AN INVESTIGATION INTO THE EXTENT TO WHICH THE DOMESTIC MINING INDUSTRY HAS RESPONDED TO SECONDARY STAKEHOLDER DEMANDS FOR AN IMPROVED ENVIRONMENTAL PERFORMANCE

by

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A RESEARCH REPORT PRESENTED TO THE

GRADUATE SCHOOL OF BUSINESS LEADERSHIP
UNIVERSITY OF SOUTH AFRICA

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS DEGREE IN BUSINESS LEADERSHIP,
UNIVERSITY OF SOUTH AFRICA

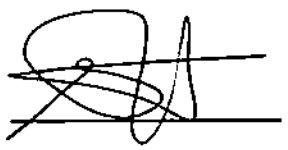
FINAL REPORT
30 NOVEMBER 2006

DECLARATION

I declare that, *an investigation into the extent to which the mining industry has responded to secondary stakeholder demands for an improved environmental performance,* is my original work and that all the sources I have used or quoted have been indicated and acknowledged as complete references, and has not been submitted for degree purposes previously.

Yoganathan Sigamoney Pillay — 30.11.2006

Name — **Date**

Signature: 

ACKNOWLEDGEMENTS

The completion of the MBL degree was made possible by the funding and support received from of Anglo Coal. In particular, the encouragement and support received from Mr. R S Wicks, Head of Energy in Anglo American plc, is gratefully acknowledged. The insightful guidance provided by Prof. P Venter of the Graduate School of Business Leadership, University of South Africa, is much appreciated. To Zakieya Pillay my sincere gratitude and thanks for all the support and help over the past 17 years.

ABSTRACT

This article presents the results of a study conducted to determine the South African mining industry's response to secondary stakeholder demands for an improved environmental performance. The study involved a questionnaire-based survey of informed senior managers in the major mining companies. The survey tested progress over the past decade on measures of environmental practice, emissions intensity, stakeholder partnerships and clean technologies. The data obtained from the survey was interpreted through use of existing theoretical models, the application of quantitative statistics, and the use of Chi-square analysis based on contingency tables. The results of the survey indicate that the industry has achieved moderate progress in the environmental performance measures tested. The study, however, finds that the industry has significant scope for improvement through the embedding of product stewardship and sustainable development strategic capabilities. The report concludes with recommendations for internal industry collaboration and engagement with secondary stakeholders, and offers a new model which could be used as framework to build such a high-level strategy.

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LIST OF ABBREVIATIONS

CT	Clean Technologies and Processes (research measure)
EI	Emissions Intensity
EP	Environmental Practice
GRI	Global Reporting Initiative
ICMM	International Council on Mining and Metals
JSE	Johannesburg Securities Exchange
KLD	Kinder, Lydenberg, Domini & Company
MMSD	Mining Minerals and Sustainable Development
SP	Stakeholder Partnerships (research measure)

CHAPTER 1

ORIENTATION

1.1 INTRODUCTION

Against the backdrop of globalisation fuelled by rapidly advancing and widely available communications and information technology, the stakeholder demands on business have over the past decade undergone a fundamental shift. Shareholders, customers, investment analysts, governments, non-governmental organisations, communities and the media have all raised their respective expectations of business.

No longer separated from the social discourse, business is seen as an integral part of the development debate, and is increasingly expected to deliver solutions. The raised stakeholder expectations are reflected in a plethora of international sustainable development related voluntary agreements and regulatory interventions. Among the major milestones is the Ratification of the Kyoto Protocol (2004) aimed at reducing global carbon emissions, the Johannesburg Plan of Implementation signed at the World Summit on Sustainable Development in 2002, to tackle a range of socio-economic and environmental imperatives, and the emergence of the Global Reporting Initiative (GRI) Guidelines, which have set a benchmark for business transparency for performance in sustainability issues.

With the end of the apartheid era in 1994, big business in South Africa has simultaneously had to come to terms with the emerging global trend and a changed national political and social dynamic, as exemplified for the mining industry by the introduction of the new Minerals and Petroleum Resource Development Act of 2002. The dual influence of the global and local drivers can be gauged in the responses of multi-national mining companies, who have, in the past decade, been catapulted to the forefront of the stakeholder influence debate. This is not surprising, given that the South African mining industry plays a major role in the national economy and through its dependence on a large export customer base, has significant exposure to global developments. According to the Chamber of Mines of South Africa, (Annual Report 2005), the mining sector employs in excess of 450 000 workers and accounts

for 6.6% of gross domestic product, 14% of total private sector investment, and 29% of the country's primary exports.

The response of multi-national mining companies to changed stakeholder demands, can to an extent be gauged from the leadership role taken by Anglo American plc, BHP Billiton and others with strong South African linkages, in a number of initiatives to co-ordinate and bring focus to stakeholder concerns on sustainability issues. These include, among a number of other initiatives, those listed below.

- The first was the setting up of the Mining, Minerals and Sustainable Development (MMSD) project in 2000. MMSD was an independent two-year process of consultation with a variety of stakeholders aimed at understanding how to maximise the contribution to sustainable development at global, national, regional and local levels.

- Secondly there was the establishment of the International Council on Mining and Metals (ICMM). The ICMM provides strategic industry leadership for continuous improvement in sustainable development performance and serves as a platform for industry to share challenges and responsibilities as well as to engage with the external stakeholder community. Information on the MMSD and ICMM can be obtained from www.icmm.com.

- Finally there was the establishment of the Sustainable Development Policy Committee at the South African Chamber of Mines during 2003. The committee serves as a platform for member companies to engage and co-ordinate input on external stakeholder sustainability concerns.

These relatively recent changes in secondary stakeholder influence have bearing on decision-making and corporate strategy in the mining industry sector.

1.2 PURPOSE OF RESEARCH

The primary purpose of this research report is to investigate the extent to which multi-national companies in the South African mining industry have responded to secondary stakeholder demands for improved environmental performance.

The selection of a multi-national segment of the industry for the purpose of this research report is due to the fact that they account for the major portion of mining production for all commodities within the industry sector (Chamber of Mines of South Africa, Annual Report 2005), and that multi-national company led interventions have the potential to make a meaningful contribution towards improving the industry's environmental performance.

The environment is an integral stakeholder issue within the broader concept of corporate social performance. Other stakeholder issues encapsulated by corporate social performance, for which there are raised stakeholder expectations, include occupational safety, occupational health, discrimination, empowerment, social upliftment and product safety. These stakeholder issues however do not fall within the ambit of this research report.

1.3 STATEMENT OF THE PROBLEM AND SUB-PROBLEMS

The key objective is to investigate the extent to which the mining industry in South Africa is responding to secondary stakeholder demands for an improved environmental performance. The following sub-problems serve as a basis for developing the research hypothesis and hence as a means for resolving the primary research objective.

Sub-problem 1

The first objective is to investigate the extent to which the mining industry has embedded strategy responses for improved environmental performance into operational activities.

Sub- problem 2

The second objective is to investigate the extent to which the mining industry makes use of partnerships with secondary stakeholders to improve environmental performance.

Sub-problem 3

The third objective is to investigate the extent to which the mining industry has adopted a product stewardship-led strategy in the use of cleaner processes and technologies to reduce environmental impacts.

1.4 DEFINITIONS

Corporate social performance

This is defined by Carroll and Buchholtz (2003) as an organisation's configuration of principles of social responsibility, processes of social responsiveness, and policies, programmes and observable outcomes as they relate to the firms' societal relationships. A graphical representation of the multi-dimensional concept as provided by Carroll and Buchholtz (2003) is presented in Figure 2.1.

Corporate reputation

According to Zyglidopoulos (2001), corporate reputation is defined as the set of knowledge and emotions held by stakeholders, concerning aspects of the firm and its activities. It could be regarded as society's counterpart of an organisation's stock market return or share price.

Emissions

As used in the context of this report, emissions refer to industry waste or other discharges that affect the natural environment. These include solid waste, discharges into ground water, river systems and the atmosphere, as well as noise pollution and induced ground vibration. The intensity of company emissions is often

used as an indicator of environmental performance. One of the most the widely used indicators for emissions is the Toxic Release Inventory (Griffin & Mahon, 1997:15).

Environmental stakeholder issues

Industry emissions affect the natural environment and are of concern to environmentalists. These include amongst others, conservation of biodiversity and endangered species, ground, water, air and noise pollution (United Nations Environment Programme, 2006).

Intensity of emissions

In the context of this report, intensity of emissions is defined as the emissions per unit of product. For example the CO_2 emissions intensity for a coal mining company will be expressed as "tonnes CO_2 per tonne saleable coal".

Stakeholder

This refers to any individual or group who can affect or is affected by the actions, decisions, policies, practices or goals of the organisation as defined by Carroll and Buchholtz (2003).

Primary stakeholder

Carroll and Buchholtz (2003) define primary stakeholders as any individual or group that has direct and well-established legal claim on the organisation's resources. Primary stakeholders can be divided into social and non-social stakeholders. Primary social stakeholders include, amongst others, shareholders and investors, employees and managers, customers, local communities, suppliers and other business partners. Primary non-social stakeholders include, amongst others, the natural environment, future generations and non-human species.

Secondary stakeholders

Carroll and Buchholtz (2003) define secondary stakeholders as those parties that have a less established legal claim on organisational resources. These stakeholders are based on 'non-binding' criteria and to a large extent, depend on the specific resource allocation at issue. Secondary stakeholders can be divided into social and non-social stakeholders. Secondary social stakeholders include, amongst others, government, regulators, civic institutions, social pressure groups, media and academic commentators, trade associations and competitors. Secondary non-social stakeholders include, amongst others, environmental pressure groups and animal welfare organisations (Carroll & Buchholtz, 2003).

Stakeholder theory

In terms of stakeholder theory, shareholders are regarded as just one of many stakeholder groups that management must consider in the business decision-making process, as defined by Carroll and Buchholtz (2003).

Sustainable development

This is defined by the United Nations World Commission on Environment and Development (1987), as 'meeting the needs of the present, without compromising the ability of future generations to meet their own needs'. Other approaches to understanding sustainable development include undertaking development, which is based on balancing the tensions between economic, social and environmental needs.

Some of the multi-national mining companies have adopted the Five Capitals model as a framework for sustainable development (Anglo American plc, 2006). According to the Five Capitals model, sustainable development for the mining sector, which involves the extraction of a non-renewable natural resource, is achieved through offset benefits. The offsets occur when the extraction of minerals and permanent reduction of natural or environmental capital is balanced by benefits accruing to the remaining four capitals, namely economic capital, manufactured capital, human capital and social capital.

1.5 DELIMITATION OF THE STUDY

The research report examines the performance of the mining industry on the environment, as perceived by managers within the industry and having knowledge of the subject. The analysis is undertaken using the theoretical research models on corporate social performance and natural resource-based competitive positioning, developed by Carroll (in Carroll & Buchholtz, 2003) and Hart (1995) respectively. The research is restricted to multi-national companies, with mining operations in South Africa. The research does not assess individual mining companies, but aims to gain a cross-sectional perspective of the industry as a whole, using 1994 as the base year for analysis. The study is specific to stakeholder issues on the environment, and therefore does not provide a holistic appraisal of the mining industry's overall corporate social performance. The results of this research will, however, make a significant contribution to such analysis, which will also need to consider the additional stakeholder issues encompassing occupational safety, occupational health, discrimination, Broad Based Black Economic Empowerment, and community upliftment and product safety.

The scope and focus of the research report is considered sufficient to meet the standard, as partial fulfilment of the requirements for the Master's Degree in Business Leadership.

1.6 IMPORTANCE OF THE STUDY

The report will provide insight on the manner in which the mining industry sector (as made up of multi-national mining companies), has responded to secondary stakeholder demands for an improved environmental performance.

Of late, it would appear that many of the stakeholder demands on multi-national companies are captured by the concept of sustainable development, which first became the focus of international policy-making with the publication of the World Commission on Environment and Development Report in 1987. This report, commonly known as the Brundtland Report, coined the term sustainable development to mean "development that meets the needs of the present generation

without compromising the ability of future generations to meet their own needs." The Brundtland Report is available at www.ace.mmu.ac.uk. Sustainable development as an umbrella for consolidating management of primary and secondary stakeholder issues and its linkage to long-term corporate strategy is steadily gaining a foothold in multi-national mining companies.

The industry's response to secondary stakeholder demand for improved environmental performance is analysed using both Carroll's framework model for corporate social performance (Carroll & Buchholtz, 2003) as well as the natural resource based theory of Hart (1995). Carroll's multi-dimensional model provides a framework for analysing the environment as a stakeholder issue against the interconnected dimensions of corporate social responsibility and corporate social responsiveness. By such positioning, the research will enable the industry to make more informed decisions when developing future approaches to secondary stakeholder issues on the environment. Hart's natural resource based theory identifies the linkages between a firm's competitive advantage and its relationship to the natural environment. This theoretical concept allows for more detailed assessment of the environment as a dimension within company strategy. Hart's model offers insight on the range of strategy interventions required to change industry's response to stakeholder issues on the environment.

Although progress in sustainability elements is often driven on an industry basis, over the medium to long term it is envisaged that individual business response to secondary stakeholder demands could potentially serve as a differentiator between companies. Multi-national mining companies operating in South Africa, who become effective in meeting local secondary stakeholder challenges, would develop skills that would provide a competitive advantage when operating in other geographies with similar sustainability constraints.

