it has been noted that the Environmental Management Practices that are being evaluated in this study are voluntary. These Environmental Management Practices include energy usage, carbon emissions reduction and water efficiency. It is, therefore, important to discuss what the possible drivers towards adopting these practices are and, subsequently, whether these Environmental Management Practices will impact firm financial performance as represented by Return On Equity.

Governments have been identified as one of the drivers towards Environmental Management Practices (EMP) (Lee & Hutchinson, 2005; Setthasakko, 2007; Zhang *et al*., 2008 and Artiach *et al.,* 2010). Governments enact legislation aimed at promoting environmental protection and these laws affect the Environmental Management Practices of companies (Setthasakko, 2007). Zhang *et al.* (2008) also note that government is a major driver towards environmental engagement. In their report, DEAT (2005) highlighted the need for firms to comply with appropriate legislation were necessary, in order to safeguard the environment.

Local communities are another driver towards Environmental Management Practices (EMP) (DEAT, 2005; Setthasakko, 2007; Zhang *et al*., 2008; Artiach *et al*., 2010; and Laurence, 2011). Mining firms in particular are expected to be part and parcel of local communities and adopt a holistic approach with regards to their operations (Laurence, 2011; and Mutti *et al*., 2011). Garvin *et al*., (2009) explored community expectations in West Ghana regarding the new mine that had recently opened and the overall expectation in one community was that the new mine was going to among other areas improve the water reticulation system and build new infrastructure.

Public relations (PR) or public opinion plays a major role in pushing firms towards Environmental Management Practices (EMP). According to the DEAT report (2005),

firms in European countries are driven towards Environmental Management Practices (EMP) partly because of the need to appear as exemplary corporate citizens, similar to the actions of North American corporations. In Japan, public relations have been noted to be a major factor driving the big corporations towards Environmental Management Practices (EMP) (Wheeler & Elkington, 2001). Mohammed, Alwi and Jamil (2009/2010) mentioned that the rapid metamorphosis of the corporate environment has led to increased pressures for firms to engage in Environmental Management Practices (EMP) amongst other sustainable practices, in order to remain competitive. These pressures originate from stakeholders such as investors, the government and shareholders, who hold the view that Environmental Management Practices (EMP) should be engraved into long-term corporate strategy (Mohammed *et al.,* 2009/2010).

These drivers resonate directly with the two related theories:

- Government regulation and intervention in this sector fosters a need for mining firms to legitimise their operations, in line with the Legitimacy theory;
- Local communities are important stakeholders who are obliged to receive various benefits from mining companies, thus satisfying the Stakeholder theory; and
- Public relations aims to portray the mining companies in a good light as good corporate and legitimate citizens, also satisfying the Legitimacy theory.

What stands out from the above drivers is that financial motives are not mentioned as one of the drivers towards adopting Environmental Management Practices, hence this study aims to show if there is any impact on firm financial performance by these Environmental Management Practices.

2.6.3 Benefits of Environmental Management Practices (EMP)

There are numerous divergent views as to the perceived benefits of Environmental Management Practices (EMP). Laurence (2011) argues that adopting leading Environmental Management Practices makes excellent business sense, which should be viewed as a plus for mining firms. He further argues that unless steps are taken in the planning and operational stages to protect the environmental values,

long-term ecological issues like acid mine drainage and tailings pollutions are likely to occur. Setthasakko (2007) states that corporate entities are willing to engage environmentally because they obtain non-monetary benefits like good relationships and a good corporate image with government regulating agencies.

Campbell (2011) states that proponents of Environmental Management Practices (EMP) view them as giving corporations an impetus by allowing them multiple options of operating with a broader and longer perspective in sight than their own immediate short-term profit maximisation. Environmental Management Practices (EMP) enables corporations to be in the public light, thus legitimising and adding credibility to the activities the firms embark on. It also has an influence on companies' share prices as it has been noted that companies that engage and report on Environmental Management Practices (EMP) have steadier share price growth and less volatility of prices. Environmental Management Practices (EMP) is also likely to draw more investors who are attracted to eco-efficient sources of investment (DEAT, 2005).

Watson, Klingenberg, Polito and Geurts (2004) were of the notion that firms could reduce their impact on the environment to zero by incorporating proactive Environmental Management Practices into their cultures. This could be accomplished by redesigning products and processes to minimise their effect on the environment, using recycled materials, eliminating toxic waste discharge or eliminating the use of toxic materials in production by using non-toxic substitutes and reducing or redesigning packaging. In their paper, Monteiro and Guzmán (2009) state that companies that have an air of conscientiousness for their environmental impacts and are fully committed to environmental protection are ever more aware that positive Environmental Management Practices (EMP) may result in important competitive advantages.

Ngwakwe (2009) found that in a Nigerian setting, Environmental Management Practices (EMP) was responsible for reducing corporate conflict, which is one of the major distractions to corporate attention. This is a supplementary benefit for firms embracing Environmental Management Practices (EMP). Lee (2012) studied the pivotal role of Environmental Management Practices (EMP) within a Chinese

business context. He found out using certain models that firms needed to develop their culture in accepting and practising Environmental Management Practices (EMP) in order to achieve higher environmental performance and improved reputations and images to gain the firms competitive advantages.

Nikolaou and Evangelinos (2010) extensively performed a SWOT analysis of Environmental Management Practices in the Greek mining and mineral industry. They established that benefits to adopting Environmental Management Practices included cost reduction, improvements in productivity and accelerated innovation developments.

2.6.4 Relationship between Environmental Management Practices (EMP) and firm financial performance

Assumptions have been made that Environmental Management Practices (EMP) and firm performance are unrelated and have nothing in common (Slater & Gilbert, 2004). Most of the existing literature on Environmental Management Practices (EMP) has focused on the relationship between corporate sustainability performance, corporate financial performance and the quality of environmental management reports (Al-Tuwaiji *et al*., 2004). Over the years, different hypotheses have emerged from researchers aimed at addressing the relationship between corporate environmental performance and firm performance. These hypotheses suggest a negative, neutral or positive relationship between the aforementioned variables (Artiach *et al*., 2010).

One perspective states that there is a negative relationship between the two variables as reported in previous studies (Alexander & Bucholz, 1978; Aupperle, Carol and Hatfield 1985; McGuire *et al*., 1988; Barnett, 2005; Becchetti, Di Giacomo & Pinnachio, 2005; Cho & Paton, 2007; and Artiach *et al*., 2010). A common reason found to cause such a negative relationship is the costs involved in adopting more environmentally friendly practices which results in resource distribution away from investors to external stakeholders such as local communities (Aupperle *et al*., 1985; McGuire *et al*., 1988; Barnett, 2005; and Artiach *et al*., 2010).

Another view suggests that Environmental Management Practices (EMP) and firm performance have no association (Ullmann, 1985; and Artiach et al., 2010). The argument raised here is that this relationship is difficult to ascertain due to the possibilities of numerous intervening influences which pose a challenge for control. This, coupled with inadequate theoretical support, was deemed to be too much for anyone to expect a relationship between Environmental Management Practices and firm performance (Artiach et al., 2010). A more recent suggestion to explain the lack of relationship found in previous studies is failure on the part of early researchers to control for firm size and industry (Paten, 2002; and De Villiers & Van Staden, 2011). However, contrary to these negative findings, other researchers maintain that Environmental Management Practices and firm performance are positively associated (Alexander & Bucholz, 1978; Waddock & Graves, 1997; Al-Tuwaiji *et al*., 2004; Barnett, 2005; Clarkson, Li, Richardson & Vasvari, 2006; Clarkson *et al*., 2008; and Artiach *et al*., 2010).

Previous research findings identify various factors in determining a positive relationship between Environmental Management Practices and firm performance. Thus, some find that the financial rewards of engaging in Environmental Management Practices outweigh the costs involved in the long run (McGuire *et al*., 1988; and Barnett, 2005) and investing in Environmental Management Practices may result in improved relationships with stakeholders such as local communities, lenders and governments. Similarly, other findings hold that environmental management investment results in improved firm performance by managing stakeholders (Artiach *et al*., 2010). Another perspective, also known as the resource view, suggests that firms that invest in Environmental Management Practices experience increased resources (Alexander & Bucholz, 1978; Waddock & Graves, 1997; Clarkson *et al*., 2006; and Artiach et al., 2010). Montabon *et al*. (2007) in their paper examined the relationship between Environmental Management Practices and firm performance. They established that a significant and positive relationship exists between Environmental Management Practices and measures of firm performance.

Montabon *et al.* (2007) also examined the impact of waste management on firm financial performance. They found a significant relationship between waste management and firm financial performance. A comprehensive study on the impact

of waste management and carbon emissions on firm financial performance was carried out by Iwata and Okada (2011). They examined this relationship in Japanese manufacturing firms for a five-year period. Using Return On Equity as one of the measures of firm financial performance, they found that the impact of waste management on firm financial performance was not statistically significant. On the other hand, Iwata and Okada (2011) also studied the impact of carbon emissions on firm financial performance. They employed Return On Equity as one of their measures of firm financial performance and discovered that carbon emission reductions increase long-run firm financial performance.

Hart and Ahuja (1996) studied the relationship between emissions reduction and firm financial performance. They found that, using Return On Equity as one of their variables, a relationship between emissions reduction and Return On Equity could only be partially confirmed. Soyka and Powers (2002) studied the effects of energy efficiency on corporate profitability performance. They found evidence suggesting that energy efficient strategies create remarkable new corporate wealth. They also discovered that investments in energy saving programs by firms used in their study resulted in statistically significant positive impacts on their operating margins. In their work, Delmas and Nairn-Birch (2010) examined the impact of greenhouse gas emissions (GHG) on firm financial performance. Interestingly, their findings indicated that increasing carbon emissions resulted in a positive impact on firm financial performance when employing accounting based measures of financial performance, while the same linkage was negative when using market based measures of firm financial performance.

In their study, Busch and Hoffmann (2011) examined the linkage between carbon emissions and carbon management strategies and corporate financial performance. They found that when using carbon emissions as outcome-based measurement, the relationship between carbon emissions and corporate financial performance was positive. However, when they used carbon management strategies as a process based measure, it resulted in a negative association between their corporate environmental performance and financial performance. Davidsdottir and Fisher (2011) examined the link between carbon emissions and economic performance in the United States. Using panel analysis, they examined any link between the two

variables, focusing on the direction of causality between the two. They discovered that a two-directional significant relationship did exist between carbon emissions and economic performance. Davidsdottir and Fisher (2011) concluded that their findings made it possible for States to introduce sector-unique policies that could reduce energy and carbon emissions intensity and improve fiscal performance at the same time.

Yu, Ting and Wu (2009) studied the greenness strides by European based firms from a resource efficiency perspective. Their aim was to determine whether a link existed between environmental effects and financial performance and also to examine if firms that showed more drive towards environmental management showed a more impactful positive relationship between environmental performance and financial performance that those that showed a lesser drive. Using correlation analysis as their methodology, Yu et al., (2009) found that no positive association existed between environmental performance and firm financial performance. They concluded that those European based companies that had superior green efforts did not have any financial rewards to show for their efforts. Yang, Hong and Modi (2011) studied the impact of lean manufacturing and environmental management on business performance. Within this study, Environmental Management Practices were measured against market and financial performance and Yang *et al*., (2011) discovered that a negative relationship existed between the two variables. Salama (2005) used regression analysis to measure the impact of environmental performance on financial performance. The findings showed that a positive relationship existed between environmental performance and firm financial performance.

Klassen and McLaughlin (1996) proposed a theoretical model aimed at establishing a linkage between strong environmental management and improved future financial performance. Using empirical methods, Klassen and McLaughlin (1996) discovered that significant positive financial returns were measured for strong environmental management while significant negative financial returns were measured for weak environmental management. Horváthová (2010) argued that the inconclusiveness of results regarding the impact of environmental performance on financial performance was due to underlying factors. The results of her study showed that the probability of

obtaining a negative association between Environmental Management Practices and financial performance drastically increases when using correlation coefficients while the use of panel data techniques and multiple regressions had a neutral effect on the outcomes.

King and Lenox (2001) investigated whether a causal relationship existed between firm's Environmental Management Practices and firm financial performance. The main thrust of their study was to test whether other underlying firm attributes had a direct effect on this relationship. Applying empirical methods, King and Lenox (2001) discovered that a link existed between a measure of Environmental Management Practices and firm financial performance, but failed to illustrate the direction of this linkage. Wingard and Vorster (2001) carried out an in-depth examination on the financial performance of environmentally responsible South African listed companies. Using correlation analysis, they argued that a positive relationship existed between the environmental responsibility and financial performance of South African listed companies. On the other hand, in their study, Oberholzer and Prinsloo (2011) used GHG emission, water usage and energy usage as environmental variables and found that gold-mining firms did not realise economic gain from efficient use of their environmental variables.

2.7 Summary

A critical analysis of the related literature as well as the theoretical framework reinforces the objectives of this research, raising the pertinent questions that are hopefully answered by this study and build a case for further studies of this kind in South Africa. Different aspects of the existing literature had been examined. As evidenced by the literature, no such studies regarding Environmental Management Practices and firm financial performance, as represented by Return On Equity (ROE), have indeed been carried out within the South African context, hence a motivation for the research.

CHAPTER 3
METHODOLOGY

Introduction

The purpose of this study is to examine the impact of Environmental Management Practices on firm financial performance in selected South African mining companies. In fulfilling this purpose, it is necessary to use an appropriate research method that will address the research questions raised.

This section outlines the overall research methodology used in this study. It describes the research method and design appropriateness, the population and sample, data collection and instruments, the data analysis and the operational definition of the variables used in this research. This is necessary to enable the reader to be able to replicate the results if need arises.

3.1 Research Method and Design Appropriateness

As stated in Chapter 1, there is insufficient evidence to show whether Environmental Management Practices impacts firm financial performance in mining companies within the South African context. In addressing the needed of stakeholders and to legitimise company operations, firms have begun engaging in voluntary Environmental Management Practices. Hence a need arises to investigate what motivates this need apart from the issues raised in the theoretical framework. As shown in the literature, studies have focused on quantitative aspects, trying to test the impact of Environmental Management Practices on firm financial performance (Hart & Ahuja, 1996; Busch & Hoffmann, 2011; and Iwata & Okada, 2011). Other studies have used case studies of company annual reports to examine this relationship (Lo´pez-Gamero, Molina-Azorı´n & Claver-Corte´s, 2009).

This lead to the researcher to adopt a mixed method approach to answer the research questions raised and addresses the problem of this study. Mixed methods research is defined as “a methodology for collecting, analysing and integrating quantitative and qualitative data in one study or longitudinal program of inquest (Buslera, 2013:6). It is very useful as it provides a better understanding of the research problem as whole rather than any individual approach (Buslera, 2013). A

combination of quantitative and qualitative methods should be appropriate to answer the questions that were raised in this research.

3.2 Quantitative methodology

3.2.1 Regression analysis

This study used multiple ordinary least squares regression to analyse data empirically. This is appropriate as it tested a relationship using statistics to determine whether there was a link or not. Due to the nature of the data in hand, two methods of regression were used; panel data analysis and pooled regression. This enabled the researcher to be able analyse the data using two statistical approaches enhancing the validity of the results and achieving the aim and objectives of the study. Using two different software packages, regression analysis was performed using the data obtained from the firms' annual integrated reports, sustainability reports and financial statements.

The regression equation used is $y=a+b_1x_1+b_2x_2+b_3x_3$

Where:

y= Return On Equity; x_1= energy usage; x_2= Carbon emission reduction; x_3=; water usage; a= intercept and b= slope

3.2.2 Research variables

3.2.2.1 Dependent variable

In the study, Return On Equity (ROE) was used as a dependent variable. It was a measure of the firms' financial performance. ROE was used because it highlights the concern shareholders have for their equity and their ability to influence a firms' Environmental Management Practices. Hence it was necessary to use ROE as our dependent variable to motivate equity holders and other stakeholders towards supporting Environmental Management Practices in the mining firms and to demonstrate the accrued benefits this support may have on their equity in the long run. Additionally, it was deemed necessary to use ROE as no major study had attempted to use ROE as a variable in examining any impact between firm financial performance and Environmental Management Practices in the South African mining sector.

3.2.3 Independent Variables

3.2.3.1 Energy usage

Energy usage has become an important measure of environmental performance or in our case Environmental Management Practices. This is because energy usage has a major impact on the environment. Pieces of legislation do not regulate how energy is used by firms, leaving the onus on the firms themselves to apply self-regulation. Thus the JSE SRI recognises those firms that are leading in voluntarily managing their energy usage amongst others. This led to the researcher testing whether there was any impact of energy usage on a firm's financial performance as represented by ROE.

3.2.3.2 Carbon emissions

Carbon emissions, or greenhouse gases, have been linked to global warming, which is the steady rise in the global atmospheric temperature due to over emission of carbon that had led to more trapping of sunlight in the atmosphere (greenhouse effect). Pronouncements, legislation and environmental self-regulation are all used by firms to disclose and manage these emissions. This has also been highlighted as a key environmental management practice and hence the researcher felt in necessary to examine any impact that carbon emissions have on a firm's financial performance.

3.2.3.3 Water Usage

Water is particularly a very important resource. Water usage or abstraction is an important measure used to examine Environmental Management Practices. In South Africa, a semi-arid country, great emphasis is placed on conserving water. Hence as a measure of Environmental Management Practices, water usage is tested for any link to a firms' ROE, representing firm financial performance.

