

Environmental Management Practices and Firm Performance in a South African Mining Firm

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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 (represented by return on equity [ROE]). 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.

Key Words: environmental management practices; environmental management; mining firms; financial performance; return on equity
JEL Classification: M11, M41

Introduction

There are contemporary environmental and ecological problems faced by mining firms within the communities in which they operate (Evangelinos and Oku 2006; Garvin et al. 2009; Mutti et al. 2010). This has often resulted in corporate reactive measures to settle environmental problems

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created in communities or to clean the environment (Garvin et al. 2009). However, firms require proactive environmental management practices (EMP) to curtail the occurrence of environmental problems. South Africa is one of the emerging economies in which ensuing rapid growth has been accompanied by environmental degradation (Shaw 2012). Consequently, mining firms have been criticised for apparent environmental neglect that contributes to climate change in Africa (Shaw 2012).

The problem that warrants this study is that there is little prior research evidence regarding environmental management practices (EMP) [carbon emission reduction, energy efficiency and efficiency in water usage] and their effect on firm financial performance (represented in this study by Return on Equity [ROE]) of mining firms in the Republic of South Africa. But an overview of mining firms in South Africa indicates that these firms have begun to integrate environmental management practices as part of corporate strategy. Hence, this study attempts to bridge this research gap and thus proceeds to determine whether the environmental management practices of a South African mining firm (Green Steel South Africa) are related to its financial performance (ROE).

Drawing from the above problem, this paper will attempt to answer the following questions: Could carbon emission reduction affect a firm's return on equity; can energy efficiency affect a firm's return on equity; and, can efficiency in water usage affect firm's return on equity. Accordingly, the objectives of this study are: to evaluate the likely effect of carbon emission reduction on firm's return on equity; to examine the likely effect of energy efficiency on firm's return on equity; and, to evaluate the likely effect of efficiency in water usage on firm's return on equity. Thus to provide answers to the above questions and objectives, three hypotheses are presented and analysed in the analysis section.

The paper is organised as follows: the next section after this introduction presents the literature review and hypotheses development, methodology, the results and discussions, the limitations and lastly, the conclusion.

Literature Review

CONCEPTUAL FRAMEWORK

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 (WSSD) in Johannesburg in 2002 and the Earth summit 2012 in Rio de Janeiro, Brazil. In various literature, the term 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, Sroufe, and Narasimhan (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 and Oku 2006; Montabon, Sroufe, and Narasimhan 2007; 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 emission reduction, efficient energy use and efficient water usage.

RETURN ON EQUITY

Return on equity (ROE) has been defined and conceptualised differently by various authors and researchers. Investopedia (www.investopedia.com) defines ROE as 'the amount of net income returned as a percentage of shareholders' equity.' It is further stated that ROE 'measures a firm's profitability by revealing how much profit a firm generates with the money invested by shareholders.' Teitelbaum, McDonald, and Brown (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. Vigarío (2005, 237) stated that the ROE shows how much of the 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 that by Tsoutsoura (2004) and Moneva and Ortas (2010). This study shall use return on equity (ROE) to measure firm performance. This is because stakeholders are believed to be interested ultimately in their equity and thus concerned about corporate engagements such as environmental management practices that may make it grow (Artiach et al. 2010).

Recent research in developed countries has established a linkage between ROE and firms' environmental management practices (Moneva and Ortas 2010). But no research has employed ROE and environmental

management practices in the Republic of South Africa. However, this has become important because contemporary research has indicated that equity holders (investors) may influence the environmental management practices of their firm (Azapagic 2004; Jenkins and Yakovleva 2006; Sumiani, Haslinda, and Lehmann 2007). The use of ROE in this research would 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; Tsoutsoura 2004). However, the strong variables that affect ROE, which are also used in determining the level of ROE, are net income and shareholders' equity (Singapurwoko and El-Wahid 2011); and these are therefore employed as control variables in this paper.