1.7 THIS STUDY'S CONTRIBUTION TO EXISTING BODY OF KNOWLEDGE

A search for recent studies on corporate social performance and stakeholder management in the South African mining industry sector yielded a limited number of articles in the public domain. Much of the existing research addresses specific societal or regulatory developments, such as the impact of the end of the sanctions

on business (Kumar, Lamb & Wokutch, 2002), the impact of the Minerals and Petroleum Resources Development Act of 2002 and the effect of the proposed Royalty Bill on mineral property values. The more recent work by Hamann (2004) examines the corporate social responsibility, partnerships and the institutional context, using case studies for selected mining companies in South Africa, with the overarching conclusion that institutional changes have led to increased collaboration and commitment from industry on social issues.

This report will add to the body of knowledge by providing an insight into the response of the mining industry to secondary stakeholder demands for improved environmental performance. The report will assess the industry's response in the context of corporate social performance framework and an environmental strategy model. In so doing, the research will provide some indication on the extent to which stakeholder issues on the environment have permeated management thinking and actions in the mining industry.

1.8 OUTLINE OF RESEARCH REPORT

Chapter 2

This section provides insight on the theoretical framework concepts used as a basis for the research undertaken. Environment as a stakeholder issue for business is put into the context of the corporate social performance model developed by Carroll (in Carroll & Buchholtz, 2003). The model sub-dimensions of corporate social responsibility, corporate social responsiveness and stakeholder issues are examined. Stakeholder issues, as proposed by Carroll, are compared with those used by Kinder, Lydenberg, Domini & Company, a respected independent investment research and rating firm based in the Chicago, and with the recently launched South African Johannesburg Securities Exchange SRI Index (Carroll & Buchholtz, 2003).

The section also examines the natural resource-based model of Hart (1995), which provides a theory of competitive advantage based on a firm's relationship with the natural environment. Hart's framework model is used to place in context the environmental strategy options that have emerged in the mining industry.

Chapter 3

A literature review is included in this section of the report. The literature review provides insight into stakeholders and drivers that influence management approach to stakeholder issues. The review also reflects on some of the more prominent stakeholder management theories and provides the rationale for the choice of theoretical models used in the research.

Chapter 4

This chapter sets out the primary purpose of the research, the methodology for resolving the research hypothesis and the limitations of the study. The research report investigates the extent to which multi-national mining companies in South Africa are responding to secondary stakeholder demands for an improved environmental performance. Sub-problems and theory-based propositions were used to develop the research hypothesis aimed at resolving the overarching research objective. This section also provides details on multi-national mining companies selected for participation in the questionnaire-based survey. A sample of the research instrument used to source primary data is provided in Appendix 2.

Chapter 5

This chapter provides a statistical analysis of data obtained from the completed research questionnaires. The analysis presented includes assessments based on descriptive statistics, and Chi-square analysis based on contingency tables. The results are used to resolve the research problems. The analysis is guided by the use of two theoretical framework models.

Chapter 6

This chapter positions industry performance over the past decade on two theoretical framework models. A new model is proposed, which would assist industry to progress from pollution prevention strategy to the embedding of product stewardship

and sustainable development strategic capabilities. The report concludes with recommendations which will facilitate such an industry change.

CHAPTER 2

FOUNDATION OF THE STUDY

2.2 INTRODUCTION

Secondary stakeholders for the most part have remained peripheral to business activities, unless engagement was necessitated by specific circumstances or in response to a crisis. This is largely due to the fact that engagement with secondary stakeholders did not generally offer competitive advantage benefits for companies. However, as described earlier, regulatory and market developments, globally and particularly in South Africa, have had the effect of moving secondary stakeholder issues closer to business sphere of influence, a position traditionally only held by primary stakeholders.

The theories listed below provide the underpinning frameworks, which are of value in assessing the response of the mining industry to secondary stakeholder demands for improved environmental performance.

2.2 CARROLL'S CORPORATE SOCIAL PERFORMANCE MODEL

Carroll's conceptual model integrates the multi-dimensional elements of (a) corporate social responsibility, (b) corporate social responsiveness and (c) stakeholder issues, which together constitute the corporate social performance construct (Carroll & Buchholtz, 2003). A description of each of the three dimensions, as provided by Carroll and Buchholtz (2003), is provided below and illustrated in Figure 2.1.

Corporate social responsibility

The corporate social responsibility of the firm is considered in terms of a four-layered pyramid, where progress to the higher order category is dependent on meeting the requirements of the preceding category. Progressing to the peak, the four sub-categories of social responsibility are economic, legal, ethical and philanthropic. A brief description of each of the sub-categories is provided below.

- Economic responsibility - it is required of business to be profitable.
- Legal responsibility - it is required of business to comply with the law.
- Ethical responsibility - it is expected of business to do what is right, fair and just.
- Philanthropic responsibility - it is desired that business acts to improve community quality of life.

Corporate social responsiveness

The firm's mode of response to stakeholder issues is measured against an improving action-orientated continuum, starting from reaction (fight), defence, and accommodation to pro-action.

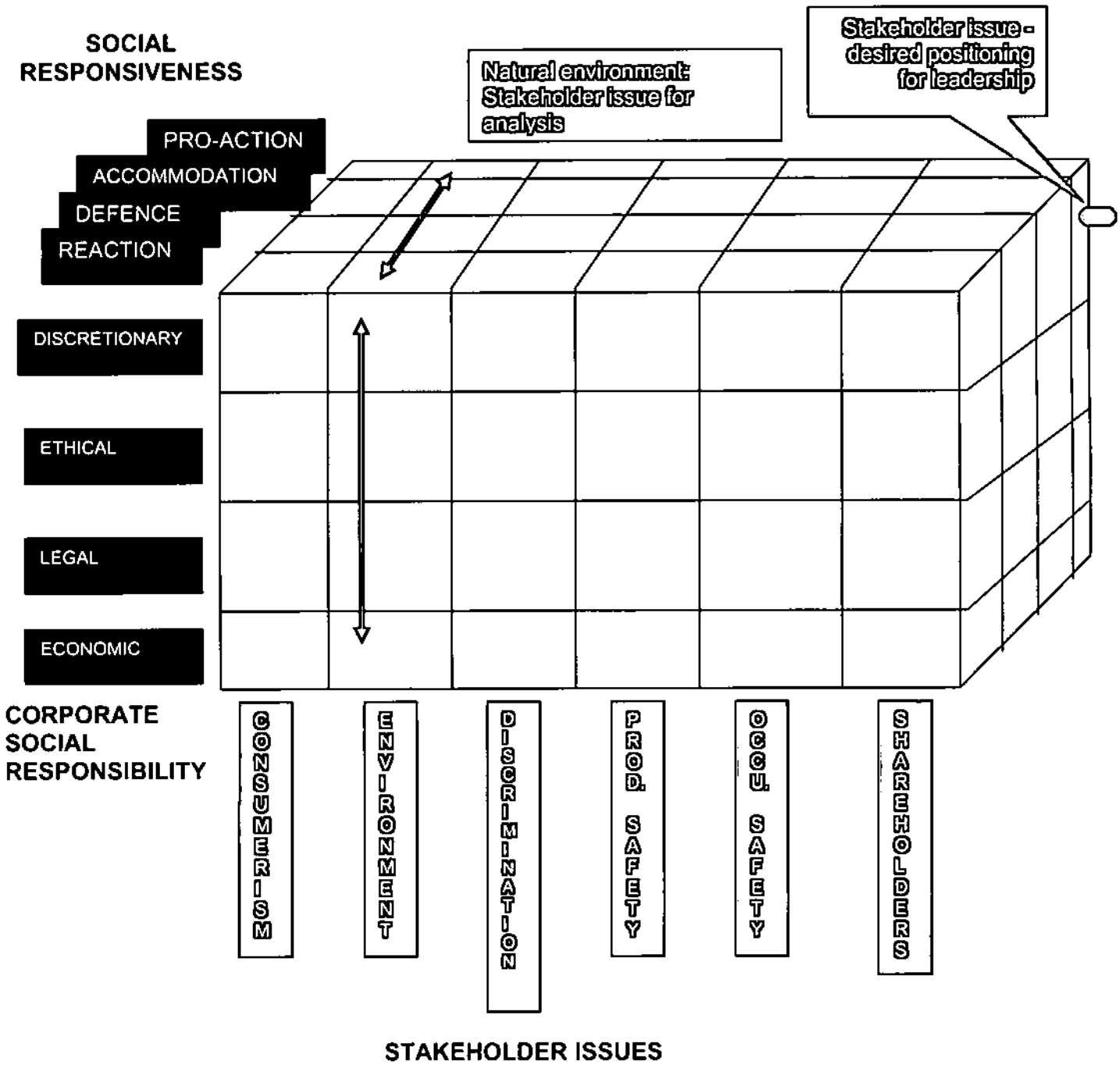
Social dimension

This relates to the scope of the stakeholder issue. Stakeholder issues are sub-divided into (a) consumerism, (b) the environment, (c) discrimination, (d) product safety, (e) occupational health and (f) shareholders. For a holistic assessment of business corporate social performance, all of the above-mentioned stakeholder issues will need to be considered.

A graphical depiction of Carroll's multi-dimensional corporate social performance model is provided in Figure 2.1. The conceptual model serves as a tool which could be used for strategic planning, diagnostic problem-solving and stakeholder management purposes (Carroll & Buchholtz, 2003). The natural environment as a stakeholder issue for analysis in this research report is highlighted in Figure 2.1.

Figure 2.1: Corporate social performance model

(Carroll and Buchholtz, 2003)



2.3 COMPARISON OF COMMONLY ANALYSED STAKEHOLDER ISSUES

The stakeholder issues as identified by Carroll and Buchholtz (2003), to a large extent match the more commonly used social dimensions, as defined and used by

Kinder, Lydenberg, Domini & Company (KLD). The KLD dimensions include (a) community relations, (b) employee relations, (c) women and minorities, (d) environmental issues and (e) product issues. KLD is an independent investment research and rating firm, which provides information on the corporate social performance of mainly large multi-national companies.

In 2005, the South African Johannesburg Securities Exchange launched a social responsibility rating, called the JSE SRI index. The JSE encourages companies listed on the exchange to participate in a questionnaire based assessment and rating of corporate social performance. The key categories (stakeholder issues) of the JSE SRI index include (a) the environment, (b) economy, (c) society and (d) governance. The national sustainability imperatives, most notably Black Economic Empowerment and HIV and AIDS, are included under the society category.

A comparison of the social dimensions as proposed by Carroll and Buchholtz, (2003), KLD and the JSE SRI index is provided in Table 2.1.

Table 2.1 Commonly analysed stakeholder issues

Carroll's Model	KLD	JSE SRI Index
Consumer	Community relations	Society
Environment	Environment	Environment
Discrimination	Women & minorities	Society
Product safety	Product issues	
Occupational safety	Employee relations	Society (occupational safety)
Shareholders		Governance

The environment is one of the more consistent social dimensions, and its sub-components, namely biodiversity, land usage, energy efficiency, water and air emissions, are readily comparable across the approaches taken by Carroll (in Carroll & Buchholtz, 2003), KLD and the JSE SRI Index. This suggests that the multi-national mining companies targeting best practice are confronted by broadly similar stakeholder issues in regard to the environment, irrespective of the geographical location of their operations. Further understanding of business engagement on the

environment could be obtained by a review of Hart's (1995) natural resource-based theory.

2.4 HART'S NATURAL RESOURCE-BASED THEORY

The resource-based theory articulates the relationship between a company's resources, capabilities and competitive advantage (Barney, 1991). The natural resource-based theory of Hart (1995) builds on the earlier resource based theory (Barney, 1991) and proposes a theory of competitive advantage based on the firm's relationship with natural environment. Hart's (1995) natural resource based view of the firm draws linkages between the interconnected environmental strategies of pollution prevention, product stewardship and sustainable development and their respective contributions to sustained competitive advantage (See Table 2.2 and Figure 2.2).

The theory is of considerable relevance to multi-national mining companies, where traditionally, efforts were made to mitigate just the direct operational impacts on the environment and hence, the adoption of environmental strategies for the prevention of pollution prevention. More recently however, companies in the mining industry are becoming increasingly engaged in environmental issues, which are of concern to secondary stakeholders, in particular governments, regulators, civic institutions, non-governmental pressure groups and the media. In response to this emerging trend, mining companies are examining the life cycle impacts of operations and products on the environment. This is reflected in the emergence of environmental strategies that now encompass elements of product stewardship and sustainable development. This perceived evolution of the industry's response to stakeholder issues on the environment, closely matches the component environmental strategies encompassed by the natural resource-based theory.