3.3 Qualitative Methodology

Case study research is one in which a researcher explores in depth an event, actions, individuals or a program (Stake; 1995; Yin, 2012; and Creswell, 2013). A content analysis of the integrated and sustainability reports for 2007-2011 was necessary to address the qualitative aspect of the study. Quantitative approaches alone were not enough as close scrutiny of these documents enabled the researcher

to have a closer view on the relationship between Environmental Management Practices and firm financial performance. A review of management statements with regards to Environmental Management Practices and any link to firm financial performance is carried out and the findings are then tabulated. Focus is placed on disclosures of the mining firms' Environmental Management Practices and how they are gathered in line with local and international frameworks, guidelines, laws, policies and standards.

This content analysis gave more insight into what the JSE SRI ranked mining firms are doing in terms of their environmental responsibility and lead the researcher into finding out whether there was any possible link between the firms' Environmental Management Practices and their firm financial performance.

3.4 Research Questions

What is the impact of Environmental Management Practices on firms' financial performance?

- What is the impact of carbon emissions on firms' financial performance?
- How does energy usage affect firms' financial performance?
- What effect does water usage have on firms' financial performance?

3.5 Population

As stated in the introduction section, the population for this study is the complete firms that are listed on the Johannesburg Securities Exchange's (JSE) Socially Responsible Investment (SRI) index for 2011. Twenty-two (22) firms are listed on the JSE SRI for 2011. This was chosen as the population because of the simplicity of finding consistent and comparable information from an impeccable source (JSE). Furthermore, the contemporary nature of the research area calls for firms that are engaged in practical environmental management. The companies listed on the JSE SRI 2011 best performing group have taken the lead in Environmental Management Practices and have a considerable wealth of environmental data that is essential in answering the research questions posed in the study.

3.6 Sample

As stated in the introduction chapter, the sample is chosen from the mining firms under the JSE (SRI) index. Nine mining firms are represented on the SRI for 2011. The researcher has elected to use all the firms on SRI due to their high ranking and reputation with regard to matters of sustainability and environmental management. This gave the researcher access to important data on Environmental Management Practices that are prevalent in these firms. Pseudonyms were used in place of the real names for commercial confidence reasons as mentioned in the ethical considerations. The nine mining firms that listed on the SRI group of the JSE are, namely:

- AAC
- AGA
- AM
- EXX
- GF
- IMP
- KUM
- LON
- MER

3.7 Ethical Considerations

3.7.1 Informed Consent and Confidentiality

The data used in the study was obtained from information that is available through public domain. The firms used in the study are publicly listed, allowing access to their financial and other reporting data. For confidentiality purposes, pseudonyms were used instead of the full company names.

3.7.2 General Ethical Considerations

The study was carried out in line with the university policies and procedures regarding research. The overall results of the study have been obtained without deviating from accepted ethical standards. No incorrect or misleading data was used and the information was used without any alterations.

3.8 Data Collection

Secondary Data were used in the study. This comprised of previous literature collected from the library, internet, magazines and other archives. Financial data from annual reports were collected from the companies' websites and from the JSE. Data on the firms' Environmental Management Practices were collected from the various annual integrated and sustainability reports as well as the firms' websites. These documents have been included in the appendix of the dissertation.

3.8.1 Types of data

3.8.1.1 Financial data

This was comprised of Return On Equity. In some cases, ROE was not available in the annual statements and had to be calculated using the generally accepted formula for ROE which is:

Net income/shareholders equity* 100.

This is expressed as a percentage

3.8.1.2 Environmental Management Practices

3.8.1.3 Energy usage

This was measured in either Giga-joules (Gj) or Mega-watt hours (Mwh) based on what the firms recorded and what in generally accepted across industry. The difference in measures did not have any effect on the regression.

3.8.1.4 Carbon emissions

This was measured in metric tonnes of CO_2 equivalent (Mt CO_2e) and is the widely accepted measurement for carbon emissions

3.8.1.5 Water usage

This was measured in million cubic metres (Mm^3) and kilolitres (Kl). These are also generally used industry wide and differences in them have no effect on the regression to be performed.

3.9 Instrumentation

The instruments used in the study were a basic MS excel spread sheet and the firms' annual reports, integrated reports and sustainability reports. This Spreadsheet

is attached to the appendix of the dissertation. This was created with six columns representing the company name, year, dependent variable (ROE), and independent variables EU, CE and WU.

These instruments were appropriate to the study given that the researcher aimed to directly focus on the problem at hand that is to examine any impact between Environmental Management Practices and firm financial performance. Hence it only captured or contained the data necessary to be used in the study.

3.10 Validity

To ensure the validity of the research instrument used in the study, a pilot study using one of the firms in the study was conducted. The pilot study followed a series of steps as follows:

- Data were collected from the sustainability reports and annual financial statements of the firm and recorded on the Spreadsheet;
- A Multicollinearity test was performed to eliminate possible Multicollinearity;
- A regression was carried out using MS Excel's data analysis function; and
- The results were presented as shown in the appendix to the dissertation

This pilot study gave the researcher an insight into how the research approach and design appropriateness would fit into the overall study being conducted.

3.11 Data analysis

This study paper uses both quantitative and qualitative methods to analyse data. It uses panel data analysis and Pooled regression analysis test if any link exists between the research variables. It also makes use of a content analysis of the mining firms' integrated reports and sustainability reports for 2007-2011 in order to examine any impact of Environmental Management Practices on firms' financial performances based on the firms' management disclosures.

3.11.1 Panel data analysis

Panel data analysis, also referred to as panel least squares is a useful method for cross-section time series data (Frees, 2004; and Hsiao, 2007). Having been used by

labour economics, panel data analysis is now used on a broader scale (Frees, 2004). Panel data have been studied by other researchers such as Baltagi, (2001), Nervlove (2002) and Arellano (2003).

Baltagi (2001) explained panel data through econometric analysis. He mentioned that panel data was advantageous in that it gave more informative data, had a greater variability, there was less collinearity between the research variables and provided more efficiency and degrees of freedom. Nervlove (2002) argues that the development of computer technology has enabled panel data to be used in a more comprehensive manner with the potential to analyse more econometric relationships. Arellano (2003) mentions that panel data uses both time series and cross-sectional data sets that is repetitive for a given number of observations.

The nature of the variables used in the study is that of time series, cross-sectional data sets. Hence the study employed panel data analysis as one of the means of testing if Environmental Management Practices had any impact on firm financial performance.

Table 2 in the appendix shows a set of time series data sourced from the mining firms' annual reports as recorded on the Excel Spreadsheet. These data are taken directly from the company reports. The data range for the time period 2007 to 2011.

The first column represents the firms under the study. There were nine firms chosen as stated in the proposal. The next column represents the time periods under study for the firms, being 2007-2011. The ROE column represents Return On Equity, used as a measure of the firms' financial performance. The EU column represents the energy used by the firms; the CE represents the carbon emissions of the firms and the WU represents the water usage of the firms. The ROE represents the dependent variable while the EU, CE and WU represent the independent variables.

The panel data analysis has been performed using Eviews 7 software. The raw data as captured from Excel were imported into the software and produced table 3 as shown in the appendix.

3.11.2 Statistical tests

This study used the following statistical tests to examine the research variables:

- Adjusted R^2
- Durbin Watson statistic
- Multicollinearity
- P-values

3.11.3 Adjusted R^2 test

This was the main test under panel least squares to test the significance of any relationship between the dependent variable (ROE) and the independent variables (CE,EU and WU). Significance levels were set at 95% degree of confidence with a coefficient C. Adjusted R^2 is a useful statistic that is adjusted for the number of variables in a regression equation (DSS, 2013; and UTEXAS, 2013). This is a useful way of generalising the results to the population as it takes into account the expected shrinkage of the conventional R^2 which cannot be used to generalise across the population (UTEXAS, 2013). Any Adjusted R^2 statistic that is lower than the significance level of 95% represents a significant relationship between the variables.

3.11.4 Durbin Watson Statistic

This test was performed to test if auto-correlation was present within the panel data. This is necessary to enhance the reliability of the regression results as the number of observations may give rise to the effect auto-correlation, which may affect the authenticity of the panel least squares regression. The Durbin Watson statistic is between 0 and 4; with a statistic towards 0 representing positive auto-correlation while a statistic leaning towards 4 represent negative auto-correlation (Investopedia, 2013).

3.11.5 P-values

The p-values represent the statistical tests used to check for any impact of the independent variables on the dependent variable. When the p-value is less than 0.05, it is significant at 95% confidence; when it is at less than 0.01, it is significant at 99% confidence levels (DSS, 2013). This p-value together with the coefficients are used to interpret the pooled regression analysis.

3.11.6 Multicollinearity

To enhance the validity of the regression, a Multicollinearity test using Eviews was performed. According to Analysights (2010), perfect correlation results in a figure of 1.00 while no correlation results in 0.00. Therefore, results closer to 1.00 means multicollinearity is present while the opposite result means multicollinearity is not present (Analysights, 2010).

3.11.6 Pooled regression analysis

The second quantitative method used to analyse data was the pooled regression analysis. This was performed using Stata software. Pooled regression is used when there is a time series of cross sections but the observations in each cross section do not refer to the same unit of measure (Podestà, 2002; and Joseph, 2010). Pooled regression has been used by researchers such as Rapach and Wohar (2004), Groen (2005), Westerlund and Basher (2007), and Mark and Sul (2012).

In their study, Mark and Sul (2012) observed that pooled regression provided better accuracy of estimations than conventional time-series regressions. This was after taking into account fixed effects. Podestà (2002) argues that pooled regression is useful as it allows for a high variability of data that may otherwise be limited due to the small number of observations that a researcher may encounter. Hence, given the scarcity of the number of recorded observations in this study, this method in highly appropriate to be used to test for any impact between Environmental Management Practices and firm financial performance in the South African mining firms.

The following test was used to assess the research variables:

- Robust regression: the equation used was reg roe eu ce wu, robust, where ROE represented the dependent variable Return On Equity; EU represented energy usage; CE represented carbon emissions; WU represented water usage and robust which controlled for the fixed effects of autocorrelation, muticollinearty and heteroskedasticity. This model has not been used to test for any impact of Environmental Management Practices on firm financial

performance in the South African mining industry hence is set to add to the existing body of knowledge on this research area.

3.12 Summary

This chapter looked at the methodology used in this study. The purpose of this study is to examine the impact of Environmental Management Practices on firm financial performance in selected South African mining companies. Thus a mixture of quantitative and qualitative methods was used to analyse the data and help answer the research questions.

The population for this study is the entire companies that are listed on the Johannesburg Securities Exchange's (JSE) Socially Responsible Investment (SRI) index for 2011. The sample used where all the firms on SRI due to their high ranking and reputation with regard to matters of sustainability and environmental management.

Confidentiality and consent forms where sent out to the participating companies to ask for their consent to use their information even though it was available in the public domain. It was also decided to use acronyms instead of the company names to protect the identity of the firms for commercial confidence reasons. Instrumentation used in this study was a basic excel spread sheet and the firms' annual reports, integrated reports and sustainability reports. Data were collected from the former and latter reports and then recorded on the spreadsheet or used directly in analysing the data.

Validity of the research instruments was ensured by the pilot study that was carried out by the researcher before the main study actually commenced. Reliability tests were also carried out within the regression to ensure the reliability of the instruments and the study as a whole.

Lastly, the chapter set out to explain the data analysis used in the paper and showed all the statistical and non-statistical methods used to analyse the data. The next chapter is the results and analysis section and now shows the findings based on the research approach and design appropriateness.

CHAPTER 4
ANALYSIS AND FINDINGS

Introduction

In this chapter, the analysis and findings based on the research problem and questions as set out in chapter one are presented. The statistical approaches and non-statistical approaches used to measure the data are all explained in this chapter. As the stated in the introduction chapter, there is insufficient evidence of previous studies examining the impact of Environmental Management Practices on firm financial performance in selected South African mining firms. As such, the study aims to measure this relationship and hopefully contribute to the little knowledge that exists on this subject.

The results are based on the two methods of regression used as explained in the methodology chapter. These are based on the sample that is used. The sample used in the study was the mining firms that were listed on the JSE SRI 2011. There were 9 firms in total used in the study. For commercial confidence reasons, pseudonyms were used in place of real names. The results are reported firstly based on the panel data analysis, thereafter the pooled regression.

4.1 Panel Data Analysis

The raw data were obtained from the annual reports, sustainability reports and integrated reports and entered into the spread sheet depicted as Table 4 in the appendix. The data were then imported into the Eviews 7 software for data analysis. Eviews is powerful software that can be used to perform statistical analysis and importantly for this study, panel data analysis which is relevant to this study given the nature of the data. The data, once imported into Eviews, are similar to the Excel Spreadsheet and is represented as depicted in Table 5 in the appendix.

The descriptive statistics of the data are set out in the table below and also represented graphically:

	ROE	CE	EU	WU
Mean	24.68889	5.395111	26.24444	38.03867
Median	15.20000	3.800000	16.10000	29.60000
Maximum	118.4000	25.40000	196.7000	116.0000

Minimum	-45.90000	0.910000	0.000000	3.330000
Std. Dev.	33.81822	5.706024	37.48023	34.07001
Skewness	1.293449	2.251570	2.885012	1.019857
Kurtosis	4.764866	6.953510	11.64820	3.050202
Jarque-Bera	18.38773	67.32846	202.6584	7.805544
Probability	0.000102	0.000000	0.000000	0.020186
Sum	1111.000	242.7800	1181.000	1711.740
Sum Sq. Dev.	50321.56	1432.583	61809.78	51073.67
Observations	45	45	45	45

Table 6: Descriptive statistics of the panel data

The mean of the dependent variable ROE was 24.68889, while those for the independent variables CE, EU and WU was 5.395111, 26.24444 and 38.03867 respectively.

The panel data analysis captures data as a panel for the nine firms used and the number of years being five (2007-2011), the number of observations thus becomes 45. The graph of the variables is as follows:

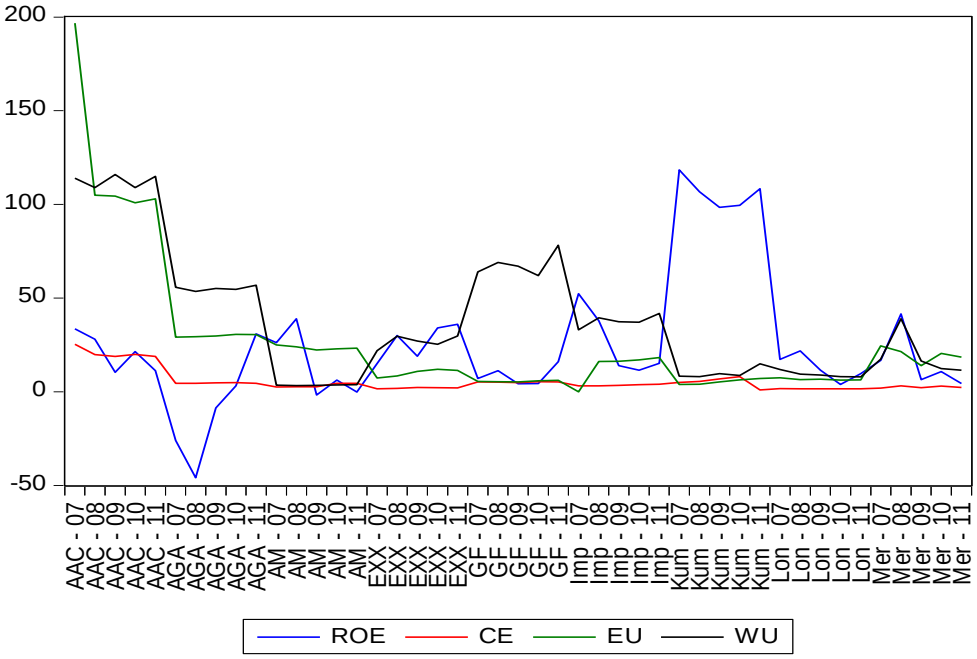

Figure 3: Graph of research variables

Going into the actual statistical analysis, the following equation is run in the program based on the multiple regression equation:

$$Y=A+BX_1BX_2BX_3$$

ROE CE EU WU C,

Where ROE is the dependent variable [Y]; CE [bx_1], EU [bx_2] and WU [bx_3] are the independent variables and c[a] is a coefficient

The equation gives us the following results:

Dependent Variable: ROE
Method: Panel Least Squares
Date: 10/23/13 Time: 12:19
Sample: 2007 2011
Periods included: 5
Cross-sections included: 9
Total panel (balanced) observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CE	9.946378	2.124500	4.681751	0.0000
EU	-0.931900	0.276362	-3.372031	0.0016
WU	-0.861132	0.206231	-4.175565	0.0002
C	28.24057	6.317727	4.470052	0.0001

R-squared	0.397878	Mean dependent var	24.68889
Adjusted R-squared	0.353820	S.D. dependent var	33.81822
S.E. of regression	27.18487	Akaike info criterion	9.527886
Sum squared resid	30299.71	Schwarz criterion	9.688478
Log likelihood	-210.3774	Hannan-Quinn criter.	9.587753
F-statistic	9.030843	Durbin-Watson stat	0.859632
Prob(F-statistic)	0.000103		

Table 7: Panel data analysis results

From the table below, the significant statistics to note is the adjusted R-squared. As the significant levels have been set to 95% confidence, the adjusted R-squared shows a 35.3620% level. This renders the regression as insignificant. A further analysis tested the variables for two important factors that could affect the regression; Multicollinearity and auto-correlation.