RELATED PREVIOUS RESEARCH LITERATURE AND DEVELOPMENT OF HYPOTHESES

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, Sundgren, and Schneeweis 1988; Barnett 2007) 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 and Bucholz 1978; Waddock and Graves 1997; Clarkson et al. 2011; Artiach et al. 2010). Montabon, Sroufe, and Narasimhan (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.

Previous studies (Evangelinos and Oku 2006; Lee 2012) found that the level of corporate apathy towards environmental responsibility is high. In contrast, other researchers have engaged in discovering the drivers of corporate environmental responsibility (Lee and Hutchinson 2005; Set-

thasakko 2007; Zhang et al. 2008; Artiach et al. 2010). Amongst other reasons, it has been found that financial performance tends to motivate firms to embark on environmental management practices (McGuire, Sundgren, and Schneeweis 1988; Barnett 2007; Artiach et al. 2010). However, these studies were conducted overseas. Environmental related research in South Africa (De Villiers and Barnard 2000; Antonites and De Villiers 2003; De Villiers 2003; Hamann 2004; Mitchell and Hill 2010) has focused more on disclosure, but none of these earlier studies looked into the effect of mining firms' environmental management practices (EMP) on return on equity in the Republic of South Africa. Hence, this research has become important to fill this gap and, in doing so; add to existing literature on environmental management practices and firm financial performance from a South African perspective.

Assumptions have been made that environmental management practices and firm performance are unrelated and have nothing in common (Slater and Gilbert 2004). Most of the existing literature on environmental management practices 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 and Bucholz 1978; Aupperle, Carroll, and Hatfield 1985; McGuire, Sundgren, and Schneeweis 1988; Barnett 2007; Becchetti, Di Giacomo, and Pinnachio 2005; Cho and Patten 2007; 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, Carroll, and Hatfield 1985; McGuire, Sundgren, and Schneeweis 1988; Barnett 2007; Artiach et al. 2010).

Another view suggests that environmental management practices and firm performance have no association (Ullmann 1985; 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; De Villiers and Van Staden 2011). However, contrary to these negative findings, other researchers maintain that environmental management practices and firm performance are positively associated (Alexander and Bucholz 1978; Waddock and Graves 1997; Al-Tuwaiji et al. 2004; Barnett 2007; Clarkson et al. 2008; 2011; Artiach et al. 2010).

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. 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. 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.

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.

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, Hong, and Modi (2011) discovered that a negative relationship existed between the two variables.

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. 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. Iwata and Okada (2011) carried out a comprehensive study on the impact of carbon emissions on firm financial performance. They examined this relationship in Japanese manufacturing firms for a five-year period. 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. From the preceding literature, we therefore present the following first hypothesis of this paper:

H₁ Carbon emission reduction affects firm's return on equity.

Furthermore, other extant researches have specifically looked at the relationship between energy efficiency, water efficiency and firm financial performance. 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. Pons et al. (2013) explored the impact of energy efficient technologies on a manufacturing firm's financial performance. Their findings showed that the adoption of energy efficient technologies had on meaningful impact on the firms' financial performance.

Wagner et al. (2002) and Wagner (2005) explored the relationship between environmental and economic performance. Energy and water usage was used as one of the variables. Using empirical methods, the results

showed no significant relationship between environmental and financial variables. 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. Drawing from the above therefore, we state the following hypotheses:

- H₂ *Energy efficiency affects a firm's return on equity.*
- H₃ *Efficiency in water usage affects a firm's return on equity.*

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 a 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 CO₂ equivalent (mt CO₂e); 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. This data in its entirety has been obtained from the environmental data of Green-Steel SA.

Thus the regression equation may be stated as follows:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3, \tag{1}$$

Where y = return on equity (ROE); x_1 = carbon emission reduction (CE); x_2 = energy usage (EU); x_3 = water usage (WU); a = intercept and b = slope.