Table 2.2: The natural resource-based theory: Environmental strategy components

(Hart, 1995)

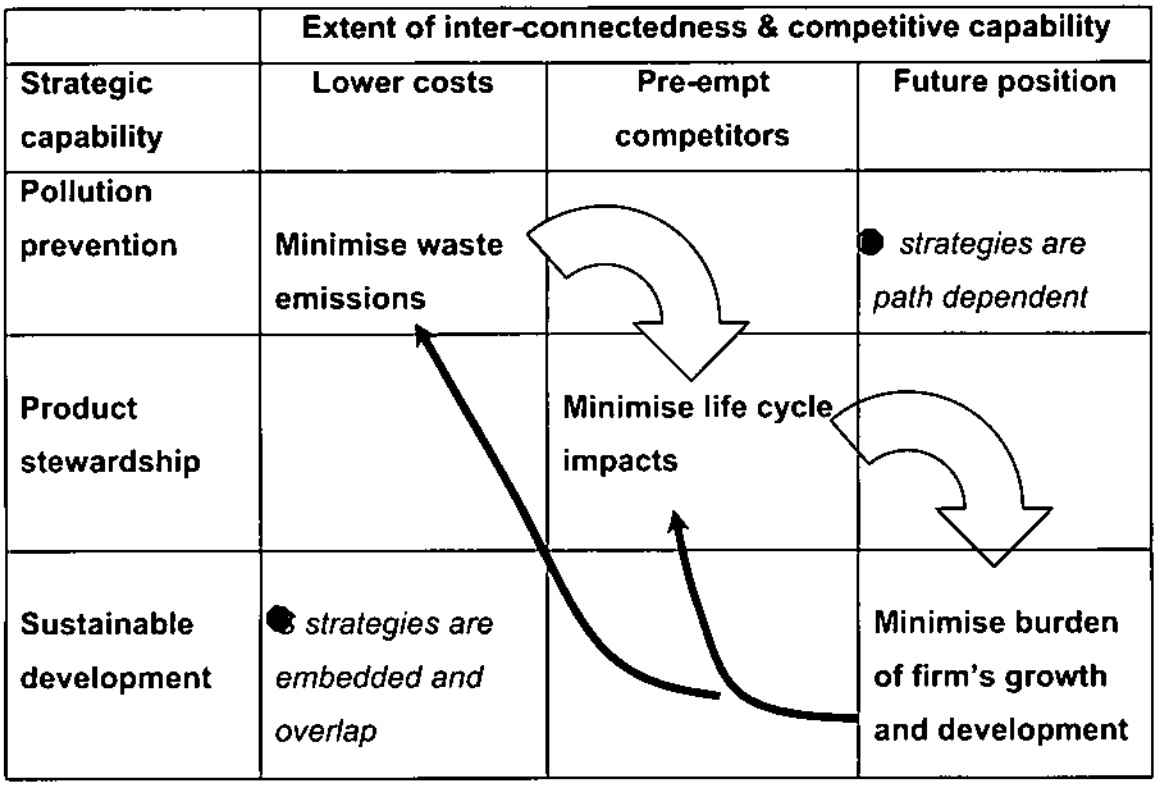
Strategic Capability	Driving Force	Key Resource	Competitive Advantage
Pollution prevention	Minimise waste emissions & discharges	Continuous improvement	Lower costs
Product Stewardship	Minimise life-cycle impacts of product	Stakeholder integration	Pre-empt competitors
Sustainable Development	Minimise burden associated with firm growth and development	Shared vision	Future position

Sustained competitive advantage requires a firm to look beyond the internal (primary stakeholders) approach and seek external (secondary stakeholders) social legitimacy and reputation. Hart (1995) argues that external legitimacy based orientation does not jeopardise competitive advantage and may reinforce and differentiate the firm's position through improved strategic decision-making and the positive effects of a good reputation.

Hart (1995) states that the three strategic capabilities, namely pollution prevention, product stewardship and sustainable development are sequential, implying that for a firm to achieve sustainable development, it would have first needed to embed a pollution prevention strategy succeeded by embedding product stewardship. The interconnectedness of the three strategic capabilities is illustrated in Figure 2.2.

Figure 2.2 The natural resource-based theory: Competitiveness capability and environmental strategy

(Hart, 1995)



Hart (1995) suggests amongst others, the following propositions for each of the strategic capabilities, to determine the positioning of a firm on a natural resource based conceptual model.

Pollution prevention

- Over time, a pollution-prevention strategy will move from being an exclusively internally focused process to an external (stakeholder) legitimacy based activity.

Product stewardship

- Firms that adopt product-stewardship strategies will display inclusion of external stakeholders in the product development and planning process.

- A product stewardship strategy will extend beyond the pre-emption of firm-specific resources and use a life cycle analysis approach to become a stakeholder orientated – legitimacy based process.

Sustainable development

- A sustainable-development strategy will extend beyond the firm to include collaboration between public and private organisations which is needed to bring about substantial technological change.

2.5 APPLICATION OF THEORY

The framework model and theoretical propositions developed by Hart (1995) serve as a guide for the research assessment of the mining industry environmental performance. Carroll (Carroll & Buchholtz, 2003) provides a conceptual model which positions the environment as a stakeholder issue in the context of other key stakeholder issues encompassed by corporate social performance. Both theoretical models are of value in positioning industry's environmental performance and the related development of strategic capabilities.

CHAPTER 3

LITERATURE REVIEW

3.1 INTRODUCTION

The literature review provides insight into the concept of stakeholders, stakeholder management, drivers influencing stakeholder management and associated trends and issues. Two theoretical framework models of corporate social performance (Carroll & Buchholtz, 2003) and the natural-resource-based view of a firm (Hart, 1995), are explored in some detail. These framework models assist in understanding the wider context and organisational strategy options for managing secondary stakeholder issues on the natural environment. As much of the literature is not written in a South African context, where appropriate, relevance to developments in the South African mining industry sector is illustrated.

3.2 STAKEHOLDER DEFINED

Carroll and Buchholtz (2003) define a stakeholder as any individual or group who can affect, or is affected by, the actions, decisions, policies, practices or goals of the organisation. These individuals or groups can be subdivided into primary or secondary stakeholders. Primary stakeholders have a direct and well-established legal claim on an organisation's resources and include amongst others, shareholders, customers, suppliers and employees. Jones (1999) refers to secondary stakeholders as those parties that have a less established legal claim on organisational resources and/or are based on "non-binding criteria such as community loyalty or ethical obligation". The secondary stakeholders to a large extent depend on specific resource allocation at issue and include, amongst others, government, community, non-governmental organisations and the environment.

In context of the South African mining sector, the power and urgency of secondary stakeholders, particularly government and communities has been significantly strengthened by the introduction of new legislation since the commencement of the new political dispensation in 1994.

3.3 STAKEHOLDER MANAGEMENT

In terms of stakeholder theory, shareholders are identified as one of multiple stakeholder groups that management must consider in the business decision-making process (Clarkson, 1995). According to Freeman (1984), stakeholder management as a component of business practice involves allocating organisational resources in such a way as to take into account the impact of such allocation on various groups within and outside of the business.

There exist various interpretations of the business approach to stakeholder management. According to Marcus (1993), stakeholder management is based on five generic strategies, namely: narrow, financial, utilitarian, social justice and social harmony. These generic strategies range from arguments that maximise the narrow economic goals for selected primary stakeholders, such as shareholders, to those that seek a more complex optimisation of multiple economic and social goals for numerous primary and secondary stakeholders. According to Ruf, Muralidhar, Brown, Janney and Paul (2001), businesses that adopt a stakeholder theory perspective assess their corporate social performance, in terms of the company's ability to meet the demands of multiple stakeholders, as an unavoidable cost of doing business.

3.4 STAKEHOLDER THEORY AND CORPORATE SOCIAL PERFORMANCE

According to Jones (1999) stakeholder theory is the key to understanding the structure and dimensions of an organisation's internal and external societal relationships. Wood (1991) defined corporate social performance as "an organisation's configuration of principles of social responsibility, processes of social responsiveness, and policies, programs and observable outcomes as they relate to the firm's societal relationships".

Carroll (1979) developed a corporate social performance model that integrates the dimensions of social responsibility, social responsiveness and stakeholder issues, see Figure 3.1. The component dimensions of the model as re-stated by Carroll and Buchholtz (2003) are summarised below.

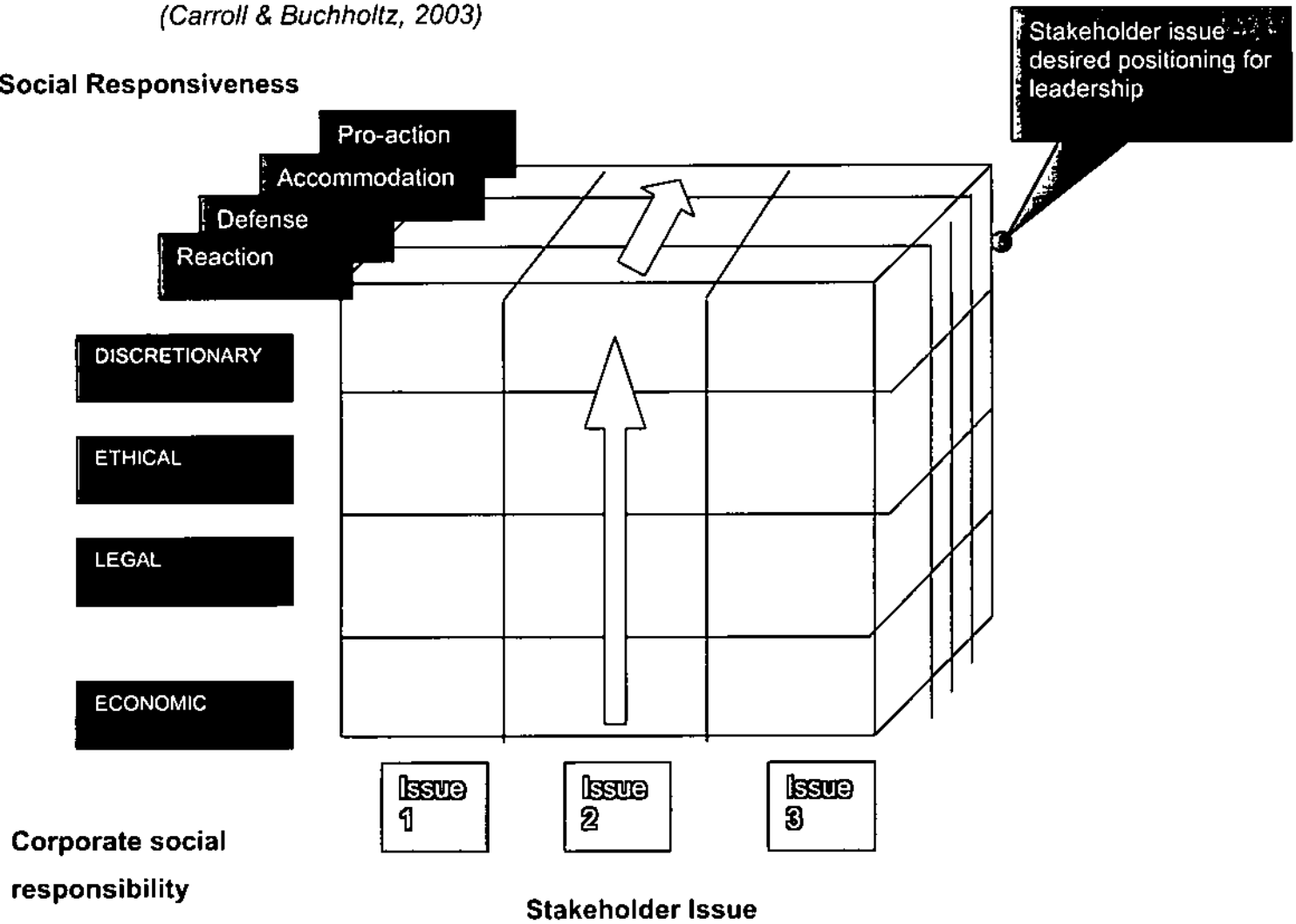
- **Corporate social responsibility** encompasses the economic, legal, ethical and discretionary (philanthropic) expectations that society has of organisations at a given point in time. For a progressive evolution, an organisation will need to exceed legal compliance and meet ethical and discretionary expectations.

- **Corporate social responsiveness** is the action phase of management response and can be broadly broken down into four types namely, reaction, defence, accommodation and pro-action.

- **Stakeholder/social issues** relate to the broad scope of the social issue involved. Examples include the environment, product safety, racial and gender discrimination and consumerism.

Figure 3.1: Carroll's corporate social performance model

(Carroll & Buchholtz, 2003)



Carroll's (Carroll & Buchholtz, 2003) corporate social performance model is both dynamic and outcomes based. The model was developed as part of the trend of making the concern for social and ethical issues more pragmatic and transparent. The model is useful in both the research and business perspectives. For the academic community, the conceptual model is an aid to perceiving the distinction among the concepts of corporate social responsibility and as a step towards understanding the major facets of corporate social performance.

In the business environment, the model provides managers the means to integrate economic concerns within a social performance framework. The model also serves as a guide for systematic thinking and organisational planning on major stakeholder issues. The model also serves as a basis for planning of longer-term organisational strategy shifts in management of secondary stakeholders. This is achieved through integrating stakeholder attribute levels of power, urgency and legitimacy with organisational corporate social performance. In addition to providing an overall perspective of stakeholder performance, the model lends its self for the understanding organisational positioning on individual stakeholder issues.

Carroll's model (Carroll & Buchholtz, 2003) enables organisations to examine performance on 'multiple bottom lines' as they relate to impacts on multiple stakeholders. Amongst others, these include the Shareholder / Financial Bottom Line, the Consumer Bottom Line and the Community Bottom Line. The 'multiple bottom line' approach can serve as means for embedding an effective stakeholder management capability within organisations. According to Carroll and Buchholtz, (2005) the ultimate form of stakeholder management is the 'stakeholder corporation' which is premised on stakeholder inclusiveness and the approach that recognises that all stakeholders depend on each other for their success and well-being.