4.1.2 Multicollinearity test

To enhance the validity of the regression, a Multicollinearity test using Eviews was performed. According to Analysights (2010), perfect correlation results in a figure of 1.00 while no correlation results in 0.00. Therefore, results closer to 1.00 mean multicollinearity is present, while the opposite result means multicollinearity is not present (Analysights, 2010). The results are shown in the table below:

	ROE	CE	EU	WU
ROE	1.000000	0.026212	-0.124912	-0.259213
CE	0.026212	1.000000	0.918015	0.811335
EU	-0.124912	0.918015	1.000000	0.729335
WU	-0.259213	0.811335	0.729335	1.000000

Table 8: Correlation matrix of panel data

From the table above, as expected, each independent variable is perfectly correlated with itself with a result of 1.00. However, the correlations between the dependent and independent variables are listed below:

$\rho X_1 Y = 0.03$

$\rho X_2 Y = -0.12$

$\rho X_3 Y = -0.26$

The Greek letter ρ is used to represent correlation (Analysights, 2010). The variables represented are Y=ROE; X_1= CE; X_2= EU; X_3= WU.

Furthermore, the correlations between the three independent variables CE, EU and WU are:

$\rho X_1 X_2 = 0.91$

$\rho X_1 X_3 = 0.81$

$\rho X_2 X_3 = 0.72$

The above test shows a weak correlation between ROE and CE, a weak correlation between ROE and EU and a weak correlation between ROE and WU. Therefore, between the dependent variable ROE and the independent variables CE, EU and WU, the mulitcollinearity is not present. However, the co-linearity between the independent variables CE, EU and WU indicates a strong correlation as the results are inclined towards 1.00. In conclusion, based on the findings of the test, in can be concluded that multicollinearity is not present as the dependent and independent variables are weakly correlated.

4.1.3 Auto correlation test

To test for auto (serial) correlation, the Durbin Watson statistic is used. This is necessary as the time series data used in such analysis is subject to auto correlation (Investopedia, 2013). The software used generates the statistic upon running the

panel least squares regression. From the results in Table 4, the Durbin Watson statistic is 0.859632. A Durbin Watson test ranges from 0 to 4. Figures below two indicate signs of auto correlation while those above two indicate signs of independence. Therefore, based on the statistic, it can be said that there are signs of serial correlation amongst the variables.

4.2 Individual Tests

To answer the specific research questions, panel data analysis is performed between Return On Equity representing firm financial performance and carbon emissions, energy usage and water usage representing Environmental Management Practices.

4.2.1 The impact of carbon emissions on firm financial performance as represented by Return On Equity

The procedures used in the first test are performed. The data captured from the Excel Spreadsheet are shown in Table 9 in the appendix.

These data show the observations of Return On Equity and carbon emissions of the firms under study. The descriptive statistics of the data are shown below:

	ROE	**CE**
Mean	24.68889	5.395111
Median	15.20000	3.800000
Maximum	118.4000	25.40000
Minimum	-45.90000	0.910000
Std. Dev.	33.81822	5.706024
Skewness	1.293449	2.251570
Kurtosis	4.764866	6.953510
Jarque-Bera	18.38773	67.32846
Probability	0.000102	0.000000
Sum	1111.000	242.7800
Sum Sq. Dev.	50321.56	1432.583
Observations	45	45

Table 10: Descriptive statistics of ROE and CE

The graph of these research variables is shown below:

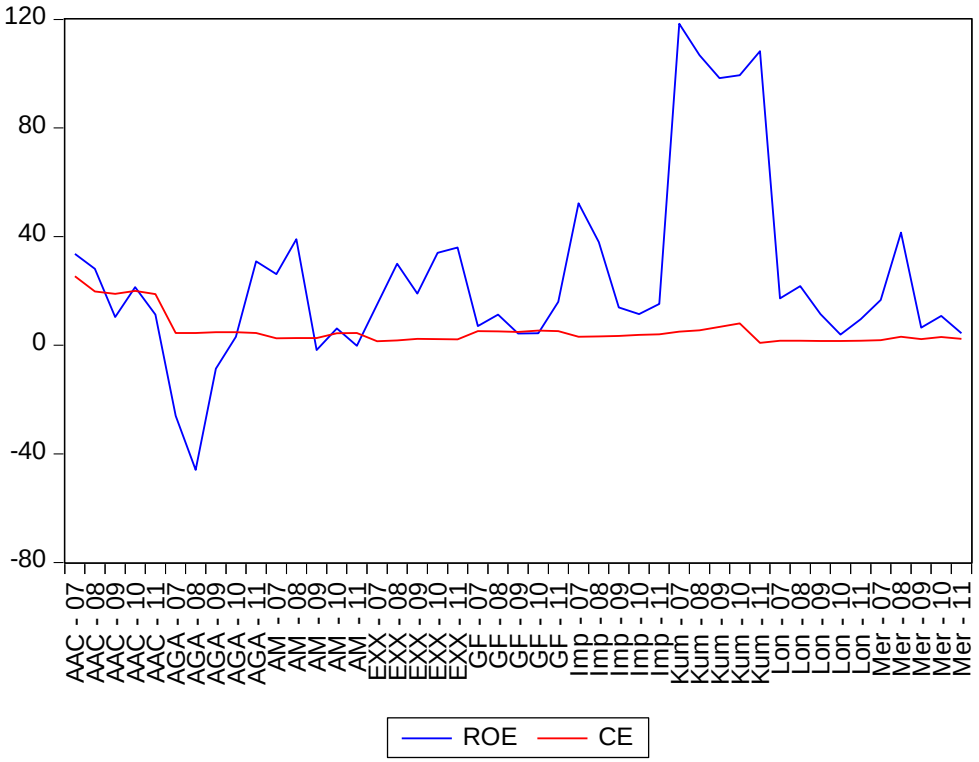

Figure 4: Graph of ROE and CE

The statistical analysis involves running the equations

$$Y=A+BX_1$$

ROE CE C

Where Y is the dependent variable ROE, CE is the independent variable BX_1 and c is the coefficient (A). This equation is based on the panel least squares method and produces the following results:

Dependent Variable: ROE
Method: Panel Least Squares
Date: 10/23/13 Time: 16:47
Sample: 2007 2011
Periods included: 5
Cross-sections included: 9
Total panel (balanced) observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CE	0.155351	0.903511	0.171941	0.8643
C	23.85076	7.053318	3.381494	0.0015

R-squared	0.000687	Mean dependent var	24.68889
Adjusted R-squared	-0.022553	S.D. dependent var	33.81822
S.E. of regression	34.19744	Akaike info criterion	9.945605
Sum squared resid	50286.99	Schwarz criterion	10.02590

Log likelihood	-221.7761	Hannan-Quinn criter.	9.975539
F-statistic	0.029564	Durbin-Watson stat	0.221491
Prob(F-statistic)	0.864291		

Table 11: Panel data analysis results for ROE and CE

From the table above, we can see an adjusted-R squared of -2.2553%. This shows that the regression is significant at the confidence levels are at 95%. A further analysis to test for Multicollinearity and auto correlation is then is performed.

4.2.2 Multicollinearity test.

As alluded to earlier on, Multicollinearity is performed to test whether there are any correlations between the research variables.

A correlation matrix between the variables is given in the table below:

	ROE	**CE**
ROE	1.000000	
CE	0.026212	1.000000

Table 12: Correlation matrix of ROE and CE

As seen from the table, the correlation between the dependent variable ROE and itself is a perfect 1.000. The same applies to the independent variable CE, which has a perfect correlation of 1.000. Using the Greek letter ρ, this is denoted as $\rho X_1 Y=0.026212$. This is closer to 0.000 hence Multicollinearity is not present in this test.

4.2.3 Auto Correlation test

As stated before, the Durbin Watson statistic is used to test for any auto correlation. In our regression results, the Durbin Watson statistic is 0.2214, hence is it below the median range of 2.00. This means that there is auto correlation present within the research variables.

4.3 The Impact of Energy Usage on Firm Financial Position as Represented by Return On Equity

Replications of the procedures carried out in the previous test are performed once again. The data used for the regression is depicted in table 13 in the appendix.

The data show the ROE and EU as captured into excel and exported to the Eviews software. These data represent the entire energy usage and Return On Equity of the firms under the study. Graphically, ROE and EU are shown as:

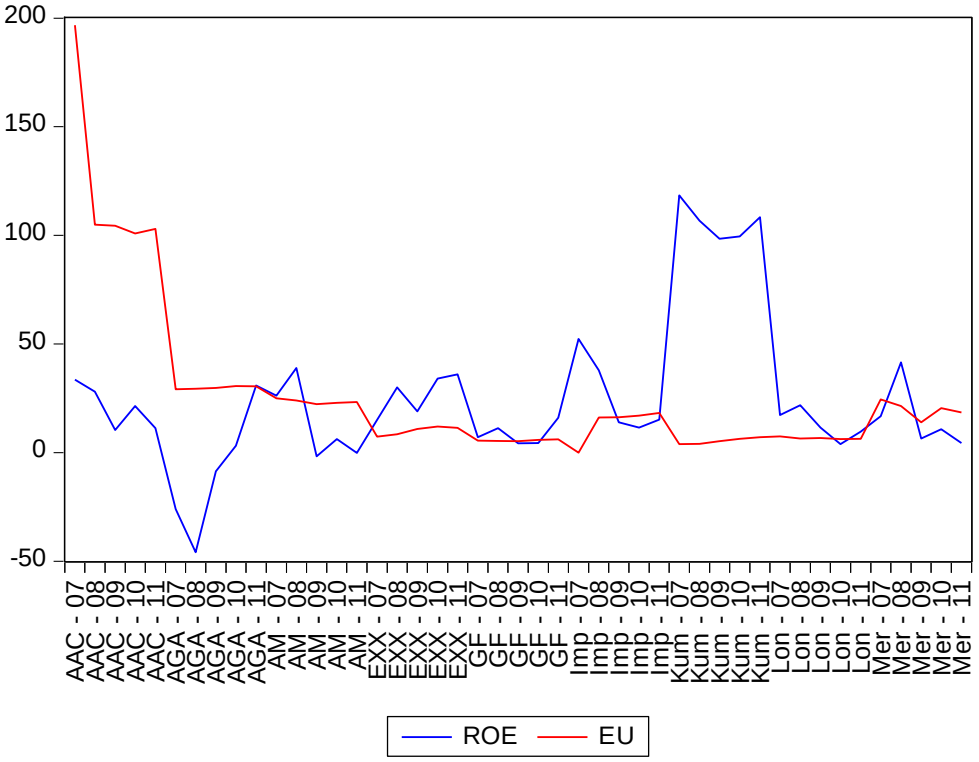

Figure 5: Graph of ROE and EU

The graph shows firm by firm how energy usage has moved in comparison to the firms' Return On Equity over the years of study. The descriptive statistics for the ROE and EU relationship are shown in the table below

	ROE	EU
Mean	24.68889	26.24444
Median	15.20000	16.10000
Maximum	118.4000	196.7000
Minimum	-45.90000	0.000000
Std. Dev.	33.81822	37.48023
Skewness	1.293449	2.885012
Kurtosis	4.764866	11.64820
Jarque-Bera	18.38773	202.6584

Probability	0.000102	0.000000
Sum	1111.000	1181.000
Sum Sq. Dev.	50321.56	61809.78
Observations	45	45

Table 14: Descriptive statistics of ROE and EU

The statistical analysis is based on the equations:

$Y=A+BX_2$

ROE EU C

Where Y is the dependent variable ROE, EU is the independent variable BX_2 and c is the coefficient (A). This equation is based on the panel least squares method and produces the following results:

Dependent Variable: ROE
Method: Panel Least Squares
Date: 10/30/13 Time: 15:50
Sample: 2007 2011
Periods included: 5
Cross-sections included: 9
Total panel (balanced) observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EU	-0.112708	0.136521	-0.825569	0.4136
C	27.64684	6.199798	4.459312	0.0001

R-squared	0.015603	Mean dependent var	24.68889
Adjusted R-squared	-0.007290	S.D. dependent var	33.81822
S.E. of regression	33.94126	Akaike info criterion	9.930566
Sum squared resid	49536.40	Schwarz criterion	10.01086
Log likelihood	-221.4377	Hannan-Quinn criter.	9.960500
F-statistic	0.681565	Durbin-Watson stat	0.230955
Prob(F-statistic)	0.413605		L

Table 15: Panel data analysis results of ROE and EU

As seen from the table above, with significant levels set at 95%, the adjusted R-squared is a low -0.07%. This is significant as it shows that a negative relationship exists between ROE and EU.

4.3.1 Multicollinearity test

A Multicollinearity test is performed to test for Multicollinearity between the variables ROE and EU. This is done through a correlation matrix shown in the table below.

	ROE	EU
ROE	1.000000	
EU	-0.124912	1.000000

Table 16: Correlation matrix of ROE and EU

The table above shows the correlations between the dependent variable Y (ROE) and the independent variable X_2(EU). Both are perfectly correlated with each other (1.000). However, the correlation between the dependent variable Y and the independent variable X_2 is shown as $\rho X_2 Y$= -0.124912. This result shows a correlation closer to 0.000 hence Multicollinearity is not present between the research variables.

4.3.2 Auto Correlation test

A Durbin Watson statistic is used to test for auto correlation. If the statistic reads 2.00 and below, auto correlation is present. If the statistic reads between 2.00 and 4.00, then auto correlation is not present in the regression. Based on the Durbin Watson statistic collected from the regression, it is 0.230955. This shows that there is auto correlation within the research variables.

4.4 The Impact of Water Usage on Firm Financial Performance as Represented by Return On Equity

The last of the panel data analysis is to measure any impact of WU on ROE. The same procedures carried out in the previous tests are performed here. The raw data used are shown in Table 17 in the appendix.

The data above show the variables ROE and WU as recorded from the annual company documents. They are first recorded into excel and then exported into the Eviews software. The variables ROE and WU are also shown graphically.

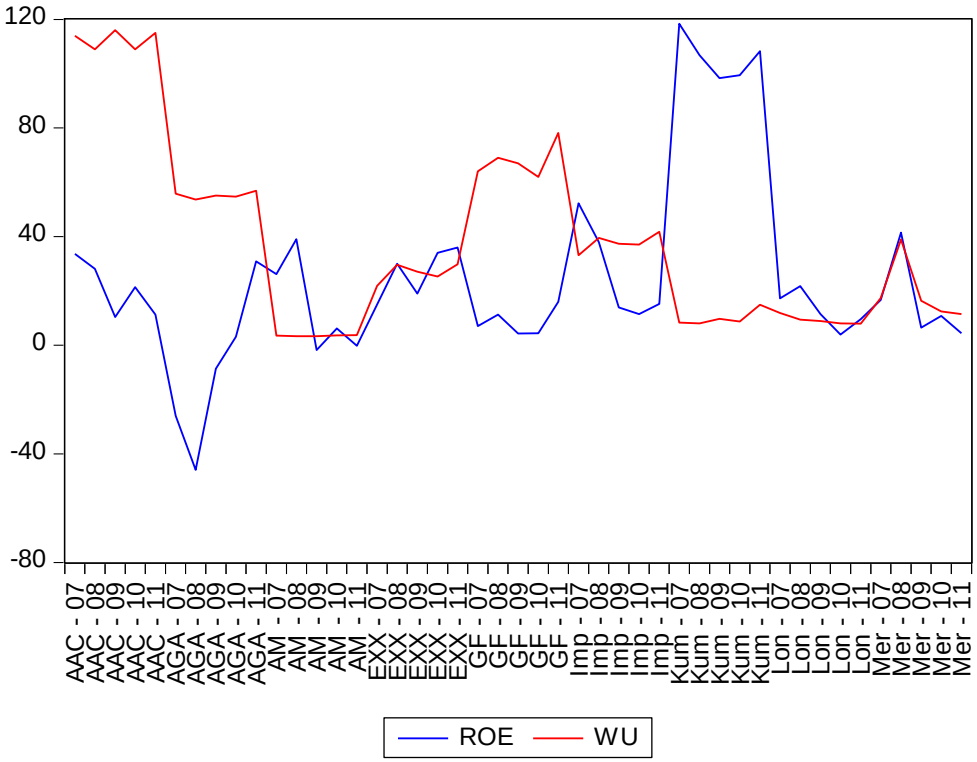

Figure 6: graph of ROE and WU

Also shown are some descriptive statistics or ROE and WU. Statistics such as the mean, median and standard deviation are shown in the table below. The number of observations is 45, based on the panel data.

	ROE	**WU**
Mean	24.68889	38.03867
Median	15.20000	29.60000
Maximum	118.4000	116.0000
Minimum	-45.90000	3.330000
Std. Dev.	33.81822	34.07001
Skewness	1.293449	1.019857
Kurtosis	4.764866	3.050202
Jarque-Bera	18.38773	7.805544
Probability	0.000102	0.020186
Sum	1111.000	1711.740
Sum Sq. Dev.	50321.56	51073.67
Observations	45	45

Table 18: Descriptive statistics of ROE and WU

The analysis is carried out next. Using the equation

$$Y=A+BX_3$$

ROE WU C

Where Y is the dependent variable ROE, WU is the independent variable BX_3 and c is the coefficient (A). The regression is carried out using the panel least squares method and produces the results as shown in Table 16 below.