Hypotheses restated here:

H₁₀ *Carbon emission reduction affects firm's return on equity in Green Steel SA.*

H₁₁ *Carbon emission reduction does not affect firm's return on equity in Green Steel SA.*

H₂₀ *Energy efficiency affects a firm's return on equity in Green Steel SA.*

H₂₁ *Energy efficiency does not affect a firm's return on equity in Green Steel SA.*

H₃₀ *Efficiency in water usage affects a firm's return on equity in Green Steel SA.*

H₃₁ *Efficiency in water usage does not affect a firm's return on equity in Green Steel SA.*

The data has 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 and Ehrhardt 2005; Singapurwoko and El-Wahid 2011). There are two common variables used to compute these three ratios; these are net income and shareholders' equity (Singapurwoko and El-Wahid

TABLE 1 Multicollinearity test results

Item	ROE	CE	EU	WU
ROE	1			
CE	-0,646150	1		
EU	0,480805	-0,079070	1	
WU	-0,115480	0,301078	0,390650	1

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.

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, 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:

$$\rho_{x_1y} = -0.65$$

$$\rho_{x_2y} = 0.48$$

$$\rho_{x_3y} = -0.12$$

The Greek letter ρ is used to represent correlation (Analysights 2010). The variables represented are $y = \text{ROE}$; $x_1 = \text{CE}$; $x_2 = \text{EU}$; $x_3 = \text{WU}$.

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

$$\rho_{x_1x_2} = -0.08$$

$$\rho_{x_1x_3} = 0.30$$

$$\rho_{x_2x_3} = 0.39$$

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, it can be concluded that co-linearity is not present in the model.

Results and Discussion

From the analysis, the results indicate (table 2) a significant level of 15% (which is above 5%) with an adjusted R^2 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, Fenn, and Naimon (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 (table 3), 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.

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.

TABLE 2 Regression results without control variables

Regression Statistics		Anova	df	SS	MS	F	Sig. F
Multiple R	0,7854607	Regression	3	1034,574769	344,858260	2,684359	0,157433
R ²	0,6169486	Residual	5	642,347453	128,469490		
Adjusted R ²	0,3871177	Total	8	1676,922222			
Standard error	11,334438						
Observations	9						

	Coefficients	Standard error	t-statistics	p-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	-68,730048	76,191347	-0,902072	0,408370	-264,586142	127,126046	-264,586142	127,126046
CE	-9,336743	4,908317	-1,902229	0,115532	-21,953974	3,280488	-21,953974	3,280488
EU	5,504764	3,472157	1,585402	0,173731	-3,420700	14,430228	-3,420700	14,430228
WU	-4,086447	9,691663	-0,421646	0,690798	-28,999661	20,826767	-28,999661	20,826767

TABLE 3 Regression result incorporating the control variables

Regression Statistics		Anova	df	SS	MS	F	Sig. F
Multiple R	0,993715	Regression	5	1655,909413	331,181883	47,282857	0,004709
R ²	0,987469	Residual	3	21,012809	7,004270		
Adjusted R ²	0,966585	Total	8	1676,922222			
Standard error	2,646558						
Observations	9						

	Coefficients	Standard error	t-statistics	p-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	18,702258	21,157710	0,883945	0,441824	-48,631019	86,035535	-48,631019	86,035535
CE	0,159895	1,631731	0,097991	0,928120	-5,033001	5,352791	-5,033001	5,352791
EU	0,301807	1,090624	0,276729	0,799959	-3,169046	3,772660	-3,169046	3,772660
WU	-0,207197	2,306277	-0,089841	0,934076	-7,546800	7,132405	-7,546800	7,132405
SE	-0,001139	0,000295	-3,867708	0,030574	-0,002077	-0,000202	-0,002077	-0,000202
NI	0,004728	0,000502	9,417771	0,002537	0,003130	0,006325	0,003130	0,006325

Limitations

This study used only one company because it was difficult to collect data on firms' environmental management practices 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 research that has found a positive relationship between environmental management practices and return on equity (Cohen, Fenn, and Naimon 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 firms.

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