Similar to Carroll, Wood (1991) developed a corporate social performance model, which included the dimensions of social responsibility, social responsiveness and the outcomes of corporate behaviour. Clarkson (1995) also developed a corporate social performance model that identifies specific problems for key stakeholder categories.

3.5 ENVIRONMENT STRATEGY AND COMPETITIVE ADVANTAGE

Carroll's framework model offers a clear linkage on environmental stakeholder issues with Hart's (1995), natural resource-based theory. The natural resource based theory examines a firm's competitive advantage, based on its relationship with the natural environment through interconnected strategies of pollution prevention, product stewardship and sustainable development (Hart, 1995). Key elements of each of the environmental strategies as provided by Hart (1995) are summarised below.

- **Pollution prevention**

Pollution prevention occurs when emissions are reduced, changed or prevented, through material substitution, recycling or process innovation and it is thus analogous to total quality management. It requires employee involvement and continuous improvement, rather than expensive 'end of pipe' interventions. Through pollution prevention, companies have the potential to realise savings over competitors. As firms progress to zero emissions, emission reduction becomes capital intensive and may require considerable changes to product design and technology. Evidence however suggests that pollution prevention projects not only cut compliance and liability costs but also generate significantly high rates of return.

- **Product stewardship**

Product stewardship is a life-cycle approach, which focuses on environmental impacts of activities at every step of the value chain, from raw access to materials, through the production processes, to disposal of the used product. Product stewardship seeks to integrate external (secondary) stakeholder perspectives into product design and development processes.

The options available to firms are either to withdraw from environmentally hazardous business, redesign existing product systems to reduce liability or develop new products with lower life-cycle costs. Competitive advantage is secured through competitive pre-emption. The sources of such advantage include preferred or exclusive access to important but limited resources (e.g. mining permits, customers),

and by working with other stakeholders and establishing rules, regulations or standards that are uniquely beneficial to the firm's capability.

- **Sustainable development**

This includes efforts to achieve pollution prevention and product stewardship, but dictates that these are not confined to developed world geographies, but applied to all geographies of activities including the firm's expansion into developing countries. In addition, sustainable development strategy advocates that firms consider building markets in developing economies, whilst reducing the environmental burden created by new economic activity in those regions.

The competitive advantage rests with expectations of the future performance of the firm relative to its competitors. Sustainable development is therefore better suited to firms with a long-term vision, capable of introducing low impact technology and products as a basis for market entry and development.

As such, sustainable development is appropriate for multi-national companies in the mining sector with prospects in developing countries, where the life of mine projects extend over a number of decades.

The natural resource based theory was successfully applied by Sharma and Vredenburg (1998), in a study of the Canadian oil and gas industry sector. Using the natural resource based theory, Sharma and Vredenburg (1998) found evidence of the relationship between valuable organisational capabilities and proactive environmental strategies.

3.6 DEBATE ON CORPORATE SOCIAL PERFORMANCE

The historical argument against corporate social performance is based on two concepts, namely institutional functions and property rights. In the case of the institutional functions, it is argued that government, churches, unions and civic associations have the skills and time and that they are accountable for social responsibility functions. By extending its management role into this area, business gains significant authority without accountability. The property rights argument

against corporate social performance is premised on the view that management has no right to do anything other than act in ways which increase shareholder value of the business.

According to Andrews (1989), historical arguments for corporate social performance were derived from either religious principles or a philosophical framework. The ethical approach is based on the notion that corporate social performance will benefit the business as a whole over the long-term, and potentially provides businesses a proactive stance with secondary stakeholders. The benefits of this are often intangible, but could manifest in the ability of businesses to influence implementation of new regulations and to exploit opportunities arising from increased levels of cultural and environmental awareness that enables differentiation of products.

3.7 DRIVERS FOR STAKEHOLDER MANAGEMENT

Jones (1991) suggests that certain institutional conditions are necessary for organisations to adopt a stakeholder management approach. Key amongst these is the presence of an organisational environment in which stakeholder management is perceived as an institutionally legitimate process for resource allocation. According to Jones (1999), the drivers that lead businesses to implement a stakeholder management approach can broadly be subdivided into socio-cultural, national, industry, firm and the individual. All of these are interrelated and are examined in more detail below.

Socio-cultural

The socio-cultural driver is dependent on the manner in which capitalist discourse has evolved. By way of example, Bowles and Gintis (1987), state that the clash between property rights (capitalism) and citizenship (democracy) centres on the notion of ownership, which is essentially the right to exclude secondary stakeholders from participating in proprietary processes or outcomes. Asian capitalism is significantly different, placing a lower emphasis on individualism, with institutions promoting trust and reciprocity. The difference could be summarised as western capitalism that is directed towards maximising profits for owners and a progressive

alternative, which attempts to contain negative externalities and promote stakeholder management.

National

According to Cannon (1994), there is ample evidence to suggest that social responsibility is positively related to society's level of economic development and modernisation. This is illustrated by the extent to which regulatory standards for environmental protection and workplace safety vary according to the level of economic development. The link however, between national economic development and the power of secondary stakeholders, is tenuous. With rapidly advancing and widely available communications and information technology, secondary stakeholders in even remote communities now have easier access to powerful international organisations and due process. It could be argued that the power of secondary stakeholders is no longer completely restricted by the national level of economic development.

Industry

An organisation's corporate social performance appears to some extent to be a function of the industry within which it is embedded (Jones, 1999). The industry profile in terms of public visibility and the degree of scrutiny from government and non-governmental organisations, is associated with intensity of stakeholder action. According to Rowley and Berman (2000), higher levels of stakeholder action are likely to be found in industries that are closer in the value chain to consumers as well as those industries that have the potential to cause great harm to human life and the environment, such as the chemicals and extractive industries.

Industry culture is also a determinant of orientation to corporate social performance at the organisational level. By way of example, leading companies in the extractive industries have established the International Council of Mining and Metals (ICMM), which has set minimum sustainable development criteria for member companies. In so doing the ICMM has promoted a culture of continuous improvement in stakeholder management. The South African Chamber of Mines is an industry organisation, which provides a forum for the major mining houses to discuss a range of common

stakeholder issues. These include a common platform for engagement with trade unions, consolidated responses to government regulations and international lobbying on environmental issues.

Organisation

According to Ruf, et al., (2001) the relationship between a firm and its stakeholders can be considered from two perspectives, namely an economic cost view and a resource based view. The costs perspective is based on the Game Theory, and examines how firms' approach opportunities and their ability to seek out co-operation to achieve win-win solutions. The level of negative stakeholder intervention in a firm's activities is related to the imbalance in firm-stakeholder relational contracts.

In the resource based view, firms can achieve sustained competitive advantage if they posses resources that are valuable, rare and non-substitutable, including intangible resources such as social reputation (Ruf, et al. 2001). According to Russo and Fouts (1997), firms can create and exploit resources that provide a sustainable competitive advantage, by moving from compliance orientation to active support of stakeholder demands.

Hart (1995) builds on the resource-based theory and proposes a natural resource based model, which reflects the constraints imposed by the natural environment. With the natural resource-based theory, Hart (1995) illustrates that an organisation's competitive advantage relates to the interconnected strategies of pollution prevention, product stewardship and sustainable development.

Individual

The preceding levels of drivers for stakeholder management, (socio-cultural to organisational level), provide the enabling conditions for stakeholder management to manifest within an organisation's strategy (Jones, 1999). It is however the individual within an organisation, who determines the nature of stakeholder management and associated corporate social performance.

It is argued by Jones (1999) that, all else being equal, in cases where institutional factors enable decision-makers to act in a manner that promotes corporate social performance, only those leaders who value such activity will do so. This suggests that the leaders' value system is a stronger determinant of a firm's potential for stakeholder engagement than its organisational control systems and strategic planning.

3.8 ISSUES AND TRENDS IN STAKEHOLDER MANAGEMENT

Although there are many of stakeholder priorities, from the literature review there are a few key issues and trends that have come under more detailed investigation from both organisations and the academic research fraternity. Most notable amongst these is the assessment of potential linkages between an organisation's corporate social performance and its financial performance. Other priority issues in stakeholder management include linkages to risk exposure, employer attractiveness and reputation. The results of a literature review on these potential linkages are discussed below.

Corporate social performance and financial performance

There is a mixed assessment on the strength of the link between corporate social performance and financial performance, with a range of arguments offering explanations for negative, neutral or positive relationships. According to Waddock and Graves (1997), the negative relationship is consistent with the argument that positive social performance causes a firm to incur costs that reduce profits and shareholder wealth. McWilliams and Siegel (2001) argue for a neutral link between social and financial performance on the premise that at equilibrium, firms produce at profit maximising level, including the production of social performance.

There are varied explanations for a positive linkage between social and financial performance. One perspective is the tension between a firm's explicit costs (e.g. cost of capital) and its implicit costs (e.g. safety or product quality costs). Waddock and Graves (1997) suggest that attempts to decrease implicit costs by socially irresponsible actions (e.g. diminished safety standards) result in higher explicit costs. A second perspective suggests that the actual costs of social performance are

minimal compared to the potential benefits to the firm. A third perspective is that the financially successful firm has slack resources as a result of superior financial performance, which can then be used to improve its social performance. Empirical work undertaken by Simpson and Kohers (2002), specific to the commercial banking industry, confirms a strong positive relationship between social and financial performance. The empirical research, however, did not extend to an analysis of causation. On the whole it would appear that the research has largely been inconclusive on a positive correlation between social and financial performance.

Risk and stakeholder management

From a stakeholder theory perspective, improving corporate social performance is expected to decrease a firm's financial risk (Orlitzky & Benjamin, 2001). Recent examples in South Africa of high financial risk caused by low social performance are the law suits against mining companies for asbestosis and silicosis, and non-governmental action against petroleum companies in the Durban South Basin for air pollution.

According to Orlitzky and Benjamin (2001) an organisation's risk is impacted by the absence of proactive engagement with stakeholders and lack of socially responsible actions. This could manifest in not only civil and criminal legal proceedings, but also in the increased likelihood of regulatory intervention by government. It could be argued that government's unexpected introduction of the Minerals and Petroleum Resources Development Bill in 2002, which significantly affected the share price of South African mining companies, was as a consequence of lack of progress in Black Economic Empowerment in the mining sector.

The increasing interest in ethical investing and in the emergence of sustainability benchmark indices in the world's major stock exchanges, such as the Dow Jones Sustainability Index, reflects a rise in investor consciousness and understanding of business stakeholder risk. There is a growing demand from the investment community for improved disclosure practice and a further recognition that traditional financial reporting does not provide sufficient information needed by investors to evaluate business performance (World Wildlife Fund, 2006). A growing number of large multinational companies are opting to complement financial reporting with

sustainability reports. Often such reports are structured in accordance with the benchmark Global Reporting Initiative (GRI) Guidelines and include third party assurance statements to emphasise the credibility of the information provided.

Corporate social performance and employer attractiveness

Companies have long recognised the importance of attracting and retaining talented staff in order to maintain their competitive position. According to the World Wildlife Fund (2001), improved social performance positively influences levels of employee satisfaction, performance and retention. Some leading companies also claim that improved performance can enhance a company's image, thereby making it easier to attract talented new employees. The World Economic Forum CEO Survey (2003), listed talent attraction and retention as a key value driver for improved social performance.

A study by Luce, et al. (2001) examined the effect of firm familiarity in assessing the relationship between corporate social performance and organisational attractiveness. The results of this study suggest that it is the publicity value of corporate social performance that is the most relevant attribute in assessing employer attractiveness during the employment process. This once again emphasises the link between corporate social performance and the building of a corporate image with stakeholders. This is of particular significance to the mining industry, which, both in South Africa and internationally, has difficulty in recruiting new graduates into the industry sector.

Corporate social performance and reputation

According to Hall (1993), corporate reputation is defined as the set of knowledge and emotions held by stakeholders concerning aspects of the firm and its activities. Szwajkowski and Figlewicz (1999), define reputation as the net present value placed on a company's accomplishments and prospects and hence as society's counterpart of a company's stock market return or share price. Jones and Murrell (2001), contend that publicity around the social performance of a firm serves as a signal, which stakeholders use for evaluation purposes.

Empirical research undertaken by Zyglidopoulos (2001) into the impact of accidents on reputation highlighted a counterintuitive finding that the severity of accidents with respect to environmental damage has a greater impact on a firm's reputation for social performance than a firm's damage to human life. The report also highlighted that it is the 'tone' of media attention that causes changes in a firm's reputation.

Organisations within the mining industry, through the nature of their core activities, hold inherent health, safety, environmental and community risks. In such an industry sector, it could be argued that good corporate social performance can serve as safeguard against a sudden and dramatic drop in public and market reputation.

3.9 CONCLUSION

Historically, primary stakeholders have come under the focus of management, whilst the role of secondary stakeholders seemed peripheral to an organisation's performance. More recently it would appear that secondary stakeholders have gained in legitimacy and are beginning more directly to influence an organisation's ability to conduct its business activities. Equally important is the momentum building in multi-national companies and in industry associations to respond effectively to secondary stakeholder challenges. This is most aptly reflected in the global response to the impact of climate change on a specific non-social stakeholder, namely the natural environment. Although the results of the literature survey appear mixed, there are potentially significant long-term sustainability benefits for organisations which adopt a progressive approach to stakeholder management.