Dependent Variable: ROE
Method: Panel Least Squares
Date: 10/31/13 Time: 15:20
Sample: 2007 2011
Periods included: 5
Cross-sections included: 9
Total panel (balanced) observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WU	-0.257298	0.146198	-1.759929	0.0855
C	34.47614	7.428671	4.640957	0.0000

R-squared	0.067191	Mean dependent var	24.68889
Adjusted R-squared	0.045498	S.D. dependent var	33.81822
S.E. of regression	33.03993	Akaike info criterion	9.876737
Sum squared resid	46940.38	Schwarz criterion	9.957033
Log likelihood	-220.2266	Hannan-Quinn criter.	9.906671
F-statistic	3.097349	Durbin-Watson stat	0.261912
Prob(F-statistic)	0.085532		

Table 19: Panel data analysis of ROE and WU

The regression was based on confidence levels of 95%. The results showed and adjusted R-squared of 4.5498%. This means that the result is significant and thus a positive link exists between ROE and WU.

4.4.1 Multicollinearity test

A Multicollinearity test is also performed to test for any Multicollinearity between the research variable. This is achieved through a correlation matrix as shown in the table below

	ROE	**WU**
ROE	1.000000	
WU	-0.259213	1.000000

Table 20: Correlation Matrix of ROE and WU

The dependent and independent variables are perfectly correlated with one another as expected at 1.000. The correlation between the independent variable X_3 and the

dependent variable Y is denoted as $\rho X_3 Y = -0.259213$. This shows a low level of correlation, therefore, Multicollinearity is not present between the research variables.

4.4.2 Auto correlation test

The Durbin Watson statistic is used to test for auto correlation. A statistic 2.00 or less indicates the presence of auto correlation, while a statistic of 2.00 to 4.00 indicates no auto correlation present. In the analysis of the link between ROE and WU, the Durbin Watson statistic is 0.261912. This therefore shows that auto correlation is present between the research variables.

4.5 Pooled Regression Analysis

Pooled regression analysis is also used to analyse the data. Pooled regression groups data into a pool and analyses them as a unit (ref). In his study, the software Stata was used to run the regression based on this data. The dataset entered into stata was shown in table 21 in the appendix.

The table above shows the company, year and variables, as well as time and firmsid used as identifiers in the pooled regression. A summary of the descriptive statistics is also shown as a table, highlighting statistics such as the mean and standard deviation.

Variable	Obs	Mean	Std. Dev.	Min	Max
roe	45	24.68889	33.81822	-45.9	118.4
eu	45	26.24444	37.48023	0	196.7
ce	45	5.395111	5.706024	.91	25.4
wu	45	38.03867	34.07001	3.33	116

Table 22: Descriptive statistics of data pool using Stata software

The nine firms used in the study are further analysed through the use of graph that are generated to further show any link between Environmental Management Practices represented by CE, EU and WU and firm financial performance represented by ROE.

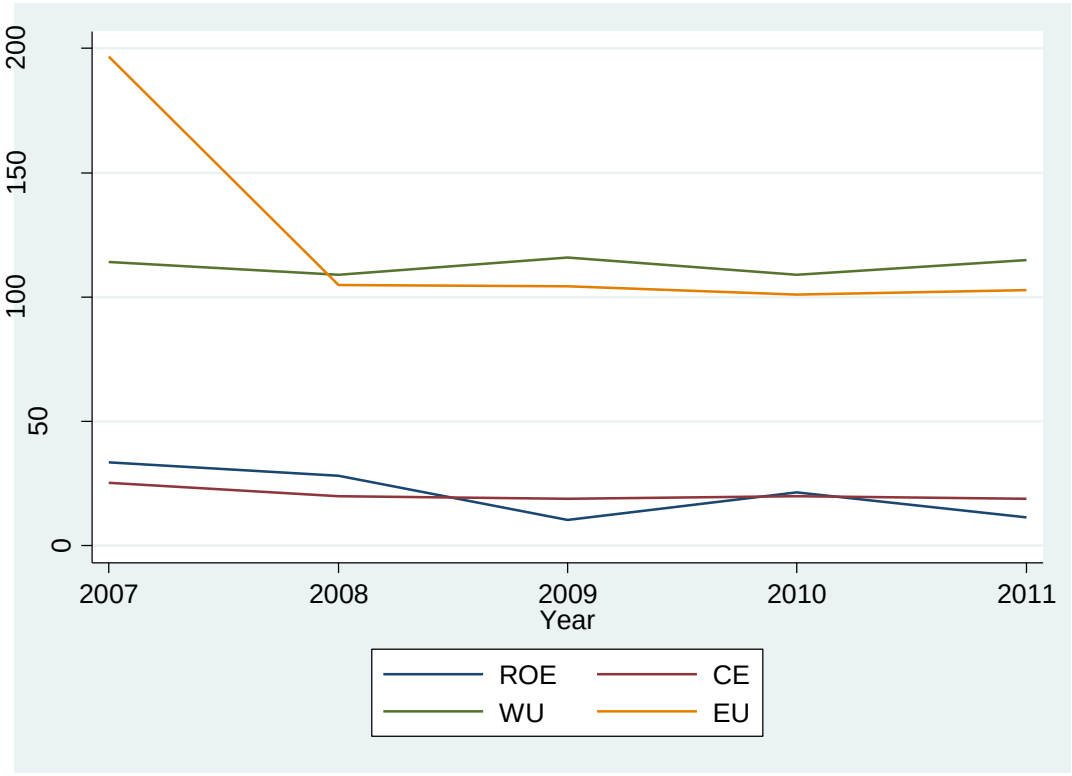

Figure 7: Graph showing the variables for AAC

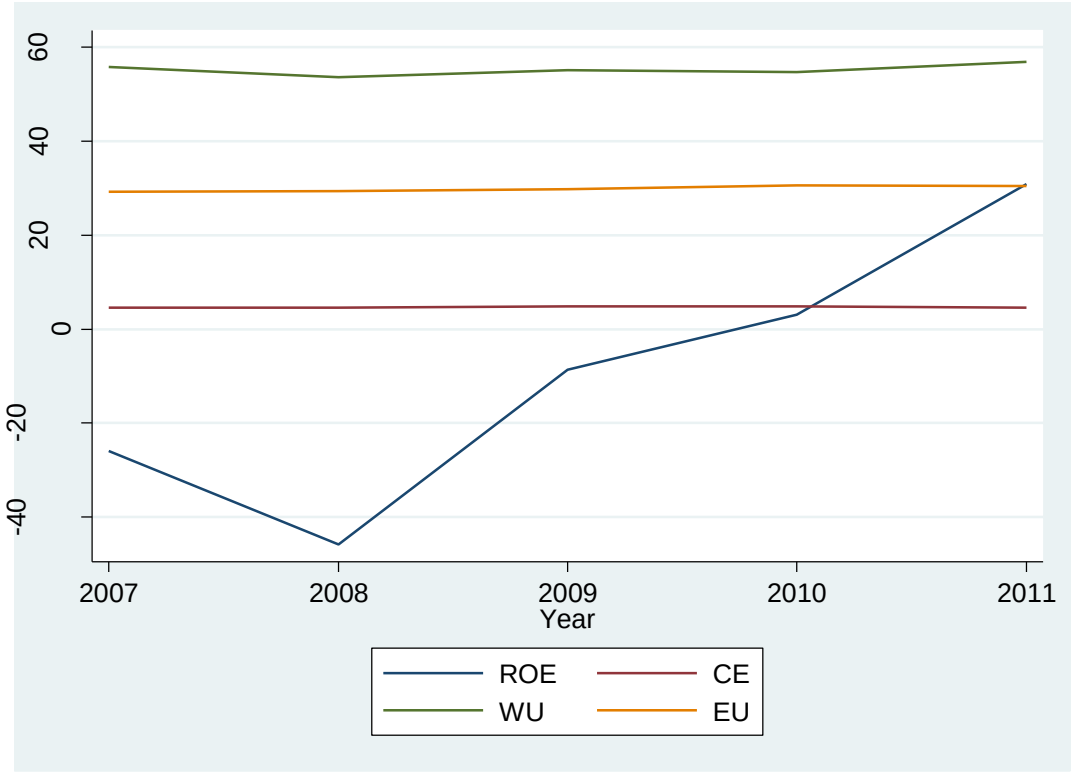

Figure 8: Graph showing the variables for AGA

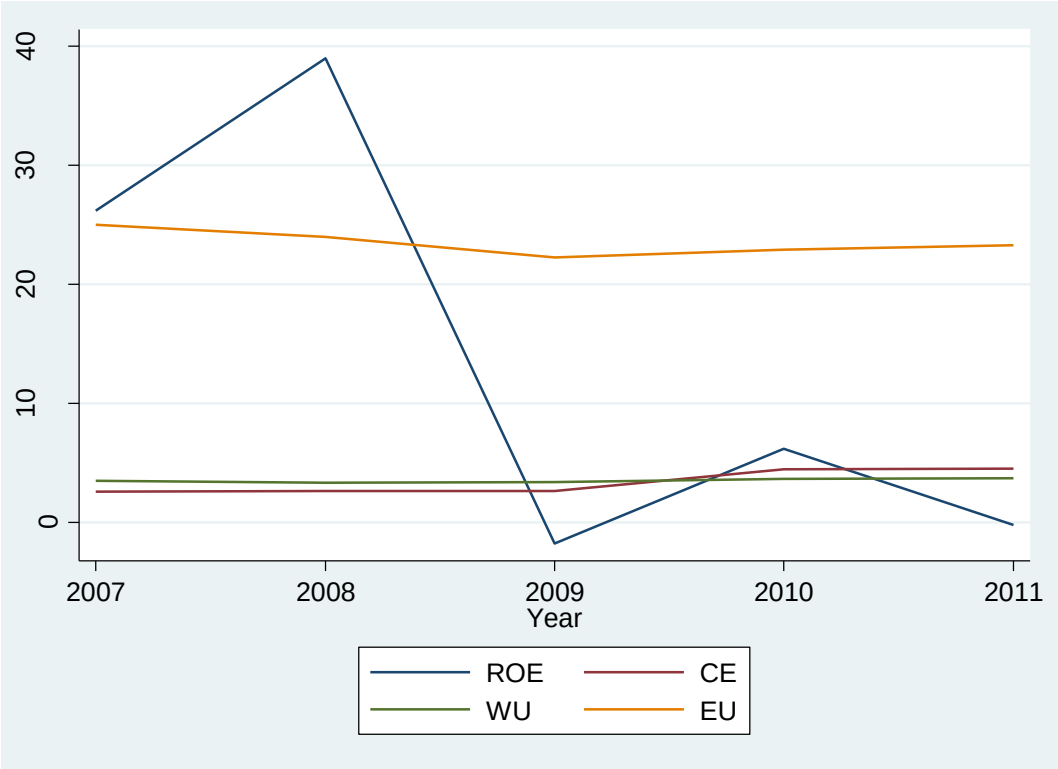

Figure 9: Graph showing the variables for AM

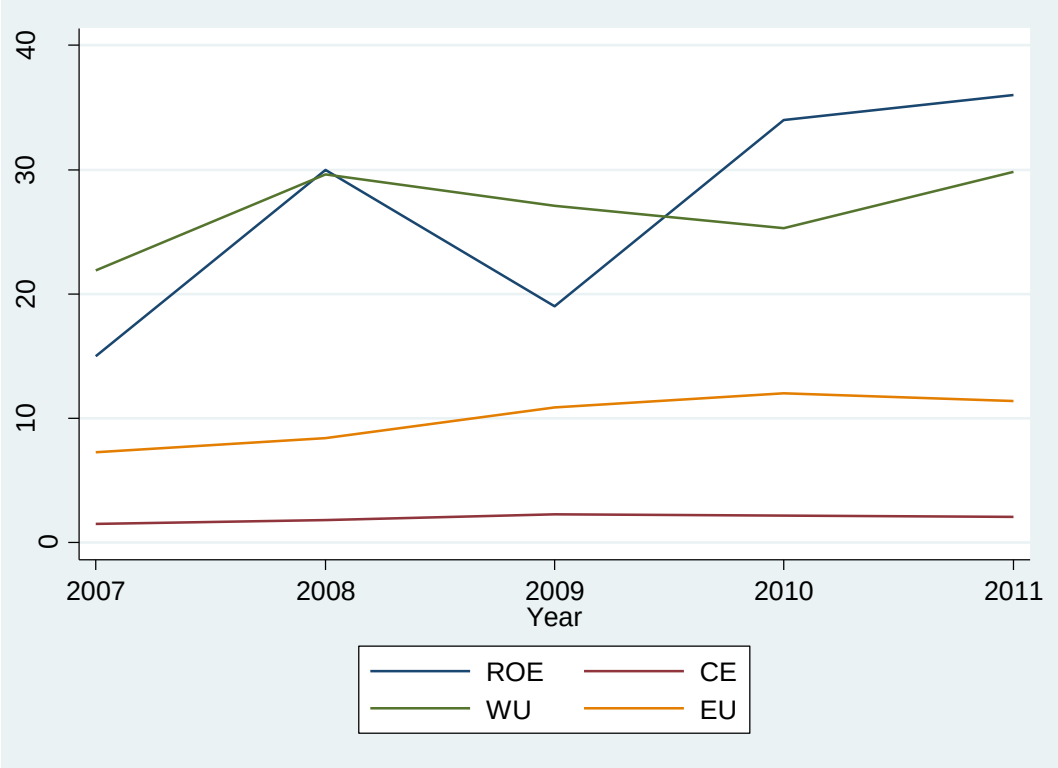

Figure 10: Graph showing variables of EXX

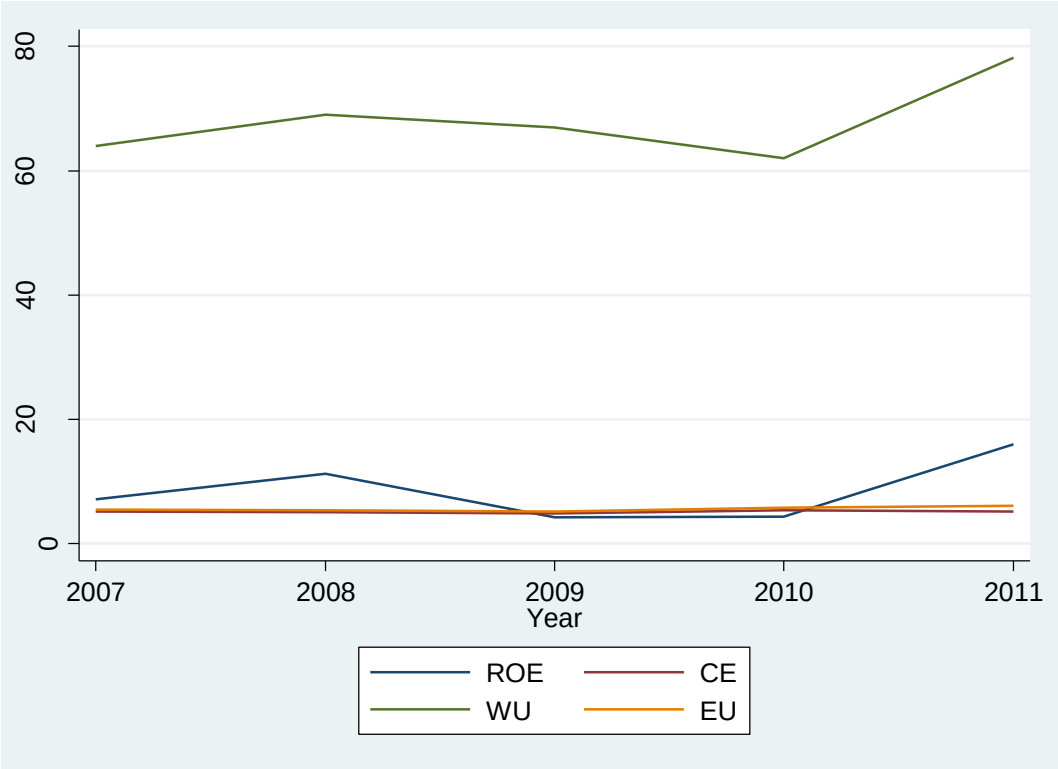

Figure 11: Graph showing variables of GF

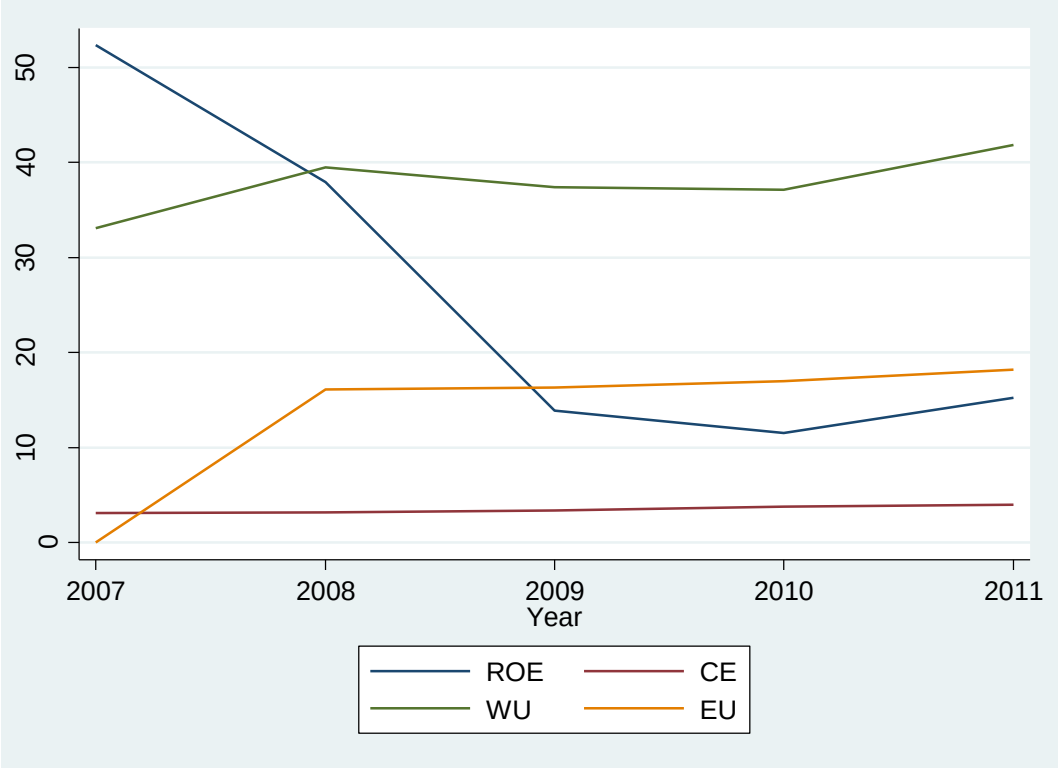

Figure 12: Graph showing variables of IMP

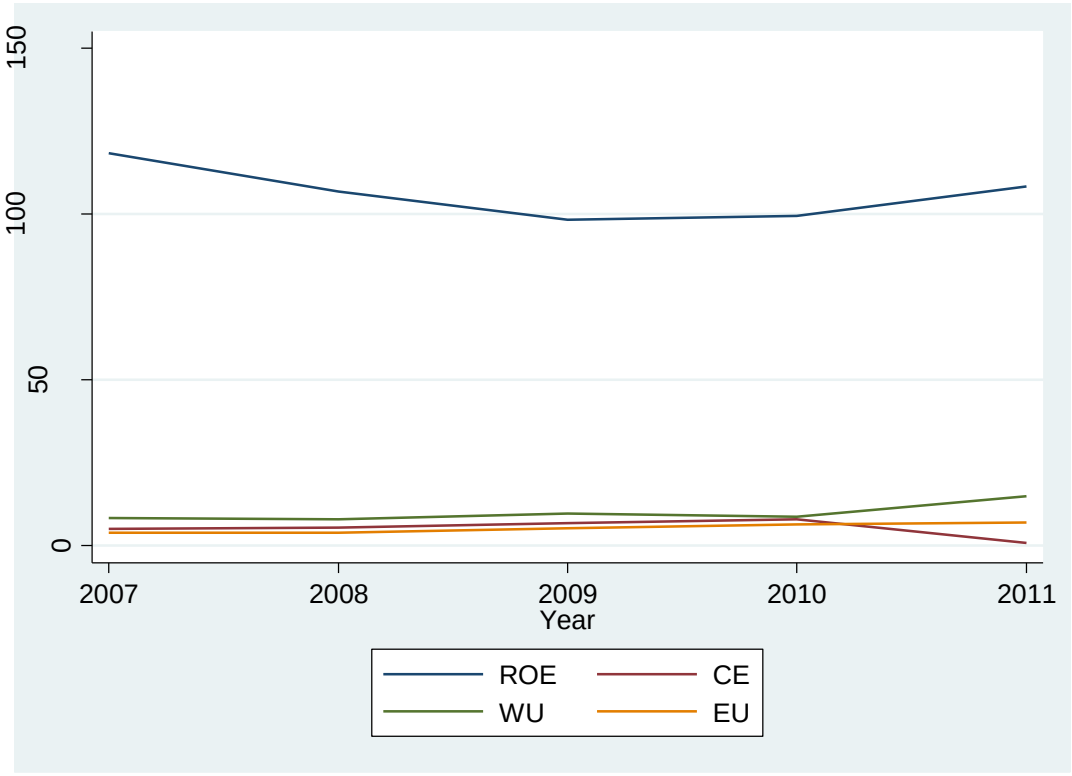

Figure 13: Graph showing variables of KUM

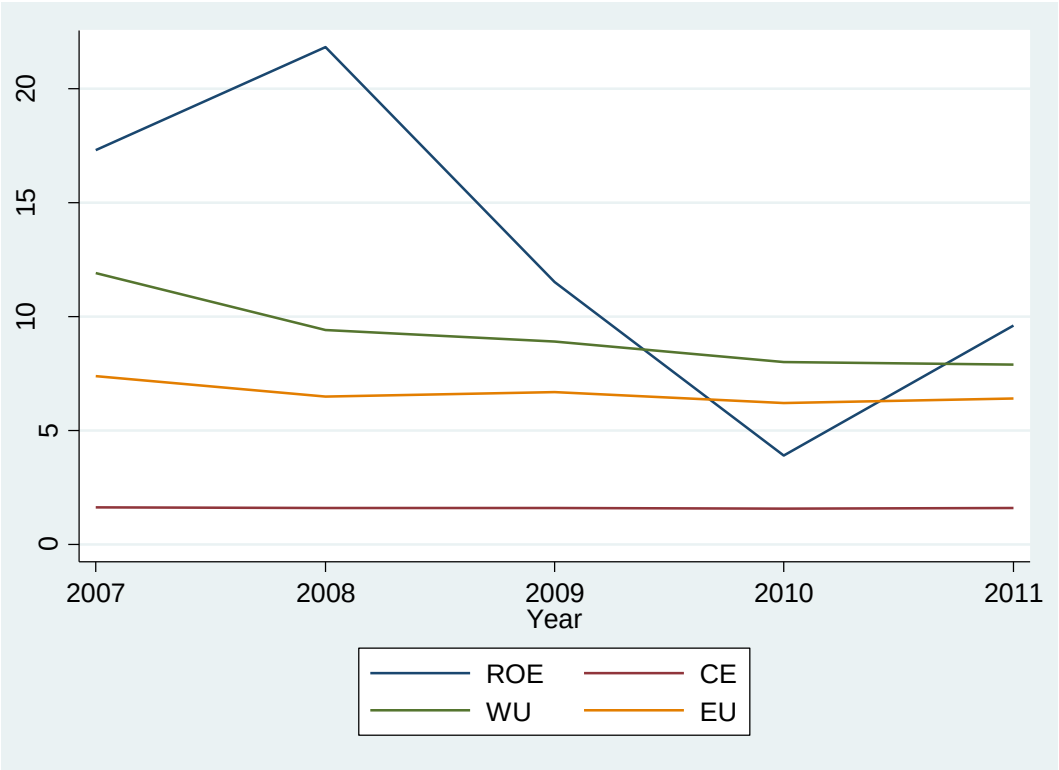

Figure 14: Graph showing variables of LON

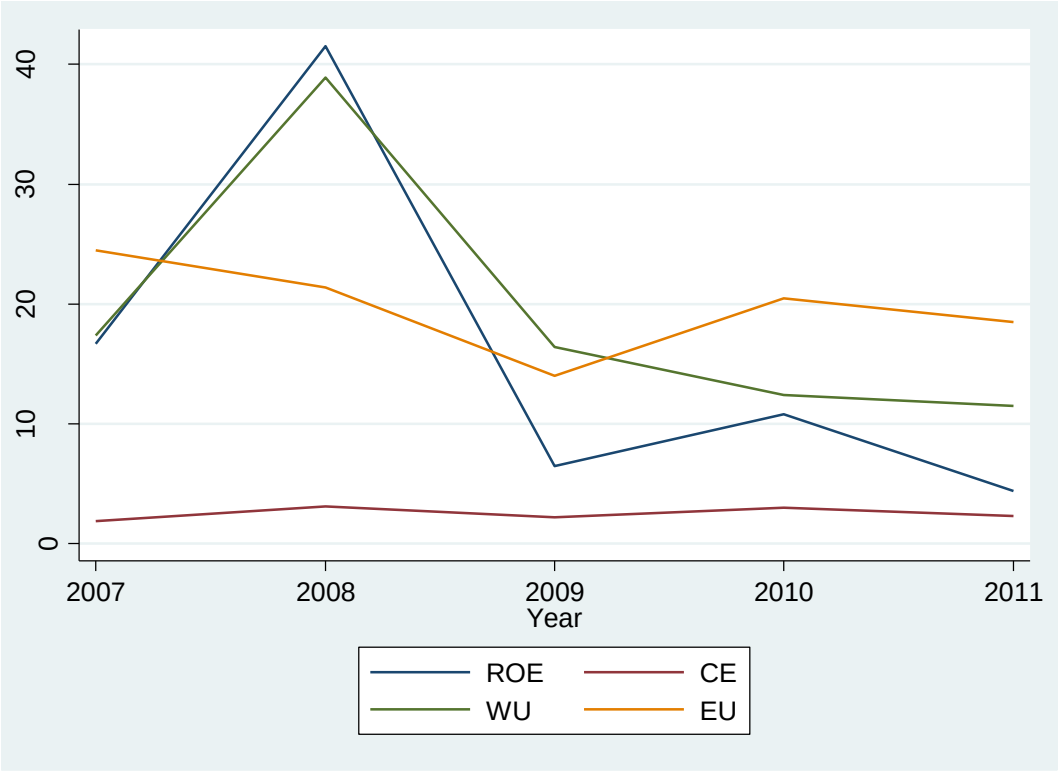

Figure15: Graph showing variables of MER

As seen from the individual company graphs above, ROE the dependent variable is plotted against the independent variables. The effects between the variables differ from one firm to the next with based on the reported data. This is shown by the different movements of the ROE line as the CE, EU and WU lines rise or fall. The general graph of all the pooled variables is present in the figure below.

The pooled graph shows how ROE is affected by CE, EU and WU. The pooled ROE begins at a very low level, gradually rising as the time period goes forward. This graph is similar to the panel data analysis graph as the data sets are cross-sectional and time series in nature.

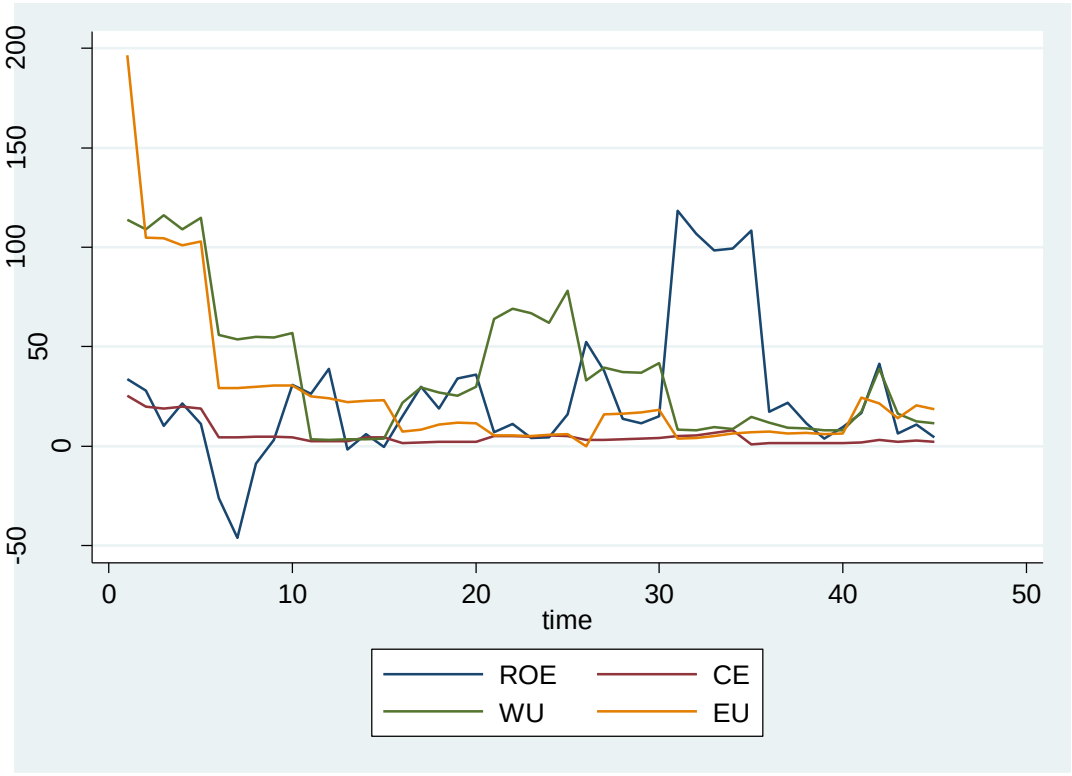

Figure 16: Graph of pooled variables representing all the firms in the study

We can now carry out statistical tests to determine if any relationship exists between Environmental Management Practices represented by CE, EU and WU and firm financial performance represented by ROE. Pooled regression is used to check for any link between the aforementioned variables. The data are gathered together into pools and then a regression is performed. Unlike the previous panel data analysis, the pooled regression takes into account p-values to test for statistical significance. Significance levels are pre-set to 5 and 10% respectively. The results of this regression are shown tin the table below. The regression equation used is:

reg roe eucewu, robust

Where:

roe is the dependent variable Y;

eu, ce and wu are the independent variables X_1, X_2, X_3; and robust allows for the pooled regression to control the data for any auto-correlation, Multicollinearity and heteroskedasticity.

Linear regression		Number of obs	=	45
		F(3, 41)	=	7.95
		Prob> F	=	0.0003
		R-squared	=	0.3979
		Root MSE	=	27.185

roeCoef.	Robust Std. Err.	t	P>t	[95% Conf.	Interval]
eu -.9318998	.2788216	-3.34	0.002	-1.494992	-.3688081
ce 9.946379	2.133331	4.66	0.000	5.638028	14.25473
wu -.8611318	.2045316	-4.21	0.000	-1.274192	-.4480717
_cons 28.24057	6.856807	4.12	0.000	14.39297	42.08817

Table 23: Pooled regression statistics for ROE, CE, EU and WU

The pooled statistics from the table show p values of 0.002 of ROE and EU, then 0.000 of ROE and CE. The p value of ROE and WU is also 0.000. Based on the significant levels of 1%, 5% and 10%, this shows that the variables are all significant and that there is a link between ROE and CE, EU and WU. This is consistent with the findings of researchers such as (Alexander & Bucholz, 1978; Waddock & Graves, 1997; Al-Tuwaiji *et al*., 2004; Barnett, 2005; Clarkson, Li, Richardson & Vasvari, 2006; Clarkson *et al*., 2008 and Artiach *et al*., 2010).

Further analysis interpreting the coefficients indicates that for every one unit increase in energy usage will result in a -0.93% decrease in the firms' Return On Equity. A one unit increase in carbon emissions will result in a 9.93% increase in the firms' Return On Equity. Lastly, a one unit increase will result in a -0.86% decrease in the firms' Return On Equity.

Therefore, based on the findings of the pooled regression taking into account all of the factors controlled for such as auto correlation, Multicollinearity and heteroskedast icity, we can conclude that Environmental Management Practices represented by carbon emissions, energy usage and water usage do indeed have an impact on firm financial performance as represented by Return On Equity. This is consistent with the findings of other researchers such as Cohen (1995) and Hart and Ahuja (1996).

A further inquest into this potential link between the firms' Environmental Management Practices and firms' financial performance is performed with a content analysis into the Environmental Management Practices of these firms.

4.6 Qualitative Data Analysis

4.6.1 Content analysis

The nine mining firms used in the study are further analysed by reviewing their annual integrated reports and sustainability reports to see what management discloses with regards to Environmental Management Practices. These are examined between the years 2007-2011 in order to be consistent with the quantitative analysis and their findings are then summarised in a table showing what is being done in terms of Environmental Management Practices and any potential impact on firm financial performance.

2007-2011

AAC Ltd

Brief company environmental overview

The company through the board of directors took cognizance of their duty to the environment by making mention of their initiatives in fostering sustainable development. The chairman made mention of the adoption of the company's environmental way, which aims to enhance operations in a more efficient and environmentally friendly way. The firm also makes mention of their commitment to ensuring that they minimise their carbon emissions and contribute positively towards developing technologies that improve operations at a minimal effect on climate. The Chairman also mentions the firm's desire to adhere to the needs of stakeholders, who place pressure on the firm to operate in an ethical and transparent manner.

The CEO mentioned that the major sustainability challenge facing the firm was in the area of climate change, access to water and energy. In addition, the firm implemented new technical standards and management tools to promote water efficiency and energy and carbon management. These tools and management standards help firm operations understand their water and energy needs and identify and implement savings projects.

AGA Ltd

Brief company environmental overview

In their opening statement, the firm mentions a commitment towards respect for the environment. They make a pledge to prevent pollution, curtail waste, use natural resources in an efficient way and reduce carbon emissions. They further state that they aim to develop ingenious solutions to help alleviate climate and environmental threats. The chairman mentions the issues of a balance between the stakeholders and shareholders. This balance is a delicate one that needs to be managed well to ensure that all parties benefit. The company also strives to be a good corporate citizen, as this is seen as a must for any good mining operation.

The CEO of the firm in turn, mentions the need for the firm to reduce their environmental footprint in line with their business activities. He further disclosed that the firm aimed to reduce environmental incidences and introduce initiatives aimed at addressing climate change, energy usage and efficient water usage through working with stakeholders such as communities, other organisations and authorities.