The South African mining industry is currently in the midst of a transition period, in which secondary stakeholders are actively narrowing the difference between their expectations and the actual corporate social performance of organisations. By way of example, government introduction of environmental legislation such as the Protected Areas Bill (1998), the Biodiversity Bill of 2003, and the Air Quality Act (2004), has raised the standards required for environmental compliance by industry. The impact of the Air Quality Act can be gauged by the recently announced decision taken by Engen to spend R2.4billion in order to reduce the sulphur content in diesel (Engen clean fuel project, 2006:1).

Through regulatory changes, the leverage available to non-governmental organisations on industry has increased. A recent example is the collective efforts of the Richards Bay Clean Air Association, the Wildlife and Environment Society of South Africa and Groundwork, which resulted in a two year delay before Tata Steel could secure approval for construction of a R650million smelter in Richards Bay (Tata Mill, 2006). It is in this context that the mining organisations need to consider their stance on secondary stakeholders and potentially avert further interventionist actions.

The dilemma however, for multi-national organisations, is the need to shift their stance on corporate social performance fundamentally, whilst at the same time meeting the economic growth aspirations of largely foreign-based shareholders. These developments will require organisations to raise their understanding of secondary stakeholders, develop a holistic approach to corporate social performance and adopt adequate response measures, which may necessitate new types of alliances with secondary stakeholders.

From the literature review, it would appear that Carroll's corporate social performance model (Carroll & Buchholtz, 2003) although less technical than those developed by Wood (1991) and Clark (1995) makes it easier to conceptualise the positioning of management actions on a range of stakeholders issues.

The model provided by Hart (1995) offers a framework from which to examine more closely the environment as a stakeholder issue within the corporate social performance model developed by Carroll (Carroll & Buchholtz, 2003). Taken together, both Carroll's corporate social performance model (Carroll & Buchholtz, 2003) and Hart's natural resource-based theory offer a theoretical foundation which could be used at an organisational and industry sector level to develop roadmaps to align and balance future initiatives to achieve specific stakeholder engagement objectives. The two theoretical models were therefore selected in order to resolve the objectives of the research report.

CHAPTER 4

PROBLEM STATEMENT AND RESEARCH METHODOLOGY

4.1 PROBLEM STATEMENT AND HYPOTHESIS

The primary purpose of this research report is to investigate the extent to which the mining industry in South Africa is responding to secondary stakeholder demands for an improved environmental performance.

The following sub-problems and theoretically based propositions have served as basis for development of the research hypothesis.

Sub-problem 1

The objective is to investigate the extent to which the industry has embedded strategic responses for improved environmental performance into operational activities.

Proposition 1

"Industry that adopts pollution prevention strategies will evidence reductions in emissions intensity", adapted from the proposition developed by Hart (1995).

Research hypothesis 1

The greater the industry adoption of environmental response strategies at the operational level, the more likely the improvement, (reduction) in industry emissions intensity.

Rationale for hypothesis 1

To deliver improved environmental performance, industry will need to have established emissions reduction targets and embedded strategies that enable operations to meet the improved environmental standards.

Sub-problem 2

The second objective is to investigate the extent to which the industry makes use of partnerships with secondary stakeholders to improve environmental performance.

Proposition 2(a)

"Industry that adopts product stewardship strategies will evidence inclusion of external stakeholders in product development and planning processes," proposition developed by Hart (1995).

Proposition 2(b)

"The more that performance measures target domains of high concern to the firm and its stakeholders, the more likely will performance actually be enhanced," proposition as developed by Mitnick (2000).

Research hypothesis 2

The greater the industry adoption of a partnership approach with secondary stakeholders on environmental issues, the more likely the improvement, (reduction) in industry emissions intensity.

Rationale for hypothesis 2

For industry to understand and respond to emission impacts on the environment, as perceived by secondary stakeholders, it would need to inform, as well as enter into dialogue, and develop partnerships with, secondary stakeholders.

Sub-problem 3

The third objective is to investigate the extent to which the industry has adopted a product stewardship led strategy in the use of cleaner processes and technologies to reduce environmental impacts.

Proposition 3a

"A product stewardship strategy will extend beyond the pre-emption of firm-specific resources to use of a life cycle analysis to become a stakeholder orientated process," proposition as developed by Hart (1995).

Proposition 3b

"A product stewardship strategy facilitates and accelerates the capability development in pollution prevention," proposition as developed by Hart (1995)

Research hypothesis 3

The greater the industry adoption of a product stewardship led strategy in the use of cleaner processes and technologies, the more likely the improvement (reduction), in industry emissions intensity.

Rationale for hypothesis 3

For product stewardship led strategy, industry will need to recognise and seek to mitigate environmental impacts that occur throughout the life cycle, including emissions associated with the product. A product stewardship led strategy will be evidenced by the emphasis on and implementation of cleaner processes and technologies, including the use of the product.

4.2 RESEARCH DESIGN

The research will provide a cross-sectional study of the mining industry's response to secondary stakeholder issues on the environment. The organisations targeted for this research include the following multi-national mining companies; Anglo American, AngloGold Ashanti, BHPBilliton, De Beers, Kumba Resources, Sasol and Xstrata, Anglo Base Metals, Anglo Coal and Anglo Ferrous Metal.

The last three organisations listed above are divisional units of Anglo American, which although wholly owned by the parent company, are separately managed multi-national organisations and hence for the purposes of this research are treated as multi-national companies.

Target population and sampling

The multi-national companies dominate the industry sector and account for the major portion of mining and related activities in South Africa and were therefore selected as the focus for this research. Due to the scale of their activities, the multi-national companies account for the great majority of the industry's environmental impacts in

each of the commodity sectors. Due to the differences in resources available, stakeholder related interventions undertaken by multi-national companies have the potential to make a significantly bigger difference than those undertaken by junior and small-scale miners.

All of the multi-national mining companies targeted for research have corporate offices located in Johannesburg. This concentration in one location facilitates data collection by providing easy access to the managers of the companies included in the study. The target population will be the senior managers who have extensive experience and are directly involved in environment related, stakeholder issues at multi-national mining companies. The sampling frame consists of senior managers employed in one or more of the following functional areas:

- sustainable development;
- environment / rehabilitation;
- community engagement;
- industry affairs;
- government relations; and
- public affairs

In addition to management level experience, the target population needs to have a level of practical experience in engaging with secondary stakeholders on environmental issues. The practical experience fosters greater depth of knowledge of secondary stakeholders as well as organisational and industry performance in addressing the range of stakeholder expectations. Such engagements include amongst others, participation in multi-stakeholder associations, government and research forums, communications with media and community liaison.

Based on to the above-mentioned screening requirements, a total of 48 senior managers were identified and constitute the target population. The sampling frame is based on company representatives on the Chamber of Mines environment and sustainable development related committees, as well as those identified through the snowball effect, using references provided by the Chamber of Mines. Given that there are a limited number of senior managers employed in the above-mentioned functional areas, it is anticipated that the sample size will be in excess of 5% of the

target population. A high response rate is anticipated, given the author's working relationship with the majority of the target population. Proportionate stratified sampling will be undertaken, so that the total sample will be equally allocated to the multi-national mining companies.

Data collection and measurement instrument

A structured questionnaire based survey was selected for data collection. The majority of the 48 senior managers participating in the survey are often out of office on either domestic or international business travel and hence required flexibility in the manner in which they could participate in the survey. This was achieved through advance notice by e-mail and subsequent use of e-mail correspondence to forward the covering survey letter and blank questionnaires and to receive the completed forms. In some instances, where practical, meetings were scheduled to collect completed forms and if necessary, to discuss issues raised in the questionnaire. Although a qualitative interview based methodology for data collection is equally appropriate, the methodology was not selected. This was due to the time constraints of the target population, and the need to have adequate data representation from each of the commodity sectors. Use of an interview based quantitative methodology would require a significantly longer timeframe to achieve adequate representation in the data collected.

The questionnaire is based on the research instrument used by Sharma and Vredenburg (1998) in their analysis of the environmental strategies and the development of organisational capabilities in the oil and gas industry sector in Canada. The 95 item, 7-point, Likert-type, continuous scale research instrument used by Sharma and Vredenburg (1998) was pre-tested with 25 oil and gas industry managers for reliability. The results exhibited high reliability, with Cronbach's coefficient alpha at above 0.8. The research undertaken by Sharma and Vredenburg (1998), tested and evidenced support for the Hart's (1995) theoretical argument on proactive environmental strategies, as proposed in the natural resource-based theory.

The research instrument used by Sharma and Vredenburg (1998) is considered appropriate, given the similarities in application to this study, as listed below.

- Information is sourced from the major players within the industry sector in order to gain an overall industry perspective.
- Both the oil and gas and mining industry sectors are involved in the extraction of non-renewable resources.
- Both industry sectors have significantly large environmental footprints and to an extent are similarly exposed to international and national regulatory constraints on the environment.
- Although there are differences in economic development and culture between South Africa and Canada, the environmental constraints on and the stakeholder issues connected to both industry sectors are similar and pertain to land, water and air pollution, the legacy of environmental degradation and product life-cycle impacts.
- In both instances, the research data is sourced from managers in major companies who are knowledgeable about the phenomena measured.
- In both instances, the research instrument is used to measure industry response to environmental issues.
- In both instances, Hart's (1995) natural resource-based model is used to evaluate the response of the industry to environmental issues.

For the resolution of the research problem and the hypothesis testing, the data obtained by use of the research instrument will be supplemented by data consolidated from annual sustainable development performance reports, issued by the targeted multi-national companies, as well as commodity specific industry publications and industry data published by the Chamber of Mines of South Africa.

4.3 DATA ANALYSIS

Descriptive statistics will be used to analyse data for measures of location, spread and shape. It is envisaged that regression analysis will be used, and that much of the statistical significance for hypothesis testing will be undertaken using non-parametric tests. Responses to the questionnaire-based research instrument will be used for the statistical analysis, and, where appropriate, the responses will be cross-checked with data sourced from publicly available reports. All data analysis will be undertaken with reference to statistical methods as provided by Cooper and

Schindler (2003). The details about the research instrument are provided in Section 4.5, and a copy is included in Appendix 2. The data source and statistical analysis envisaged for hypothesis testing is summarised below.

Research hypothesis 1

The first 16 items in the research instrument are used to measure the extent of environmental practices adopted by the industry to reduce environmental impacts. High scores on these items will indicate the embedding of a proactive environmental response strategy, whilst low scores on the opposite end of the scale will indicate a reactive response. Items 17 to 25 on the research instrument are used to measure the change in industry emissions since 1996, with high scores indicating an improvement, (reduction) in industry emissions intensity.

Using statistical procedures, Hypothesis 1 will test whether, the scores for environmental response strategies relate to scores for reduced emissions intensity. The data on the actual industry emissions trend as from 1996 will be sourced from publicly issued company and industry annual environmental and sustainability reports will be used for cross-checking purposes.

Research hypothesis 2

Items 26 to 41 of the research instrument constitute a measure of industry and secondary stakeholder partnerships on environment. High scores on these items indicate a proactive industry stance in establishing partnerships to reduce environmental impacts, whilst low scores will indicate a reactive response. Items 17 to 25 on the research instrument are used to measure the change in industry emissions since 1996, with high scores indicating an improvement (reduction) in industry emissions intensity.

Using statistical procedures, Hypothesis 2 will test whether the scores for industry stance on establishing stakeholder partnerships relate to scores for reduced industry emissions. The data on the actual industry emissions trend as from 1996 will be sourced from publicly issued company and industry annual environmental and sustainability reports will be used for cross-checking purposes.

Research hypothesis 3

Items 42 to 59 of the research instrument constitute a measure of how far industry has adopted cleaner processes and technologies to reduce environmental impacts, including emissions in product use. High scores on these items indicate a proactive industry stance in adopting a product stewardship led strategy to reduce environmental impacts. Items 17 to 25 on the research instrument are used to measure the change in industry emissions since 1996, with high scores indicating an improvement (reduction) in industry emissions intensity.

Using statistical procedures, Hypothesis 3 will test whether the scores for industry stance on a product stewardship led strategy relate to scores for reduced industry emissions intensity. The data on the actual industry emissions trend as from 1996 will be sourced from publicly issued company and industry annual environmental and sustainability reports will be used for cross-checking purposes.

4.4 LIMITATIONS OF THE RESEARCH

The research is restricted to multi-national companies with mining operations in South Africa. The research does not assess individual mining companies, but aims to obtain a cross-sectional perspective of the industry as a whole. The study is specific to secondary stakeholder issues on the environment. The research report therefore does not provide a holistic appraisal of the mining industry's corporate social performance, although the result could be used as input for such an analysis. An analysis of the mining industry's corporate social performance will require an evaluation of additional primary and secondary stakeholder issues including occupational safety, occupational health, discrimination, Broad Based Black Economic Empowerment, community upliftment and product safety.

The study examined the industry adoption of partnerships with secondary stakeholder on the basis environmental issues, however it could be that such environmental partnerships are consequent upon or subservient to, industry relationships initially developed on community or other stakeholder issues.

The research relies heavily on the views of company managers, which could be considered a methodological weakness often found in corporate strategy research (Sharma & Vredenburg, 1998). To some extent this weakness is offset by the use of supplementary data sourced from publicly available corporate and industry environmental and sustainability reports.

The research instrument used in this study is adapted from the instrument developed, tested and used by Sharma and Vredenburg (1998) on the oil and gas industry in Canada. Both industry sectors are involved in the exploitation of non-renewable natural resources and share a number of similar environmental regulatory and market constraints. Although the stakeholder issues on the environment are generally common to both studies, ideally it would have been preferable to base the study on prior research specifically undertaken in the domestic mining industry sector.