AM Ltd

Brief company environmental overview

The firm mentioned the need for it to be a good corporate citizen. This required an integrated approach towards issues of economic, environmental and social responsibility. Progress was made with regards towards environmental issues. Strides were made with regards to reducing emissions and improving air quality. There was a feeling of uncertainty regarding the proposed carbon tax and South Africa's stance on carbon emissions, which the firm felt would result in decreased profitability and the potential for some operations to cease. The firm also mentioned of developing initiatives to carry out operations in a sustainable manner and reduce their overall carbon footprint.

EXX Ltd

Brief company environmental overview

The company includes sustainability as part of its core strategy. They mention the need to be environmentally responsible and to ensure that they reduce their overall carbon footprint. They introduced more carbon reporting and lunched a biodiversity,

waste and air quality management programme. The firm also increased the costs and provision of environmental liabilities. In addition, they mentioned their water management strategy which aimed to reduce their water usage by 5%. They also carried out a risk assessment of their operations and identified key risks resulting from climate change. These risks were then integrated into the firm's climate change position statement that required internal and external inputs to help achieve the firm's target of being carbon-neutral.

On the energy side of things, the firm reported an improvement in its energy usage from previous years due to better energy management and lower economic production as a result of greater macro-economic challenges. They were able to report more on environmental data through detailed consumption tables on the company's website.

GF Ltd

Brief company environmental overview

As part of the overall company strategy, it is mentioned that the company aims to be a global leader in sustainable mining. As such, attention was paid to the need for greater environmental management and disclosure. The company employed a comprehensive water management strategy that aimed to limit the overall water usage in mining operations and this led to an overall improvement in terms of water usage. Energy saving is also viewed as a key component of the company's Environmental Management Practices. It is thus imbibed in the company's integrated carbon management strategy due to the fact that the company derives most of its energy from coal fired power plants.

It is mentioned that the firm is seen as a leader in the South African mining industry in dealing with greenhouse gas related issues. The firm was ranked in the Carbon Disclosure Project Leadership Index as well as the JSE SRI for consecutive years due to their effective carbon management and disclosure or carbon emissions. It is also actively involved in Carbon Emissions Reduction (CER) trading schemes, using the proceeds from one such trade to build a methane powered gas project at one of their mining operations. The company significantly increased their investment in

energy-saving initiatives which resulted in an overall energy saving of 5% from the previous financial reporting period.

IMP Ltd

Brief company environmental overview

The management approach mentioned that the firm was aimed at addressing safety, health and environmental matters relating to their products at every stage of the product life cycle. This was in line with the broader company strategy of ensuring that the firm operates in a sustainable way by adopting economic, social and environmental concerns at the heart of their operations. The nature of the products of the company (PGMs) which are recyclable reduces their environmental footprint and sustains their continued supply.

The company also mentioned the implementation of the ISO 14001: environmental management systems at their various operations, which was used to manage the company's environmental impacts and manage any risks to the environment resulting from the company's operations. The company made mention of the necessity of water to their operations hence the adoption of a water management strategy during the course of the year which became central to the core business operations. They further mentioned that an inquest into the possibility of reducing water intake was initiated in the year as well.

The group mentioned their need for substantial amounts of energy. Therefore, the firm adopted a strategy of improving efficiency rather than reducing absolute consumption due to their projected expansion of operations. This, coupled with a greater demand of electricity due to increased economic activities, prompted the need for the company to adopt energy saving technologies as the supply risk persists. This energy efficiency strategy also has a bearing on the group's carbon emissions strategy as the firm is heavily reliant on Coal power for electricity. Also mentioned are the emissions brought about as a result of the company's smelting and mining activities.

KUM Ltd

Brief company environmental overview

The company makes mention of a strategy which seeks to ensure that the company is positioned as a responsible and proactive corporate citizen which acts beyond legislative compliance. This can be seen in the company's priority areas. They prioritise energy and carbon management through measuring monitoring and reporting in line with their parent's strategy on energy and carbon management. They further state that they focus on the implementation of energy saving and energy efficient products. Water management is also mentioned as a key priority with the implementation of water saving and water efficiency projects in place.

Furthermore, the company fully applies the ISO 14001 standard. The standard's plan-do-check-act logic forms the basis for the company's overall environmental management strategy.

LON Ltd

Brief company environmental overview

The company has in place a safety and sustainable development policy in place and also has an integrated sustainable development approach. In 2011, the company reported that it had rolled out the integrated environmental management strategy and developed the company's climate change response strategy. They also mentioned their overall reduction of their water usage by 33% and were granted and atmospheric emissions licence for their operations.

The integrated environmental management strategy was based on the Global Reporting Initiatives (GRI) guidelines and included air quality management, energy management, land management, water management and waste management. Through the establishment of a safety and sustainability committee, the firm was able to implement these strategies, some of which were voluntary such as energy management.

MER Ltd

Brief company environmental overview

The firm mentions issues that are material to their operations. They mentioned energy and climate change issues as those which affect all stakeholders and therefore had to be managed well. The company also uses the ISO 14001 standard for environmental management. Their core Environmental Management Practices focused on energy, climate change and water usage.

The firm's operations gave rise to a significant level of greenhouse gas emissions. This is through smelting and energy usage. The company mentions their commitment to reducing their greenhouse gas emissions and energy usage with positive results for the 2011 year. The energy usage is as a result of the operations such as smelting and mining and this is fed by coal power from power plants. The firm also mentions their need to use water efficiently and avoid any negative impacts on water quality in the surrounding operating environment. The firm aims to continuously refine their water usage measurement in line with continued evolvement of this measurement across the industry at large.

The overview provides a brief insight into the operations of these mining firms and lays the foundation for further analysis of the firms' Environmental Management Practices. These are presented in the table below, with a brief discussion to follow.

COMPANY	GRI GUIDELINES	IS0 14001	CARBON DISCLOSURE PROJECT	LEGISLATION	VOLUNTARY STAKEHOLDER CONCERN	FINANCIAL MOTIVES
AAC	YES	YES	YES	YES	YES	YES
AGA	YES	YES	NO	YES	YES	YES
AM	YES	NO	NO	YES	YES	YES
EXX	YES	YES	YES	YES	YES	YES
GF	YES	YES	YES	YES	YES	YES
IMP	YES	YES	YES	YES	YES	YES
KUM	YES	YES	NO	YES	YES	YES
LON	YES	YES	YES	YES	YES	YES
MER	YES	YES	YES	YES	YES	YES

Table 24: Compliance with mandatory legislation and voluntary environmental guidelines

4.6.2 Carbon Disclosure Project

The Carbon Disclosure Project is used by six (6) of the nine (9) firms under study representing 67%. Completely voluntary as mentioned in the literature section

earlier, this project is used as a means for firms to self-monitor their emissions and water usage with the aim of gradually reducing their environmental footprint in the long run.

4.6.3 Financial motives

The sustainability and integrated reports of all the firms under the study indicated that there is a potential financial motive behind them engaging in sustainable practices vis-à-vis Environmental Management Practices. Their motivations to engage in these practices was borne out of the theories laid out in the theoretical framework to this study and showed the need for these firms to act in conformity to those underlying concepts.

It was felt that monitoring carbon emissions, energy usage and water usage with a view to gradually reducing their consumption and emissions would have long term financial benefits to the firms in the form of cost savings on huge energy bills, water bills and licence fees and carbon tax. This would eventually trickle down to the stakeholders in the form of greater retained earnings which could then be passed on to them in the form of dividends. Other potential financial motives from Environmental Management Practices could be increased investments from sustainable conscious investors, would buy into firms that are considered to be economically, socially and environmentally responsible.

4.6.4 Global Reporting Initiatives (GRI) guidelines

The firms in the study all used these GRI guidelines as a benchmark for developing their Environmental Management Practices. These guidelines as mentioned in the literature provide the means for firms to develop policies, strategies or systems aimed to address development in a more sustainable manner.

The firms have thus adopted these guidelines as a means with which they have been able to convey environmental data in a clear and understandable way that all stakeholders could digest and use the information to suit their needs. All data on the environment are drawn from these guidelines as shown in the table in the literature section.

4.6.5 ISO 14001: Environmental Management Systems

The ISO 14001 standard first developed in 2004 has been used by firms to create environmental management systems that can be certified by the International Organisation for Standardisation (ISO). In the study, eight (8) out of the nine (9) firms used this standard to develop their own environmental policies, strategies and systems. This represented 89% of the firms.

The standard as stated in the literature encourages firms and organisations to promote environmental friendliness through development and adhering to standards that govern how the organisations deal with environmental related matters such as energy usage, carbon emissions and water usage. This is evident in the sustainability and integrated reports of the mining firms under the study that use this standard.

4.6.6 Legislation

As stated in the literature, legislation on mining and other extractive industries is in place to ensure safe and sustainable mining operations with care for the environment at the heart of it. As such, it is well documented in the annual reports that all the firms in this study are fully compliant with the provisions of the law in terms of mining.

Care is placed upon complying with this legislation to avoid penalties and other remedial action by regulators and stakeholders. This makes the need to use voluntary Environmental Management Practices even greater given that watchful eyes are on these firms in an industry synonymous with environmental incidents.

4.6.7 Voluntary Stakeholder Concern

One of the key criteria used by the JSE SRI in selecting their best performing firms is their overall commitment and concern for all stakeholders in terms of overall corporate social and environmental responsibility. It is well evidenced by all the firms in their sustainability and integrated reports that all stakeholders are at the heart of their concerns.

Consistent with the key underpinnings of the Legitimacy and Stakeholder theories, this duty to all stakeholders entails a sense of responsibility for sound environmental management which benefits all the stakeholders. It is important for all stakeholders that the mining firms operate in an environmentally friendly manner to ensure the safeguarding and efficient use of resources. As such, the mining firms through the various guidelines and standards mentioned have taken it upon themselves to manage their carbon emissions, energy usage and water usage. This is as stated before the basis of their Environmental Management Practices and has an effect on all stakeholders.

4.7 Summary

As seen from the company reports, after the content analysis, it can be said that the JSE SRI 2011 mining firms are actively engaging in Environmental Management Practices with the belief that they would obtain some financial rewards from doing so, as well as through their moral obligations to all stakeholders in line with the Legitimacy and Stakeholder theories. This is consistent with the findings of researchers such as Wingard and Vorster (2001), Oberholzer and Prinsloo (2011) and Yang *et al*. (2011).

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter highlights the conclusions and recommendations based on the findings of this research. The major objective of this study is briefly restated as well as the steps taken to address this objective. The findings, linked to the literature as well as the objectives are discussed as well as their implications on academia, industry, managers, regulators and stakeholders. New knowledge based on this research is then pointed out and recommendations for further study are discussed.

5.1 Objective

As stated before, the main objective that motivated this study was to examine if Environmental Management Practices had an impact on firms' financial performance. This was based on the JSE SRI 2011 mining firms. No such previous study had been carried out in the South African mining industry. The sub objectives of this study were:

- to show any impact of carbon emissions on firms' financial performance,
- to determine if energy usage impacted firms' financial performance and
- to establish if water usage has an effect on firms' financial performance

In order to address these objectives, mixed methods involving quantitative and qualitative approaches were used. Multiple regression using panel data analysis and pooled regression was used as quantitative methods, while a content analysis of the firms' Environmental Management Practices was used as a qualitative method. The data used for both research methods was obtained from the firms' annual integrated and sustainability reports, as well as information from the company websites.

Quantitative data were entered onto an MS Excel spread sheet, which was then exported into the software used to run the analysis. For panel data, Eviews 7 software was used while for pooled regression, Stata 12 software was utilized. Panel data analysis was run to test for any significance between the dependent variable Return On Equity and the independent variables carbon emissions, energy usage and water usage. Pooled regression also employed Return On Equity as

dependent variable and carbon emissions, energy usage and water usage as the independent variables. The Adjusted R-squared was used as the test of significance for the panel data while the p-values were the test used in the pooled regression. Issues of auto-correlation and Multicollinearity were addressed in both panel data and pooled regression.

Qualitative data were analysed based on the content of the mining firms' reports on their Environmental Management Practices. This was examined against international guidelines and local legislation. Management statements on Environmental Management Practices were examined for the period 2007-2011. This Environmental Management Practices were then viewed from management's angle, as the study tried to quiz what drove management into these Environmental Management Practices.

5.2 Findings

The findings were all based on the major objective and sub objectives of this study. The main research question restated asked what the impact of Environmental Management Practices was on firm financial performance.

Panel data analysis showed that there was no significant link between the mining firms' Environmental Management Practices and their firm financial performance. This is consistent with the findings of previous researchers such as Yu et al., (2009) and Horváthová (2010). Further tests to answer the specific research questions were carried out. The test to examine if carbon emissions had an impact on firm financial performance as represented by Return On Equity showed that a negative link between carbon emissions and Return On Equity existed. This is in line with the findings of previous research such as Delmas and Nairn-Birch (2010) and Oberholzer and Prinsloo (2011). The link between energy usage and firm financial performance represented by Return On Equity showed that a negative association existed between the research variables as reported in previous works such as Yu et al., (2009) and Oberholzer and Prinsloo (2011). Lastly, the link between water usage and Return On Equity showed that a positive association existed between the variables. This is in line with the findings of King and Lenox (2001) and Wingard and Vorster (2001).

Pooled regression also examined whether there was a link between the firms' Environmental Management Practices (carbon emissions, energy usage and water usage) and firm financial performance (Return On Equity). The results showed a significant link existed between the firms' Environmental Management Practices and firm financial performance. This regression also showed that a positive link existed between carbon emissions and Return On Equity; a negative link existed between energy usage and Return On Equity and a negative link existed between water usage and Return On Equity. This is in line with the results of previous research such as Cohen (1995), Hart and Ahuja (1996), King and Lenox (2001), Wingard and Vorster (2001),Montabon *et al.,* (2007) and Iwata and Okada (2011).

The content analysis of the mining firms' reports with focus on their Environmental Management Practices showed that the firms were of the view that the Environmental Management Practices would have potential financial benefits on their companies through cost savings and fewer fines hence the implication being that there was a link between their Environmental Management Practices and firm financial performance similar to the findings of Hart and Ahuja (1996), Wingard and Vorster (2001) and Yang *et al*., (2011). They were also driven into these Environmental Management Practices as result of their moral obligations to fulfil their fiduciary duties to their stakeholders, consistent with the legitimacy and stakeholder theories as stated by Suchman (1995); Elijido-Ten (2007); Tilling and Tilt (2010); Mahadeo et al., (2011); Mutti *et al.,* (2011) .

5.3 Implications

5.3.1 Academia

This study presented a unique opportunity for the researcher to delve into a contemporary issue that had not been investigated within the South African mining industry context. The research methods and approaches used were somewhat unique and helped the researcher achieve their overall aim and objectives of the study.

The study did show that through using panel data analysis, there was no impact of Environmental Management Practices on firm financial performance. This was due

in part to the serial nature of the data which was only readily available for a period of five consistent years. Therefore, to adopt this method for future research would require a greater set of raw data to be used in the analysis. Furthermore, an additional model that takes into account the limited amount of this voluntary data would need to be developed by researchers.

Pooled regression on the other hand showed that there was a significant impact of the Environmental Management Practices on firm financial performance. The tests used incorporated all the aspects that would have affected the regression results. Future research should focus on this method due to its robust nature and its integration of the tests that independently measure phenomena such as auto correlation. As information on Environmental Management Practices becomes more and more available, it would provide academics with more data to develop models based on this pooled regression.

A qualitative content analysis of the company annual integrated reports and sustainability reports showed that the firms believed that these Environmental Management Practices would result in some financial gain. This presents academia with a chance to have a direct engagement with these mining firms and work with management throughout the stages involved in gathering data on their Environmental Management Practices. Questionnaires targeted towards management could further add to the knowledge on this issue by showing what management perceptions with regards to this possible relationship between Environmental Management Practices and firm financial performance.

5.3.2 Industry

This study presented an opportunity to show if there is any impact of Environmental Management Practices on firm financial performance. As previously stated, these Environmental Management Practices are borne out of voluntary environmental self-regulation. The South African mining industry is dogged by a reputation of poor Corporate Social Responsibility and environmental neglect by these firms.

The study showed that the mining firms did have a yearning for their environment and while profit still remained at the core of their business (as is the case with any

other profit oriented venture), they strived to operate in line with the expectations and needs of their stakeholders with regards to the environment. The content analysis documented their Environmental Management Practices.

This study also showed that there was an impact of the Environmental Management Practices on firm financial performance. This can be seen as a way that mining firms could use to measure any financial rewards of doing voluntary environmental management.

5.3.3 Managers

This study showed some insight into the views that managers had with regards to Environmental Management Practices and their impact on firm financial performance. Across all the mining firms used in this study, it was noted that all managers views their firms as custodians on their operating environment hence the need to conform to voluntary self-regulation and mandatory regulation. The content analysis showed that management believed that these Environmental Management Practices would have an impact on firm financial performance as stated in their integrated annual reports and sustainability reports.

The findings of the study can be used to incentivise managers to disclose more information on their Environmental Management Practices. This will allow managers to enhance their organisations' standing with all stakeholders and reduce on any possible financial burdens due to ecological damage. Additionally, the findings can allow for managers to improve their organisation's competitiveness with regards to Environmental Management Practices.

5.3.4 Regulators

The findings of the study have an impact on regulatory bodies. They can be used in many ways to enhance the role of regulators in the South African mining industry. The government for instance may use this impact of Environmental Management Practices on firm financial performance to develop a system that can reward those firms that actively pursue voluntary environmental self-regulation.

The findings may also encourage regulators to develop hybrid pieces of legislation that can combine more monitoring of mining firms for their carbon emissions, energy usage and water usage while at the same time encourage those firms that are already doing so to bolster these Environmental Management Practices. Regulators must also use these findings to divide their focus on not only aspects such as pollution, Acid Mine Drainage (AMD) and restoration, but can also look at how the mining firms have taken the lead in ensuring that carbon emissions are kept low, energy is efficiently utilised and water is conserved.

5.3.5 Stakeholders

Stakeholders such as investors, the government, organisations and societies at large can benefit by having a clearer understanding of how Environmental Management Practices can benefit them. The findings of the study suggest an impact between Environmental Management Practices and firm financial performance.

Investors have a vested interest in the mining firms. The actions of these mining firms have consequences on their equity investments. As such, the modern day investor should not merely be satisfied by receiving a return on their investment, but also by how responsible the custodians of that investment are towards their social and environmental obligations. Therefore, these findings should provide investors with the knowledge that what they receive on their Return On Equity is related it the firms' carbon emissions, energy usage and water usage. This provides them with additional information that can be useful in their decision making process.

The government can also use the findings of the study to enhance legislation as earlier mentioned, to provide incentives for these well performing mining firms and to use the findings as means to further drive their green agenda in line with current international trends.

Society can view these findings as a tool to further justify the necessity of environmental responsibility in line with profit making and also as a means to legitimise the mining firms' operations in their own local communities. These findings have the potential to further spur other mining firms to adopt these Environmental Management Practices which can only result in better environments

within mining communities and the chance for more social spending by these firms as a result of more savings through better resource management such as lower energy and water bills and lower carbon tax.

5.4 Contributions to Knowledge

This research was unique in that it attempted to study a previously unsearched area; the impact of Environmental Management Practices on firm financial performance of the JSE SRI 2011 South African mining firms. This presented an opportunity to delve into this contemporary issue, using existing research designs.

However, the voluntary nature of these Environmental Management Practices meant finding data was always going to be a major challenge. The advent of the JSE SRI in 2004 meant that the availability of environmental data were only likely to increase in the coming years, hence the data was limited. This called for the use of methods that could work with the limited data; hence this study used a combination of panel data analysis, pooled regression and a content analysis to attempt to answer the research questions. This was unique for this type of study and presented an opportunity to bridge the extant knowledge gap, which this research attempted to do so.

This study also developed a framework looking at Environmental Management Practices from broader perspective incorporating the views of all stakeholders. This added something new to the existing literature on the impact of Environmental Management Practices and firm financial performance. The results of this study had been used to develop a journal article that was published in an accredited international journal, as well as presented at two international conferences. This greatly contributed to the existing knowledge on the impact of Environmental Management Practices on firm financial performance.

5.5 Conclusion

The notion of Environmental Management Practices is a unique opportunity that provides the South African mining industry with an opportunity to mitigate climate change and deter environmental damage. This will have a lasting effect on generations going forward

The study did show that there is indeed an impact of Environmental Management Practices on firm financial performance. This goes to show that in spite of their voluntary nature, these practices do affect financial performance hence the need to seriously study them over an extended period and further encourage all mining firms across the South African mining sector to adopt them.

While the study exhausted this topic at length, an opportunity exists for further study incorporating the development of specific statistical models and greater firm participation in order to extensively cover this broad and contemporary research area. Hence a call for further research into this area is made.

5.6 Recommendations

This study presented an opportunity to further explore the emerging area of sustainability and environmental accounting. The field is broad hence opportunities for further research are numerous. It also presented an opportunity to deeply examine the effect of voluntary environmental self-regulation and the potential rewards thereof.

This study could be attempted using the entire JSE SRI at doctoral level. An econometric model, with the help of an expert, could be developed that could address issues of limited data and time series data. Content analysis could also be used to augment the statistical analysis that could be carried out. Measures of firm financial performance could be increased to include more variables.

The recommendation is that the mining firms continue with these Environmental Management Practices given their mostly positive impact on the firms' financial performance. While these practices are merely voluntary, my recommendation is that they are adopted by all mining firms as the results indicate potential future financial benefits to those firms that adopt them. This will greatly contribute to concerted global efforts in addressing climate change issues and also meet one of the key MDG targets, ensuring sustainable development for future generations.

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APPENDIXES

Appendix (A): List of Figures

Appendix (B): List of Tables

Appendix (C): Tables

Company	Year	ROE	EU	CE	WU
AAC	2007	33.6	196.7	25.4	114
AAC	2008	28.1	104.9	19.8	109
AAC	2009	10.4	104.4	18.9	116
AAC	2010	21.4	100.9	20	109
AAC	2011	11.3	102.9	18.8	115
AGA	2007	-26	29.2	4.51	55.8
AGA	2008	-45.9	29.4	4.55	53.6
AGA	2009	-8.6	29.8	4.79	55.1
AGA	2010	3.1	30.6	4.82	54.7
AGA	2011	30.9	30.5	4.51	56.9
AM	2007	26.2	25	2.56	3.5
AM	2008	39	24	2.61	3.33
AM	2009	-1.8	22.25	2.65	3.36
;AM	2010	6.2	22.91	4.44	3.64
AM	2011	-0.2	23.29	4.49	3.71
EXX	2007	15	7.3	1.5	21.9
EXX	2008	30	8.4	1.8	29.6
EXX	2009	19	10.9	2.3	27.1
EXX	2010	34	12	2.2	25.3
EXX	2011	36	11.4	2.1	29.8
GF	2007	7.1	5.5	5.2	64
GF	2008	11.3	5.4	5.1	69
GF	2009	4.3	5.2	4.9	67
GF	2010	4.4	5.8	5.4	62
GF	2011	16	6.1	5.2	78.2
Imp	2007	52.3	0	3.1	33.1
Imp	2008	37.9	16.1	3.2	39.5
Imp	2009	13.9	16.3	3.4	37.4
Imp	2010	11.5	17	3.8	37.1
Imp	2011	15.2	18.2	4	41.8
Kum	2007	118.4	3.9	5	8.3
Kum	2008	106.8	4	5.5	8
Kum	2009	98.4	5.2	6.8	9.7
Kum	2010	99.5	6.4	8	8.7
Kum	2011	108.3	7.05	0.91	14.9
Lon	2007	17.3	7.4	1.63	11.9
Lon	2008	21.8	6.5	1.61	9.4
Lon	2009	11.5	6.7	1.6	8.9
Lon	2010	3.9	6.2	1.59	8
Lon	2011	9.6	6.4	1.61	7.9
Mer	2007	16.7	24.5	1.9	17.4
Mer	2008	41.5	21.4	3.1	38.9
Mer	2009	6.5	14	2.2	16.4
Mer	2010	10.8	20.5	3	12.4

Mer	2011	4.4	18.5	2.3	11.5

Table 2: Excel spread sheet comprising Raw data of the JSE 2011 SRI mining firms

obs	ROE	CE	EU	WU
AAC - 07	33.6	25.40	196.70	114.00
AAC - 08	28.1	19.80	104.90	109.00
AAC - 09	10.4	18.90	104.40	116.00
AAC - 10	21.4	20.00	100.90	109.00
AAC - 11	11.3	18.80	102.90	115.00
AGA - 07	-26.0	4.51	29.20	55.80
AGA - 08	-45.9	4.55	29.40	53.60
AGA - 09	-8.6	4.79	29.80	55.10
AGA - 10	3.1	4.82	30.60	54.70
AGA - 11	30.9	4.51	30.50	56.90
AM - 07	26.2	2.56	25.00	3.50
AM - 08	39.0	2.61	24.00	3.33
AM - 09	-1.8	2.65	22.25	3.36
AM - 10	6.2	4.44	22.91	3.64
AM - 11	-0.2	4.49	23.29	3.71
EXX - 07	15.0	1.50	7.30	21.90
EXX - 08	30.0	1.80	8.40	29.60
EXX - 09	19.0	2.30	10.90	27.10
EXX - 10	34.0	2.20	12.00	25.30
EXX - 11	36.0	2.10	11.40	29.80
GF - 07	7.1	5.20	5.50	64.00
GF - 08	11.3	5.10	5.40	69.00
GF - 09	4.3	4.90	5.20	67.00
GF - 10	4.4	5.40	5.80	62.00
GF - 11	16.0	5.20	6.10	78.20
Imp - 07	52.3	3.10	0.00	33.10
Imp - 08	37.9	3.20	16.10	39.50
Imp - 09	13.9	3.40	16.30	37.40
Imp - 10	11.5	3.80	17.00	37.10
Imp - 11	15.2	4.00	18.20	41.80
Kum - 07	118.4	5.00	3.90	8.30
Kum - 08	106.8	5.50	4.00	8.00
Kum - 09	98.4	6.80	5.20	9.70
Kum - 10	99.5	8.00	6.40	8.70
Kum - 11	108.3	0.91	7.05	14.90
Lon - 07	17.3	1.63	7.40	11.90
Lon - 08	21.8	1.61	6.50	9.40
Lon - 09	11.5	1.60	6.70	8.90
Lon - 10	3.9	1.59	6.20	8.00
Lon - 11	9.6	1.61	6.40	7.90
Mer - 07	16.7	1.90	24.50	17.40
Mer - 08	41.5	3.10	21.40	38.90
Mer - 09	6.5	2.20	14.00	16.40
Mer - 10	10.8	3.00	20.50	12.40
Mer - 11	4.4	2.30	18.50	11.50

Table 3: Panel data as captured into Eviews software

Company	Year	ROE	EU	CE	WU
AAC	2007	33.6	196.7	25.4	114
AAC	2008	28.1	104.9	19.8	109
AAC	2009	10.4	104.4	18.9	116
AAC	2010	21.4	100.9	20	109
AAC	2011	11.3	102.9	18.8	115
AGA	2007	-26	29.2	4.51	55.8
AGA	2008	-45.9	29.4	4.55	53.6
AGA	2009	-8.6	29.8	4.79	55.1
AGA	2010	3.1	30.6	4.82	54.7
AGA	2011	30.9	30.5	4.51	56.9
AM	2007	26.2	25	2.56	3.5
AM	2008	39	24	2.61	3.33
AM	2009	-1.8	22.25	2.65	3.36
AM	2010	6.2	22.91	4.44	3.64
AM	2011	-0.2	23.29	4.49	3.71
EXX	2007	15	7.3	1.5	21.9
EXX	2008	30	8.4	1.8	29.6
EXX	2009	19	10.9	2.3	27.1
EXX	2010	34	12	2.2	25.3
EXX	2011	36	11.4	2.1	29.8
GF	2007	7.1	5.5	5.2	64
GF	2008	11.3	5.4	5.1	69
GF	2009	4.3	5.2	4.9	67
GF	2010	4.4	5.8	5.4	62
GF	2011	16	6.1	5.2	78.2
Imp	2007	52.3	0	3.1	33.1
Imp	2008	37.9	16.1	3.2	39.5
Imp	2009	13.9	16.3	3.4	37.4
Imp	2010	11.5	17	3.8	37.1
Imp	2011	15.2	18.2	4	41.8
Kum	2007	118.4	3.9	5	8.3
Kum	2008	106.8	4	5.5	8
Kum	2009	98.4	5.2	6.8	9.7
Kum	2010	99.5	6.4	8	8.7
Kum	2011	108.3	7.05	0.91	14.9
Lon	2007	17.3	7.4	1.63	11.9
Lon	2008	21.8	6.5	1.61	9.4
Lon	2009	11.5	6.7	1.6	8.9
Lon	2010	3.9	6.2	1.59	8
Lon	2011	9.6	6.4	1.61	7.9
Mer	2007	16.7	24.5	1.9	17.4
Mer	2008	41.5	21.4	3.1	38.9
Mer	2009	6.5	14	2.2	16.4
Mer	2010	10.8	20.5	3	12.4

Mer	2011	4.4	18.5	2.3	11.5

Table 4: Variables by company and year and denoted by ROE (Return On Equity) EU (Energy usage), CE (Carbon emissions) and WU (Water usage)

Obs	**ROE**	**CE**	**EU**	**WU**
AAC - 07	33.6	25.40	196.70	114.00
AAC - 08	28.1	19.80	104.90	109.00
AAC - 09	10.4	18.90	104.40	116.00
AAC - 10	21.4	20.00	100.90	109.00
AAC - 11	11.3	18.80	102.90	115.00
AGA - 07	-26.0	4.51	29.20	55.80
AGA - 08	-45.9	4.55	29.40	53.60
AGA - 09	-8.6	4.79	29.80	55.10
AGA - 10	3.1	4.82	30.60	54.70
AGA - 11	30.9	4.51	30.50	56.90
AM - 07	26.2	2.56	25.00	3.50
AM - 08	39.0	2.61	24.00	3.33
AM - 09	-1.8	2.65	22.25	3.36
AM - 10	6.2	4.44	22.91	3.64
AM - 11	-0.2	4.49	23.29	3.71
EXX - 07	15.0	1.50	7.30	21.90
EXX - 08	30.0	1.80	8.40	29.60
EXX - 09	19.0	2.30	10.90	27.10
EXX - 10	34.0	2.20	12.00	25.30
EXX - 11	36.0	2.10	11.40	29.80
GF - 07	7.1	5.20	5.50	64.00
GF - 08	11.3	5.10	5.40	69.00
GF - 09	4.3	4.90	5.20	67.00
GF - 10	4.4	5.40	5.80	62.00
GF - 11	16.0	5.20	6.10	78.20
Imp - 07	52.3	3.10	0.00	33.10
Imp - 08	37.9	3.20	16.10	39.50
Imp - 09	13.9	3.40	16.30	37.40
Imp - 10	11.5	3.80	17.00	37.10
Imp - 11	15.2	4.00	18.20	41.80
Kum - 07	118.4	5.00	3.90	8.30
Kum - 08	106.8	5.50	4.00	8.00
Kum - 09	98.4	6.80	5.20	9.70
Kum - 10	99.5	8.00	6.40	8.70
Kum - 11	108.3	0.91	7.05	14.90
Lon - 07	17.3	1.63	7.40	11.90
Lon - 08	21.8	1.61	6.50	9.40
Lon - 09	11.5	1.60	6.70	8.90
Lon - 10	3.9	1.59	6.20	8.00
Lon - 11	9.6	1.61	6.40	7.90
Mer - 07	16.7	1.90	24.50	17.40
Mer - 08	41.5	3.10	21.40	38.90
Mer - 09	6.5	2.20	14.00	16.40
Mer - 10	10.8	3.00	20.50	12.40
Mer - 11	4.4	2.30	18.50	11.50

Table 5: Data captured into Eviews software representing the observations and variables

Obs	ROE	CE
AAC – 07	33.6	25.40
AAC – 08	28.1	19.80
AAC – 09	10.4	18.90
AAC – 10	21.4	20.00
AAC – 11	11.3	18.80
AGA – 07	-26.0	4.51
AGA – 08	-45.9	4.55
AGA – 09	-8.6	4.79
AGA – 10	3.1	4.82
AGA – 11	30.9	4.51
AM – 07	26.2	2.56
AM – 08	39.0	2.61
AM – 09	-1.8	2.65
AM – 10	6.2	4.44
AM – 11	-0.2	4.49
EXX – 07	15.0	1.50
EXX – 08	30.0	1.80
EXX – 09	19.0	2.30
EXX – 10	34.0	2.20
EXX – 11	36.0	2.10
GF – 07	7.1	5.20
GF – 08	11.3	5.10
GF – 09	4.3	4.90
GF – 10	4.4	5.40
GF – 11	16.0	5.20
Imp – 07	52.3	3.10
Imp – 08	37.9	3.20
Imp – 09	13.9	3.40
Imp – 10	11.5	3.80
Imp – 11	15.2	4.00
Kum – 07	118.4	5.00
Kum – 08	106.8	5.50
Kum – 09	98.4	6.80
Kum – 10	99.5	8.00
Kum – 11	108.3	0.91
Lon – 07	17.3	1.63
Lon – 08	21.8	1.61
Lon – 09	11.5	1.60
Lon – 10	3.9	1.59
Lon – 11	9.6	1.61
Mer – 07	16.7	1.90
Mer – 08	41.5	3.10
Mer – 09	6.5	2.20
Mer – 10	10.8	3.00
Mer – 11	4.4	2.30

Table 9: Data of ROE and CE

obs	ROE	EU
AAC - 07	33.6	196.70
AAC - 08	28.1	104.90
AAC - 09	10.4	104.40
AAC - 10	21.4	100.90
AAC - 11	11.3	102.90
AGA - 07	-26.0	29.20
AGA - 08	-45.9	29.40
AGA - 09	-8.6	29.80
AGA - 10	3.1	30.60
AGA - 11	30.9	30.50
AM - 07	26.2	25.00
AM - 08	39.0	24.00
AM - 09	-1.8	22.25
AM - 10	6.2	22.91
AM - 11	-0.2	23.29
EXX - 07	15.0	7.30
EXX - 08	30.0	8.40
EXX - 09	19.0	10.90
EXX - 10	34.0	12.00
EXX - 11	36.0	11.40
GF - 07	7.1	5.50
GF - 08	11.3	5.40
GF - 09	4.3	5.20
GF - 10	4.4	5.80
GF - 11	16.0	6.10
Imp - 07	52.3	0.00
Imp - 08	37.9	16.10
Imp - 09	13.9	16.30
Imp - 10	11.5	17.00
Imp - 11	15.2	18.20
Kum - 07	118.4	3.90
Kum - 08	106.8	4.00
Kum - 09	98.4	5.20
Kum - 10	99.5	6.40
Kum - 11	108.3	7.05
Lon - 07	17.3	7.40
Lon - 08	21.8	6.50
Lon - 09	11.5	6.70
Lon - 10	3.9	6.20
Lon - 11	9.6	6.40
Mer - 07	16.7	24.50
Mer - 08	41.5	21.40
Mer - 09	6.5	14.00
Mer - 10	10.8	20.50
Mer – 11	4.4	18.50