The research is limited to the use of Carroll's corporate social performance model (Carroll & Buschholtz, 2003) to set the context, and Hart's resource-based theory (1995) to analyse industry response to secondary stakeholder environmental demands. Although none have been identified in the literature review, more appropriate framework models for undertaking the study could well exist.

The study relates to relatively recent changes in secondary stakeholder demands, using 1996 as the base year, which is relatively close to the 1994 start of a new political dispensation in South Africa. There is limited existing academic research on the topic for this time period, which has restricted attempts to set a more specific context and scope for the study.

4.5 RESEARCH INSTRUMENT

The research instrument is an adaptation of the version tested and used by Sharma and Vredenburg (1998) to determine the extent of proactive environmental strategies and related organisational capabilities in the Canadian oil and gas industry sector. The instrument is a 7-point Likert-type, continuous scale. Where necessary, the terminology for oil and gas industry was adapted to equivalent terminology for the mining industry, (e.g. 'mining production' in place of 'well extraction').

As suggested by Sharma and Vredenburg (1998) the research instrument was vetted by a group of university-based management researchers and industry experts, and pre-tested amongst a group of 25 oil and gas industry managers. Reliability (Cronbach's co-efficient alpha) checks were run for the constructs used. Most constructs exhibited high reliability in excess of 0.80. Data diagnostic tests were undertaken for normality; homoscedasticity and factor analysis indicated unidimensionality of items.

A listing of the 59 item, 7-point Likert-type scale, research instrument for use in this study is provided in Appendix 2. The 7-point rating ranges from **one (1) strongly disagree** to **seven (7) strongly agree.** For purposes of statistical analysis, data obtained using the research instrument will, where appropriate, be cross-checked by data sourced from annual environmental and sustainability public reports as well as commodity-specific industry reports. The covering letter and survey questionnaire to be sent to the targeted managers is provided in Appendix 1 and Appendix 2 respectively.

CHAPTER 5

RESEARCH RESULTS

5.1 INTRODUCTION

From a total of 48 questionnaires distributed to the target population, 36 completed questionnaires were received. The sampling frame was carefully selected to ensure that those participating in the survey had the necessary mining industry exposure and experience to assess the change in the industry's environmental performance over the past decade.

As this research anticipated a low response rate, respondents were encouraged to participate through follow-up e-mail correspondence and telephone calls. Through these efforts 26 completed questionnaires were received by e-mail. However in order to secure a higher response, meetings were arranged with members of the target population to collect some of the outstanding questionnaires in person. A further 10 completed responses were received through this process. Of the responses, one survey questionnaire was incorrectly completed. The remaining 35 correctly completed survey questionnaires accounted for 73% of the target population and were used for the statistical analysis. The relatively high final response rate could in part be ascribed to the existence of the author's working relationship with the majority of the target population.

This chapter provides biographical information on respondents participating in the survey and the results of the statistical analysis of data obtained from completed survey forms. The descriptive statistical analysis was undertaken using the business methods provided by Cooper and Schindler (2003). The non-parametric statistical analysis was based on methods provided by Lehmann and D'Abrera (1975). The statistical programmes called 'Analyse-it' and Xlstat were used to interrogate the data. Both programmes are Microsoft Excel based software packages.

5.2 BIOGRAPHICAL INFORMATION

The majority of the respondents were senior managers in multi-commodity mining companies with more than five year's experience in the environmental or sustainable development fields. A breakdown of respondents by job type is provided in Figure 5.1, and by job title in Figure 5.2. The major portion of respondents falling within the 'Other' category of Figure 5.1, are primarily employed in management positions. Included in the 35 correctly completed responses were submissions from all of the major industry players and the responses covered the full range of mining activities by product type.

Figure 5.1 Respondents by job type

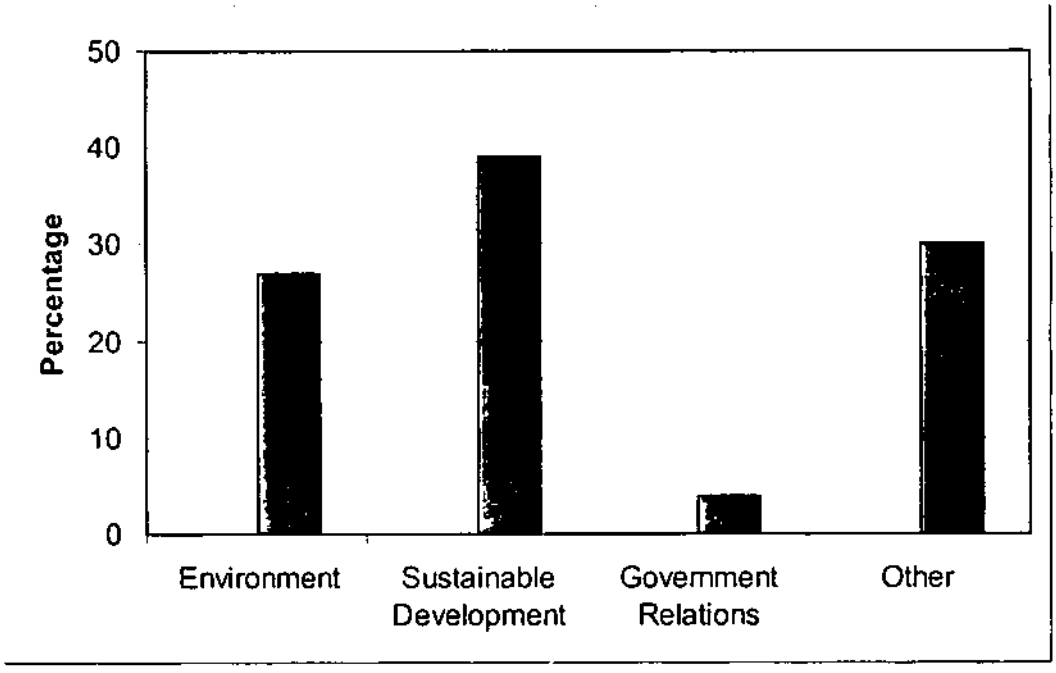
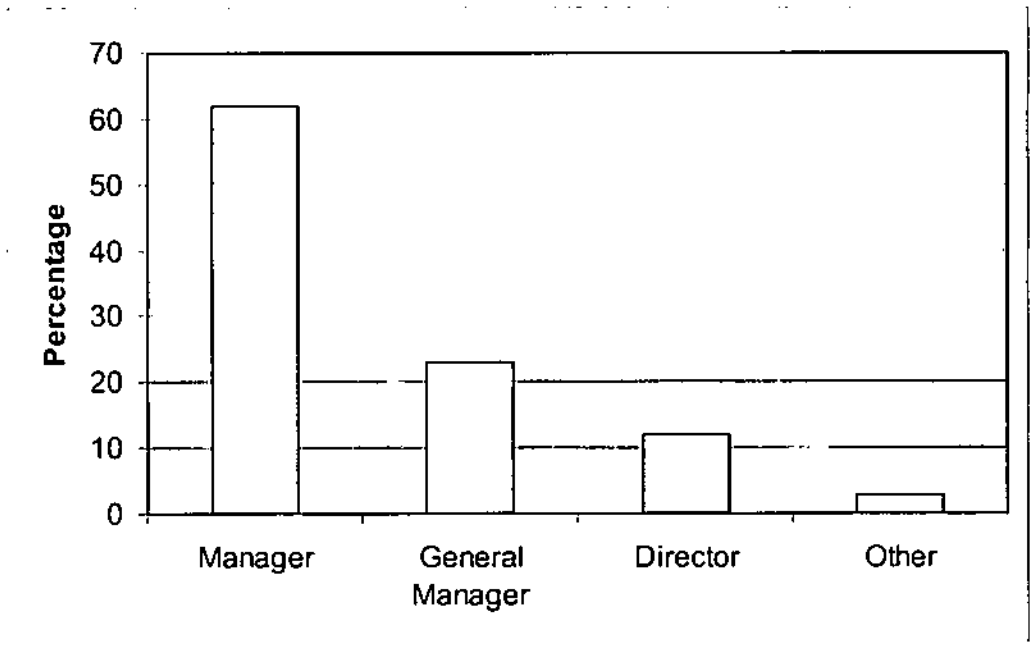


Figure 5.2 Respondents by job title



5.3 DESCRIPTIVE STATISTICAL ANALYSIS

Through the use of a 7-point Likert scale (see Table 5.1), the research instrument tested responses on four measures, namely, Environmental Practice (EP), Emissions Intensity (EI), Stakeholder Partnerships (SP) and Clean Technologies (CT). The list of items included in the Research Instrument for each of the four measures is provided in Appendix 3.

Table 5.1 The 7-point Likert scale

1 = very strongly disagree	5 = agree
2 = strongly disagree	6 = strongly agree
3 = disagree	7 = very strongly agree
4 = neither agree nor disagree	

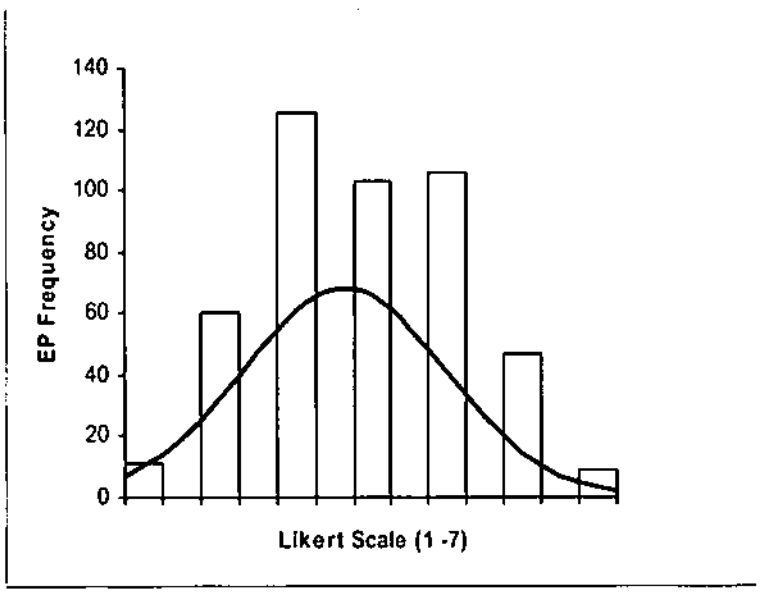
The 7-point Likert scale rating provided interval type data on which the descriptive statistical analysis for each of the four measures were undertaken.

Environmental Practice (EP)

The first 16 items in the research instrument were used to measure the extent of improvement in environmental practices adopted by the industry over the past decade. High scores ($\geq$ 5) on these items indicate significant improvement and the embedding of a proactive environmental response strategy. Low scores ($\leq$ 3) on the opposite end of the scale indicate limited to no change and the continuance of a reactive response. A score of greater than 3, but less than 5, implies a moderate improvement.

The frequency distribution and descriptive statistics for EP is provided in Figure 5.3. The kurtosis value of -0.65 indicates a weak platykurtic shape. The results for mean, median and mode indicate that the industry has achieved moderate improvements in EP over the past decade.

Figure 5.3: EP - Frequency plot and descriptive statistics



	EI
N	324
Mean	3.84
Standard Deviation	1.44
Minimum	1.00
Q1	3.00
Median	4.00
Q3	5.00
Maximum	6.00
Skewness	-0.009
Kurtosis	-1.07
Mode	5.00

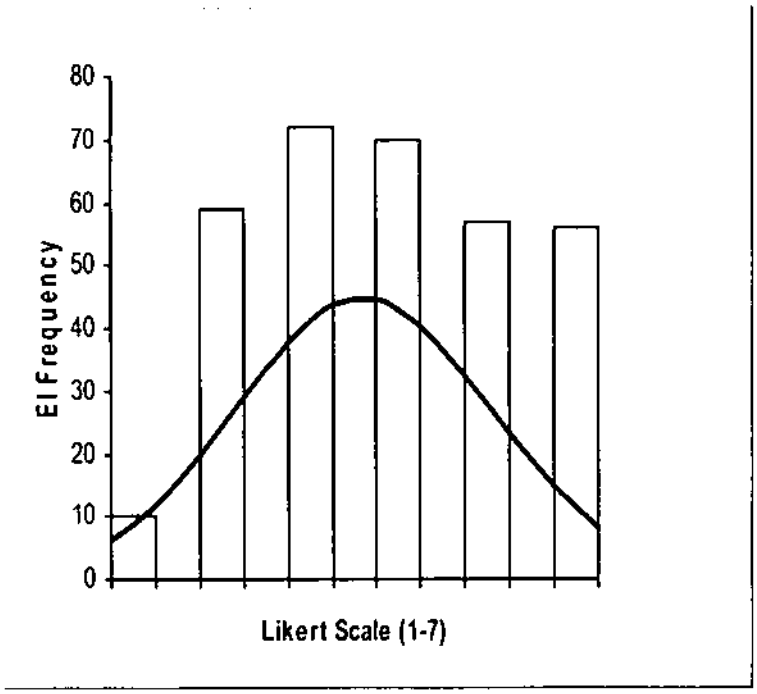
Emissions Intensity (EI)

Items 17 to 25 on the research instrument were used to measure the extent of improvement (reduction) in industry emissions intensity over the past decade. High

scores ($\geq$ 5) indicate a significant improvement in industry emissions intensity. Low scores ($\leq$ 3) on the opposite end of the scale indicate limited to no improvement. A score greater than 3 but less than 5 implies a moderate improvement.