Table 13: Raw data showing ROE and EU

Obs	ROE	WU
AAC – 07	33.6	114.00
AAC – 08	28.1	109.00
AAC – 09	10.4	116.00
AAC – 10	21.4	109.00
AAC – 11	11.3	115.00
AGA – 07	-26.0	55.80
AGA – 08	-45.9	53.60
AGA – 09	-8.6	55.10
AGA – 10	3.1	54.70
AGA – 11	30.9	56.90
AM – 07	26.2	3.50
AM – 08	39.0	3.33
AM – 09	-1.8	3.36
AM – 10	6.2	3.64
AM – 11	-0.2	3.71
EXX – 07	15.0	21.90
EXX – 08	30.0	29.60
EXX – 09	19.0	27.10
EXX – 10	34.0	25.30
EXX – 11	36.0	29.80
GF – 07	7.1	64.00
GF – 08	11.3	69.00
GF – 09	4.3	67.00
GF – 10	4.4	62.00
GF – 11	16.0	78.20
Imp – 07	52.3	33.10
Imp – 08	37.9	39.50
Imp – 09	13.9	37.40
Imp – 10	11.5	37.10
Imp – 11	15.2	41.80
Kum – 07	118.4	8.30
Kum – 08	106.8	8.00
Kum – 09	98.4	9.70
Kum – 10	99.5	8.70
Kum – 11	108.3	14.90
Lon – 07	17.3	11.90
Lon – 08	21.8	9.40
Lon – 09	11.5	8.90
kLon – 10	3.9	8.00
Lon – 11	9.6	7.90
Mer – 07	16.7	17.40
Mer – 08	41.5	38.90
Mer – 09	6.5	16.40
Mer – 10	10.8	12.40
Mer – 11	4.4	11.50

Table 17: Raw data of ROE and WU

COMPANY	YEAR	ROE	CE	EU	WU	TIME	FIRMSID
AAC	2007	33.6	25.4	196.7	114	1	1
AAC	2008	28.1	19.8	104.9	109	2	1
AAC	2009	10.4	18.9	104.4	116	3	1
AAC	2010	21.4	20	100.9	109	4	1
AAC	2011	11.3	18.8	102.9	115	5	1
AGA	2007	-26	4.51	29.2	55.8	6	2
AGA	2008	-45.9	4.55	29.4	53.6	7	2
AGA	2009	-8.6	4.79	29.8	55.1	8	2
AGA	2010	3.1	4.82	30.6	54.7	9	2
AGA	2011	30.9	4.51	30.5	56.9	10	2
AM	2007	26.2	2.56	25	3.5	11	3
AM	2008	39	2.61	24	3.33	12	3
AM	2009	-1.8	2.65	22.25	3.36	13	3
AM	2010	6.2	4.44	22.91	3.64	14	3
AM	2011	-.2	4.49	23.29	3.71	15	3
EXX	2007	15	1.5	7.3	21.9	16	4
EXX	2008	30	1.8	8.4	29.6	17	4
EXX	2009	19	2.3	10.9	27.1	18	4
EXX	2010	34	2.2	12	25.3	19	4
EXX	2011	36	2.1	11.4	29.8	20	4
GF	2007	7.1	5.2	5.5	64	21	5
GF	2008	11.3	5.1	5.4	69	22	5
GF	2009	4.3	4.9	5.2	67	23	5
GF	2010	4.4	5.4	5.8	62	24	5
GF	2011	16	5.2	6.1	78.2	25	5
Imp	2007	52.3	3.1	0	33.1	26	6
Imp	2008	37.9	3.2	16.1	39.5	27	6
Imp	2009	13.9	3.4	16.3	37.4	28	6
Imp	2010	11.5	3.8	17	37.1	29k	6
Imp	2011	15.2	4	18.2	41.8	30	6
Kum	2007	118.4	5	3.9	8.3	31	7
Kum	2008	106.8	5.5	4	8	32	7
Kum	2009	98.4	6.8	5.2	9.7	33	7
Kum	2010	99.5	8	6.4	8.7	34	7
Kum	2011	108.3	.91	7.05	14.9	35	7
Lon	2007	17.3	1.63	7.4	11.9	36	8
Lon	2008	21.8	1.61	6.5	9.4	37	8
Lon	2009	11.5	1.6	6.7	8.9	38	8
Lon	2010	3.9	1.59	6.2	8	39	8
Lon	2011	9.6	1.61	6.4	7.9	40	8
Mer	2007	16.7	1.9	24.5	17.4	41	9
Mer	2008	41.5	3.1	21.4	38.9	42	9
Mer	2009	6.5	2.2	14	16.4	43	9
Mer	2010	10.8	3	20.5	12.4	44	9
Mer	2011	4.4	2.3	18.5	11.5	45	9

Table 21: Raw Data of ROE, CE, EU and WU

Appendix (D): Pilot Study

To test the validity of the research instruments and the reliability of the research methods used, a pilot study was conducted based on one JSE SRI mining firm. This firm used had 9 observations and a regression was performed on the ROE with CE, EU and WU as the independent variables. The findings of this study were then presented at a research seminar and an international conference and subsequently published in an international peer-reviewed journal.

The study

This paper examines the impact of Environmental Management Practices on the financial performance of a South African mining firm. The major aim of this paper is to investigate whether such practices have a close relationship with the mining firm's financial performance. The approach is a case study of a South African mining firm listed under the socially responsible index (SRI) of the Johannesburg Stock Exchange (JSE). It uses Green-Steel SA (pseudonym used in place of the real name) as a case study. Using multiple regression statistics, the Return On Equity of Green-Steel SA is regressed on three Environmental Management Practices of Green-Steel (carbon reduction, energy efficiency, and water usage).

The result shows there is no significant relationship between the variables and this lends credence to information gathered from Green-Steel environmental reports that Green-Steel's Environmental Management Practices are driven mostly by a desire to abide by regulations and also by a moral obligation to use Environmental Management Practices to mitigate climate change impact. It concludes that the Environmental Management Practices of a South African mining firm may likely be entrenched in proactive rather than reactive strategy and on ethical obligations as an environmental stakeholder. This finding could be explored further in a main research study of the entire SRI mining firms in South Africa

Methodology

This paper evaluates the impact of Environmental Management Practices on financial performance of a South African mining firm (Green-Steel South Africa) and data has been collected from Green-Steel South Africa (real name withheld for

reasons of commercial confidentiality). Green-Steel SA is among the South African mining firms that have positioned environmental concern as an important component of corporate strategy. Green-Steel SA has embraced various Environmental Management Practices to enhance natural resource efficiency and to reduce negative impact on the environment. Some of the Environmental Management Practices of Green-Steel SA include *inter alia*, water efficiency, energy efficiency and carbon emission reduction. Green Steel SA is leading steel producer and can be categorised as a large firm based on the total workforce employed and annual turnover.

Sample

The Company used as sample in this paper is drawn from the nine JSE SRI 2011 listed mining firms. Mining firms were used in this study as they are ranked as high impact firms with regards to Environmental Management Practices in this index. This paper has used only one mining firm – Green-Steel (a pseudo name in place of the real name) for the analysis as this was the only firm that had related environmental data (used in this analysis) available to the public domain for the periods examined.

Data collection

Data on Return On Equity and Environmental Management Practices were gathered from the various annual and sustainability reports of Green-Steel for the time periods under study. In this paper, Environmental Management Practices (EMP) constitute the independent variables and are represented by carbon emission reduction (CE), energy usage (EU) and water usage (WU). As captured from the firm's environmental data; carbon emissions reduction is measured in Metric Tonnes of Co_2 equivalent (Mt Co_{2e}); energy usage is measured in Giga Joules per tonne (Gj/t); and, water usage is measured in kilo litres per tonne (Kl/t).On the other hand, the dependent variable is Return On Equity (ROE) is a percentage. These data in its entirety have been obtained from the environmental data of Green-Steel SA.

Thus the regression equation may be stated as follows:

$$y=a+b_1x_1+b_2x_2+b_3x_3 \quad (1)$$

Where:

Variables:

Dependent variable: Y: Return On Equity (ROE)

Independent variables X_1: Carbon emissions (CE)

X_2: Energy usage (EU)

X_3: Water usage (WU)

y= Return On Equity; x_1= Carbon emission; x_2=energy usage; x_3= water usage; a= intercept and b= slope.

Hypotheses Restated Here:

Hypothesis 1:

$H1_0$ Carbon emission reduction affects firm's Return On Equity in Green Steel SA

$H1_1$ Carbon emission reduction does not affect firm's Return On Equity in Green Steel SA

Hypothesis 2:

$H1_{0:}$ Energy efficiency affects a firm's Return On Equity in Green Steel SA

$H1_{1:}$ Energy efficiency does not affect a firm's Return On Equity in Green Steel SA

Hypothesis 3:

$H1_{0:}$ Efficiency in water usage affects a firm's Return On Equity in Green Steel SA

$H1_{1:}$ Efficiency in water usage does not affect a firm's Return On Equity in Green Steel SA

The data have been analysed using the regression function in Microsoft excel. Using the multiple regression statistics at 0.05 significant levels, the Return On Equity of Green-Steel SA over a period of nine years is regressed on three Environmental Management Practices (carbon reduction [CE], energy usage [EU], and water usage [WU]) of Green-Steel SA.

Control Variables

Return On Equity (ROE) is normally affected by variables such as profit margin ratio, assets turnover and the assets to equity ratio (equity multiplier) (Brigham & Ehrhardt, 2005; and Singapurwoko & El-Wahid, 2011). There are two common variables used to compute these three ratios; these are net income and shareholders' equity (Singapurwoko & El-Wahid, 2011). For the purpose of this study, these two variables are used as control variables in the regression analysis.

Multicollinearity

To enhance the validity of the regression, a co-linearity test using excel was performed. The results are shown in Table 1 below:

	ROE	*CE*	*EU*	*WU*
ROE	1			
CE	-0.64615	1		
EU	0.480805	-0.07907	1	
WU	-0.11548	0.301078	0.39065	1

Table 1: Multicollinearity test results

According to Analysights (2010), perfect correlation results in a figure of 1.00 while no correlation results in 0.00. Therefore, results closer to 1.00 means multicollinearity is present while the opposite result means multicollinearity is not present (Analysights, 2010). From the table above, as expected, each independent variable is perfectly correlated with itself with a result of 1.00. However, the correlations between the dependent and independent variables are listed below:

$\rho X_1 Y = -0.65$

$\rho X_2 Y = 0.48$

$\rho X_3 Y = -0.12$

The Greek letter ρ is used to represent correlation (Analysights, 2010). The variables represented are Y=ROE; X_1= CE; X_2= EU; X_3= WU.

Furthermore, the correlations between the three independent variables CE, EU and WU are:

ρX_1X_2=-0.08
ρX_1X_3= 0.30
ρX_2X_3= 0.39

The above test shows a strong correlation between ROE and CE, a slightly weak correlation between ROE and EU and a weak correlation between ROE and WU. Therefore, between the dependent variable ROE and the independent variables CE, EU and WU, the co-linearity is spurious. However the co-linearity between the independent variables CE, EU and WU indicates a weak correlation as the results are inclined towards 0.00. In conclusion, based on the findings of the test, in can be concluded that co-linearity is not present in the model.

Results and discussion

From the analysis, the results indicate (refer to figure 1) a significant level of 15% (which is above 5%) with an adjusted r-squared of 38%. This therefore shows that there is no significant relationship existing between Green-Steel Environmental Management Practices and its Return On Equity; hence we reject the three null hypotheses and accept the alternative hypotheses that: carbon emission reduction does not affect firm's Return On Equity in Green Steel SA; energy efficiency does not affect a firm's Return On Equity in Green Steel SA; and, efficiency in water usage does not affect a firm's Return On Equity in Green Steel SA. This finding is contrary to previous research by Cohen et al., (1995) and Hart and Ahuja (1996) that find a positive relationship between Environmental Management Practices and Return On Equity.

Further analysis incorporating the control variables shareholders' equity and net income, indicates a significant relationship (refer to figure 2), but close scrutiny of the significance levels of individual independent variables shows that this positive significance level is caused by the presence of non-environmental variables – the control variables – shareholders' equity and the net income respectively. The

environmental variables remain insignificant, thus indicating that in this evaluation, they do not constitute a causative factor on ROE in Green Steel South Africa.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.7854607							
R Square	0.6169486							
Adjusted R Square	0.3871177							
Standard Error	11.334438							
Observations	9							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	3	1034.574769	344.8583	2.684359179	0.157432596			
Residual	5	642.347453	128.4695					
Total	8	1676.922222						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	-68.73005	76.19134744	-0.90207	0.408369759	-264.5861416	127.126	-264.586	127.12605
CE	-9.336743	4.90831717	-1.90223	0.115532395	-21.9539736	3.280488	-21.954	3.2804883
EU	5.5047641	3.472156975	1.585402	0.173731421	-3.420699558	14.43023	-3.4207	14.430228
WU	-4.086447	9.691663484	-0.42165	0.690797578	-28.99966108	20.82677	-28.9997	20.826767

Fig.1. Regression results without control variables

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.989572							
R Square	0.979253							
Adjusted R	0.944674							
Standard E	3.405476							
Observatic	9							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regressior	5	1642.13041	328.4261	28.31926	0.009957942			
Residual	3	34.7918095	11.59727					
Total	8	1676.92222						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Upper 95.0%*
Intercept	9.311393	26.8910607	0.346264	0.752007	-76.26796351	94.89075	-76.268	94.89075023
CE	-0.23354	2.10461174	-0.11096	0.918651	-6.931352039	6.464276	-6.93135	6.464275664
EU	0.405631	1.40799549	0.288091	0.792034	-4.075239324	4.886501	-4.07524	4.886500765
WU	2.936823	3.07859874	0.953948	0.410486	-6.86065175	12.7343	-6.86065	12.73429864
SE	-1.23688	0.38650475	-3.20018	0.049325	-2.466914028	-0.00685	-2.46691	-0.006852811
NI	4.711245	0.65112534	7.235542	0.005445	2.639073293	6.783416	2.639073	6.783416153

Fig. 2. Regression result incorporating the control variables

Some researchers have concluded that financial performance may drive firms' Environmental Management Practices. However, the lack of a significant relationship, as evidenced in this analysis, indicates that Green-Steel's Environmental Management Practices may not be driven by potential financial value to the firm or shareholders' Return On Equity. This leaves one to question what major factors drive the Green-Steel environmental proclivity.

Information obtained from financial and sustainability reports of Green-Steel South Africa does not portray financial motive as a driving force for Green-Steel Environmental Management Practices; it shows that Green-Steel's Environmental Management Practices are rooted in its concern to meet growing environmental demands and comply with regulations. Additionally, it is also encouraging to note that Green-Steel SA emphasizes that environmental management practice is a moral obligation on the part of the company.

Limitations

This study used only one company because it was difficult to collect data on firms' Environmental Management Practices due given that firms have only recently commenced adopting these voluntary practices; hence, lack of disclosed data for prior years that could allow for an extended time series regression. As such, the paper did not test for auto correlation due to the limited number of observations, and could not use more than once company. It is hoped that similar research may be repeated in the near future when more environmental data have been made available and with more companies involved.

Conclusion

This paper examined the effect of the Environmental Management Practices of a South African mining firm (Green-Steel South Africa) on financial performance (represented in this research by Return On Equity). The study used Green-Steel South Africa for the study and, employing regression statistics, Return On Equity is regressed on three Environmental Management Practices. Given that previous research results indicate mixed findings – some find negative relationship between Environmental Management Practices, whilst others find positive relationship; this paper thus hypothesised that Environmental Management Practices (carbon

emission reduction, energy efficiency and water efficiency) affects Return On Equity (ROE) in Green Steel SA. However, contrary to some previous researches that have found a positive relationship between Environmental Management Practices and Return On Equity (Cohen et al. 1995, Hart and Ahuja, 1996), our analysis shows no significant relationship between the Environmental Management Practices and the ROE of Green-Steel; hence our hypotheses were rejected.

This leads us to a conjecture that other factors apart from impact on equity may be driving Green-Steel's environmental practices. Information obtained from the company reports shows that Green-Steel's Environmental Management Practices are spurred by moral obligation to mitigate climate change impact and by a desire to meet growing environmental regulations. The paper concludes that it may not be in all cases that firms' Environmental Management Practices are driven by financial motive and, that firms may still possess the moral and ethical obligation to curb negative climate impact and to respect environmental regulations. The paper therefore offers an agenda for further research on the impact of regulations and ethics on corporate Environmental Management Practices in developing economies.

This finding has implication for industry and academia. For the industry; it shows that firms may eschew their desire for immediate financial profit and pursue environmental ethics to enhance corporate resiliency and thus future profitability. For the academia; this study may assist to expand theoretical knowledge beyond the long-held view that the sole aim of every business activity is for profit; thus further research becomes apposite to examine the factors – financial or ethics that motivate environmental practices in other sectors of South African