The frequency distribution and summary statistics for EI is provided in Figure 5.4. The distribution is platykurtic, (ku = -1.07) in shape. On inspection of the mean, median and mode, it would appear that the respondents indicate a moderate improvement in industry emissions intensity over the past decade.

Figure 5.4: EI - Frequency plot and descriptive statistics



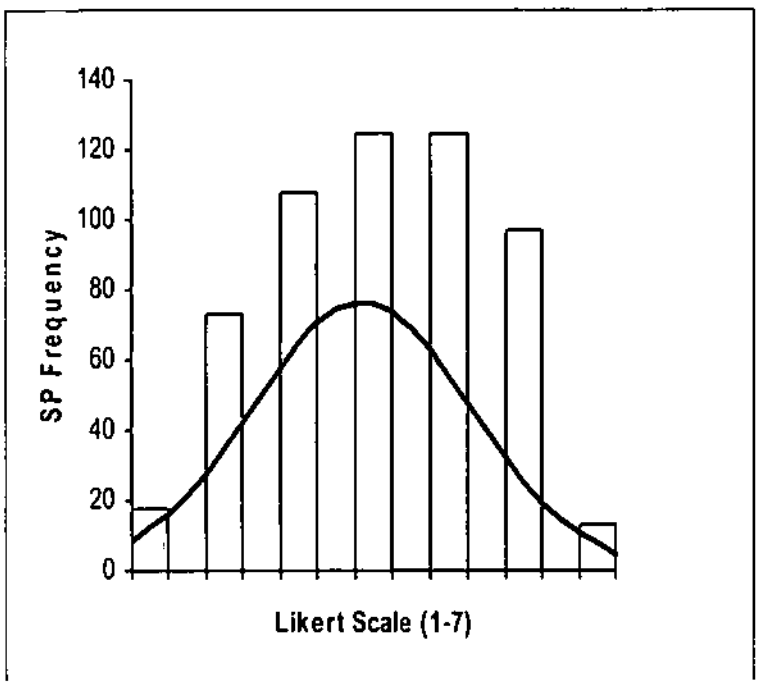
	EP
N	525
Mean	3.89
Standard Deviation	1.36
Minimum	1.00
Q1	3.00
Median	4.00
Q3	5.00
Maximum	7.00
Skewness	0.09
Kurtosis	-0.65
Mode	3.00

Stakeholder Partnerships (SP)

Items 26 to 41 of the research instrument constitute a measure of industry and secondary stakeholder partnerships on the environment. High scores ($\geq$ 5) on these items indicate a significant improvement and a proactive industry stance in establishing partnerships to reduce environmental impacts, whilst low scores ($\leq$3) indicate a limited reactive to no response.

The frequency plot and statistics for SP are provided in Figure 5.5. The frequency distribution is marginally negatively skewed (-0.14) with a platykurtic shape (ku -0.82). From the mean, median and mode, it would appear that industry has achieved moderate progress on the SP measure.

Figure 5.5: SP - Frequency plot and descriptive statistics



	SP
N	559
Mean	4.09
Standard Deviation	1.46
Minimum	1.00
Q1	3.00
Median	4.00
Q3	5.00
Maximum	7.00
Skewness	-0.14
Kurtosis	-0.82
Mode	5.00

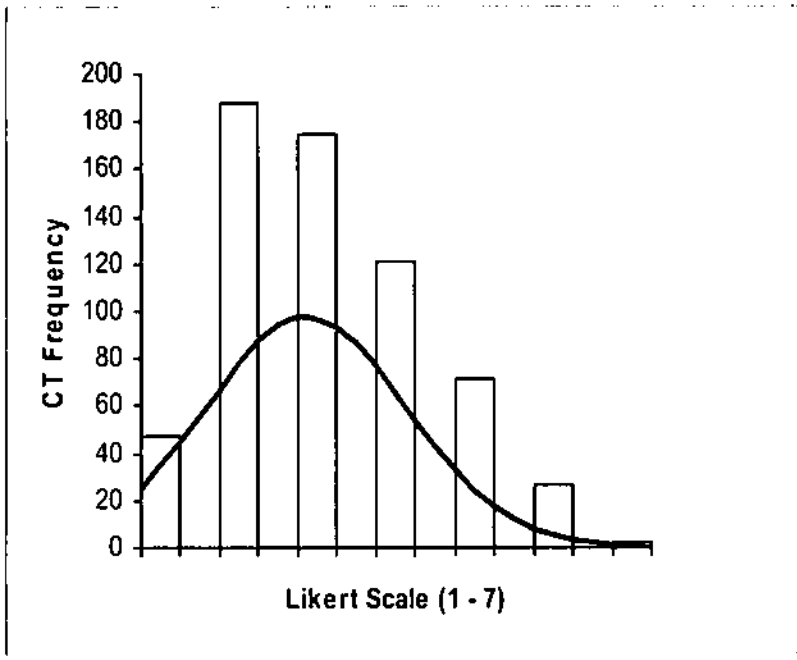
Cleaner Technologies (CT)

Items 42 to 59 of the research instrument were used to measure the extent to which industry has adopted cleaner processes and technologies to reduce environmental impacts, including emissions associated with product use. High scores ($\geq$ 5) indicate a significant improvement and the adoption of a product stewardship led strategy. Low scores ($\leq$ 3) indicate limited to no improvement
and the continuation of a reactive response.

A summary of CT statistics and frequency distribution is provided in Figure 5.6. The frequency plot illustrates a positively skewed (0.47) distribution. The mean, median and

mode values, suggest that the industry has achieved a limited to moderate improvement in the use of cleaner process and technologies.

Figure 5.6: CT - Frequency plot and descriptive statistics



	CT
N	630
Mean	3.11
Standard Deviation	1.28
Minimum	1.00
Q1	2.00
Median	3.00
Q3	4.00
Maximum	7.00
Skewness	0.47
Kurtosis	-0.39
Mode	3.00

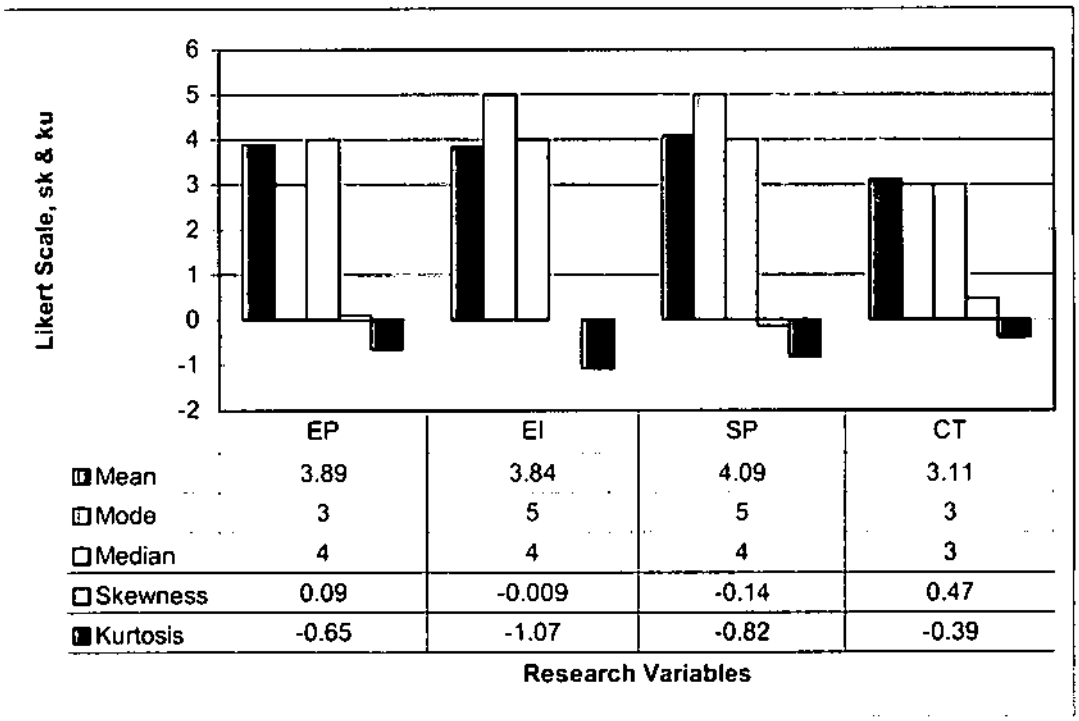
Summary

The statistical analysis, (see Figure 5.7) indicates that the industry has achieved a moderate improvement in its environmental performance; however, it is also apparent that there is significant scope for the application of more proactive environmental strategies. This is most notable for the CT measure, where limited to moderate progress has been achieved. These results are supported to an extent by improving environmental key performance indicators and outlook targets published in individual company sustainable development reports.

The majority of the major players in the mining industry issue sustainable development reports on an annual basis. These reports are generally drafted in accordance with the benchmark Global Reporting Initiative (GRI) guidelines and include an independent audit assurance statement on the data published. The environmental section of the

guidelines include information on policies, management systems and data on water, energy and greenhouse gas intensities and other toxic emissions. There are, however, difficulties in consolidating the industry's emission intensity trends on a quantitative basis. These constraints mainly relate to differences between companies in their definition of system boundaries and baseline elements for measuring efficiencies and emission intensities.

Figure 5.7: Descriptive statistics – summary



5.4 SAMPLE DISTRIBUTION TEST FOR NORMALITY

The frequency distribution plots, as well as the skewness and kurtosis values, for each of the EP, EI, SP and CT measures, tend to indicate relatively significant deviation from a normal distribution. The Shapiro-Wilk test was undertaken for each of the four measures, to determine whether the deviation is statistically significant and hence the type of statistical testing procedures to be implemented for further analysis of the data. The Shapiro-Wilk test, tests the null hypothesis that a sample came from a normally

distributed population. If the null hypothesis is rejected, data relationships will need to be determined using non-parametric statistical tests. The results of the analysis are provided below.

Environmental Performance

The Shapiro-Wilk test was used to determine whether the EP sample follows a normal distribution.

Null hypothesis H_o: The EP sample data follows a normal distribution.

H_A: The EP sample data does not follow a normal distribution.

Decision Rule: Reject H_o if for the calculated W statistic, the significance value (p-value) is lower than the alpha value (0.05).

Result: W= 0.943; p-value <0.0001; alpha 0.05 (n = 525)

As the computed p-value is lower than the significance level (alpha 0.05), the null hypothesis H_0 is rejected. The alternative hypothesis H_A, that the sample data does not follow a normal distribution, is accepted.

Emission Intensity

The Shapiro-Wilk test was used to determine whether the EI sample follows a normal distribution.

Null hypothesis H_o: The EI sample data follows a normal distribution.

H_A: The EI sample data does not follow a normal distribution.

Decision Rule: Reject H_o if for the calculated W statistic, the significance value (p-value) is lower than the alpha value (0.05).

Result: W= 0.919; p-value <0.0001; alpha 0.05 (n = 324).

As the computed p-value is lower than the significance level (alpha 0.05), the null hypothesis H_0 is rejected. The alternative hypothesis H_A, that the sample data does not follow a normal distribution, is accepted.

Stakeholder Partnerships

The Shapiro-Wilk test was used to determine whether the SP sample follows a normal distribution.

Null hypothesis H_o: The SP sample data follows a normal distribution.

H_A: The SP sample data does not follow a normal distribution.

Decision Rule: Reject H_o if for the calculated W statistic, the significance value (p-value) is lower than the alpha value (0.05).

Result: W= 0.941; p-value <0.0001; alpha 0.05 (n = 559)

As the computed p-value is lower than the significance level (alpha 0.05), the null hypothesis H_0 is rejected. The alternative hypothesis H_A, that the sample data does not follow a normal distribution, is accepted.

Clean Technology (CT)

The Shapiro-Wilk test was used to determine whether the SP sample follows a normal distribution.

Null hypothesis H_o: The CT sample data follows a normal distribution.

H_A: The CT sample data does not follow a normal distribution.

Decision Rule: Reject H_o if for the calculated W statistic, the significance value (p-value) is lower than the alpha value (0.05).

Result: W= 0.922; p-value <0.0001; alpha 0.05 (n = 630)

As the computed p-value is lower than the significance level (alpha 0.05), the null hypothesis H_0 is rejected. The alternative hypothesis H_A, that the sample data does not follow a normal distribution, is accepted.

Summary

The results of the Shapiro-Wilk test indicate that the sample data for each of the EP, EI, SP and CT measures are not symmetrical and do not follow a normal distribution. Further statistical tests on the sample data relationships were undertaken through the use of non-parametric tests.

5.5 KENDALL CORRELATION ANALYSIS

The Kendall (τ), which is a non-parametric measure of association, was used to the examine whether a relationship exists between the respondents' mean rating of the EI measure when compared to their respective mean rating for each of the EP, SP and CT measures. The scatter graphs and the Kendall tau coefficient (τ) values for each of the data set comparisons are provided in Figure 5.8, Figure 5.9 and Figure 5.10. The Kendall tau coefficient (τ) has the properties listed below.

- If the agreement between the two rankings is perfect (i.e., the two rankings are the same), the coefficient has value 1.

- If the disagreement between the two rankings is perfect (i.e., one ranking is the reverse of the other), the coefficient has value -1.

- For all other arrangements, the value lies between -1 and 1, and increasing values imply increasing agreement between the rankings. If the rankings are completely independent, the coefficient has value 0.

In general, results of the correlation analysis indicate a moderate, positive relationship between the respondents' mean value for EI when compared to their respective means values for each of EP, SP and CT.

Figure 5.8: Correlation analysis – EI and EP

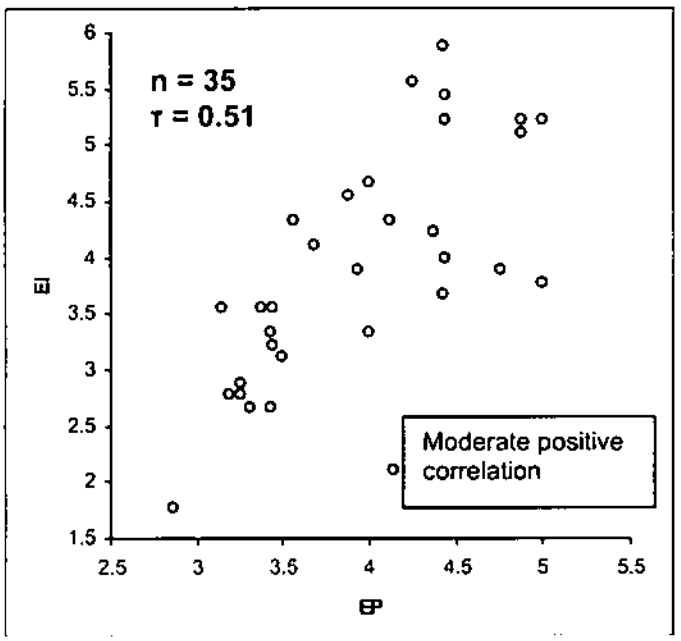


Figure 5.9: Correlation analysis EI and SP

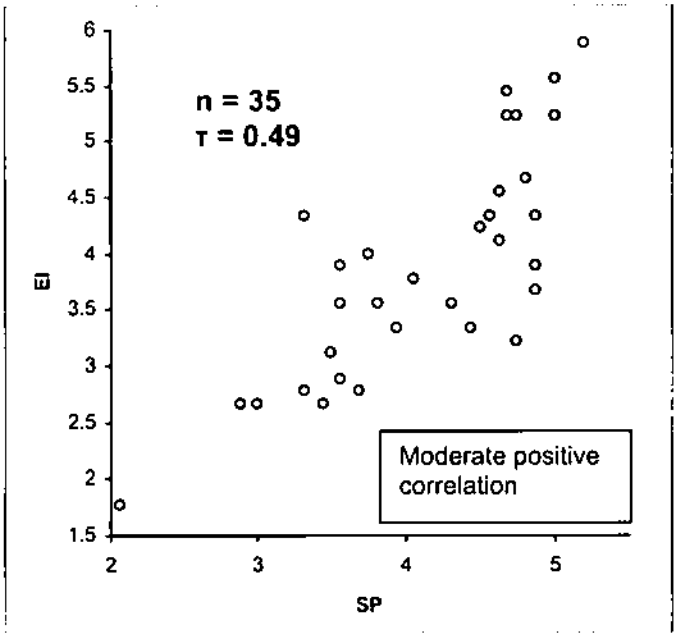
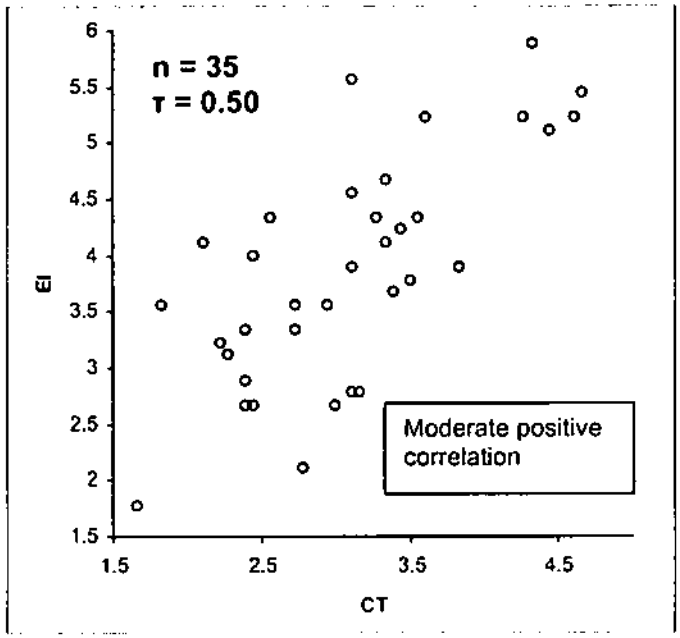


Figure 5.10: Correlation analysis EI and CT



5.6 HYPOTHESIS TESTING

Chi-square analysis, based on 2 X 2 contingency tables of frequency distribution, was used to test the three research hypothesis, as set out in Chapter 4. The contingency tables were developed by consolidating the frequency of the respondents' mean value each of the measures into two categories, namely (1) those less than and equal to 3.6, and (2) those greater than 3.6. The tables were checked to ensure that frequencies below 5 did not consist of more than 20% of cells and that none of the cells had a value of less than 1. In so doing the analysis provides further insight into the moderate positive correlation between EI and each of EP, SP and CT measures.

Research Hypothesis 1

Using the contingency table and Chi-square analysis, the research hypothesis examined whether a statistically significant relationship existed between the respondents' EI and EP measures, see Table 5.2.

Table 5.2: EI / EP contingency table

Frequency count of mean values		Environmental Performance (EP)	
		EP – 1 (≤3.6)	EP – 2 (>3.6)
Emissions Intensity (EI)	EI – 1 (≤3.6)	8	5
	EI -2 (>3.6)	6	16

Null hypothesis (H_o):

There is no relationship between the EI and the EP measures, the values are independent of each other.

Alternate hypothesis (H_A):

There is a relationship between the EI and the EP measures.

Decision Rule:

Reject H_o if α calculated from the contingency table is greater than the critical α value for 1 degree of freedom, (2-1) (2-1).

Result:

The calculated α value of 3.99 was found to be greater than the critical α value of 3.84 and the *p* value of 0.045 is less than the significance level alpha of 0.05. Hence the null hypothesis is rejected, see Table 5.3. The alternate hypothesis (H_A), that there is a relationship between EI and EP measures, is therefore accepted.

Table 5.3: EI / EP Chi-square analysis

Chi-square by cell (EI / EP)

	EP-1	**EP-2**	**Total**
EI-1	1.508	1.005	2.513
EI-2	0.891	0.594	1.485
Total	2.399	1.599	3.998

Research Hypothesis 2

Using the contingency table and Chi-square analysis, the research hypothesis examined whether a statistically significant relationship existed between EI and SP measures, see Table 5.4.

Table 5.4: EI / SP Contingency table

Frequency count of mean values		**Stakeholder Partnerships (SP)**	
		SP – 1 (≤3.6)	**SP – 2 (>3.6)**
Emissions Intensity (EI)	EI – 1 (≤3.6)	8	15
	EI -2 (>3.6)	5	17

Null hypothesis (H_o):
There is no relationship between the EI and the SP measures, the values are independent of each other.

Alternate hypothesis (H_A):
There is a relationship between the EI and the SP measures.

Decision Rule:
Reject H_o if α calculated from the contingency table is greater than the critical α value for 1degree of freedom, (2-1) (2-1).

Result:
The calculated α value of 5.27 was found to be greater than the critical α value of 3.84 and the *p* value of 0.022 is less than the significance level alpha of 0.05. Hence the null hypothesis is rejected, see Table 5.5. The alternate hypothesis (H_A), that there is a relationship between EI and EP measures, is therefore accepted.

Table 5.5: EI / SP Chi-square analysis

Chi-square by cell (EI / SP)			
	SP-1	**SP-2**	**Total**
EI-1	2.083	1.231	3.314
EI-2	1.231	0.727	1.958
Total	3.314	1.958	5.272

Research Hypothesis 3

The contingency table drafted for the CT measure does not meet the necessary criteria for analysis using Chi-square, with one cell having a value of less than 5, see Table 5.6. As a consequence, and given the current sample data set, it could not be determined whether a statistically significant relationship exists between EI and CT measures.

Table 5.6: EI / CT Contingency Table

Frequency count of mean values		**Clean Technologies (CT)**	
		CT – 1 (≤3.6)	**CT – 2 (>3.6)**
Emissions Intensity (EI)	EI – 1 (≤3.6)	11	2
	EI -2 (>3.6)	17	5

As an alternative, the two-tailed Kolmogorov-Smirnov test was used to determine whether the sample distribution of EI and CT measures are significantly different.

Null hypothesis (H_o):
The sample distribution for EI and CT is not significantly different.

Alternate hypothesis (H_A):
The sample distribution for EI and CT is significantly different.

Decision Rule:

Reject H_o if the calculated *p* value is lower than the significance alpha level of 0.05.

Result:

The calculated *p* value of 0.006 was found to be less than the significance level alpha of 0.05. Hence, the null hypothesis is rejected. The alternate hypothesis (H_A), that the distribution of EI and CT measures is significantly different, is therefore accepted.

Summary

The results of analysis for the Hypotheses 1 and 2, using the Chi-square test, indicate that a statistically significant relationship exists between EI measure and each of EP and SP. Thus, it can be said that the industry's moderate improvement over the past decade in EI measure is associated with moderate improvements in EP and SP measures.

Although results of correlation analysis between EI and CT, using the Kendall's tau test, indicate a moderate positive correlation, the Chi-square analysis based on contingency tables could not be used to test the hypothesis that the relationship is statistically significant. However a comparison of the sample distributions, using the Kolmogorov-Smirnov test, indicates that the EI and CT distributions are significantly different. Thus it could be said that the industry's moderate improvement in EI is not related to the moderate improvement in CT. It is however noted that, with a larger sample size, it may become feasible to test the relationship through the construction of a contingency table that meets the minimum criteria for the Chi-square analysis.

CHAPTER 6

DISCUSSION, CONCLUSION AND RECOMMENDATION

Using the three research hypotheses, the study investigates the extent to which the major players in the South African mining industry have in the past decade responded to secondary stakeholder demands for an improved environmental performance. The research analyses used the corporate social performance model (Carroll & Buchholtz, 2003), and the natural resource-based theory (Hart, 1995) as the basis for evaluation. The industry positioning using each of the theoretical models is discussed below.

6.1 CORPORATE SOCIAL PERFORMANCE – INDUSTRY POSITIONING

Carroll's (Carroll & Buchholtz, 2003) corporate social performance model integrates the multi-dimensional elements of corporate social responsibility, corporate social responsiveness and stakeholder issues, and makes it easier to conceptualise the positioning of management actions on a range of stakeholder issues. Carroll's framework model offers a clear linkage on environmental stakeholder issues with Hart's (1995), natural resource-based theory. The component dimensions of the corporate social performance model, as re-stated by Carroll and Buchholtz (2005), are summarised below.

- **Corporate social responsibility** encompasses the economic, legal, ethical and discretionary (philanthropic) expectations that society has of organisations at a given point in time.

- **Corporate social responsiveness** is the action phase of management response and can be broadly broken down into four types namely, reaction, defence, accommodation and pro-action.

- **Stakeholder/social issues** relate to the broad scope of the social issue involved. Examples include the environment, product safety, racial and gender discrimination and consumerism.

For the purpose of this research, the dimension of corporate social responsiveness is evaluated, and the environment as a secondary stakeholder issue, is divided into the sub-components of EI, EP, SP and CT. The positioning on the dimension of corporate social responsibility is not part of this research. However, for illustrative purposes, the industry is assumed to be meeting legal compliance and hence positioned on the interface between legal and ethical categories, see Figure 6.1.

Emissions Intensity (EI)

The results of the descriptive statistical analysis, as detailed in Chapter 5, indicate that over the past decade the industry has made moderate progress in EI. The industry's moderate improvement suggests that the EI measure be positioned between the 'proactive' and 'reactive' categories on the corporate social responsiveness dimension. Accordingly, EI was positioned on the interface between the 'defence' and the 'accommodation' categories (See Figure 6.1).

Environmental Practice (EP)

The results of the descriptive statistical analysis, as detailed in Chapter 5, indicate that over the past decade the industry has made moderate progress in EP. The results of the correlation and Chi-square analysis suggest that the moderate progress in EP is associated with the moderate reduction in the industry EI. The industry's moderate improvement suggests that the EP measure be positioned between the 'proactive' and 'reactive' categories on the corporate social responsiveness dimension. Accordingly, EP was positioned on the interface between the 'defence' and the 'accommodation' categories (See Figure 6.1).

Stakeholder Partnership (SP)

The results of the descriptive statistical analysis, as detailed in Chapter 5, indicate that industry has achieved moderate improvement in developing partnerships with secondary stakeholders on environmental issues. A result of the Kendall's tau and Chi-Square analyses suggests that the moderate improvement in SP is associated with a moderate reduction in the industry EI.

As with the EP measure, the industry's moderate improvement in secondary stakeholder relationships suggests that the SP measure be positioned between the 'proactive' and 'reactive' categories on the social responsiveness dimension. Hence, the SP measure was positioned on the interface between the 'defence' and the 'accommodation' categories (See Figure 6.1).

Clean Technology (CT)

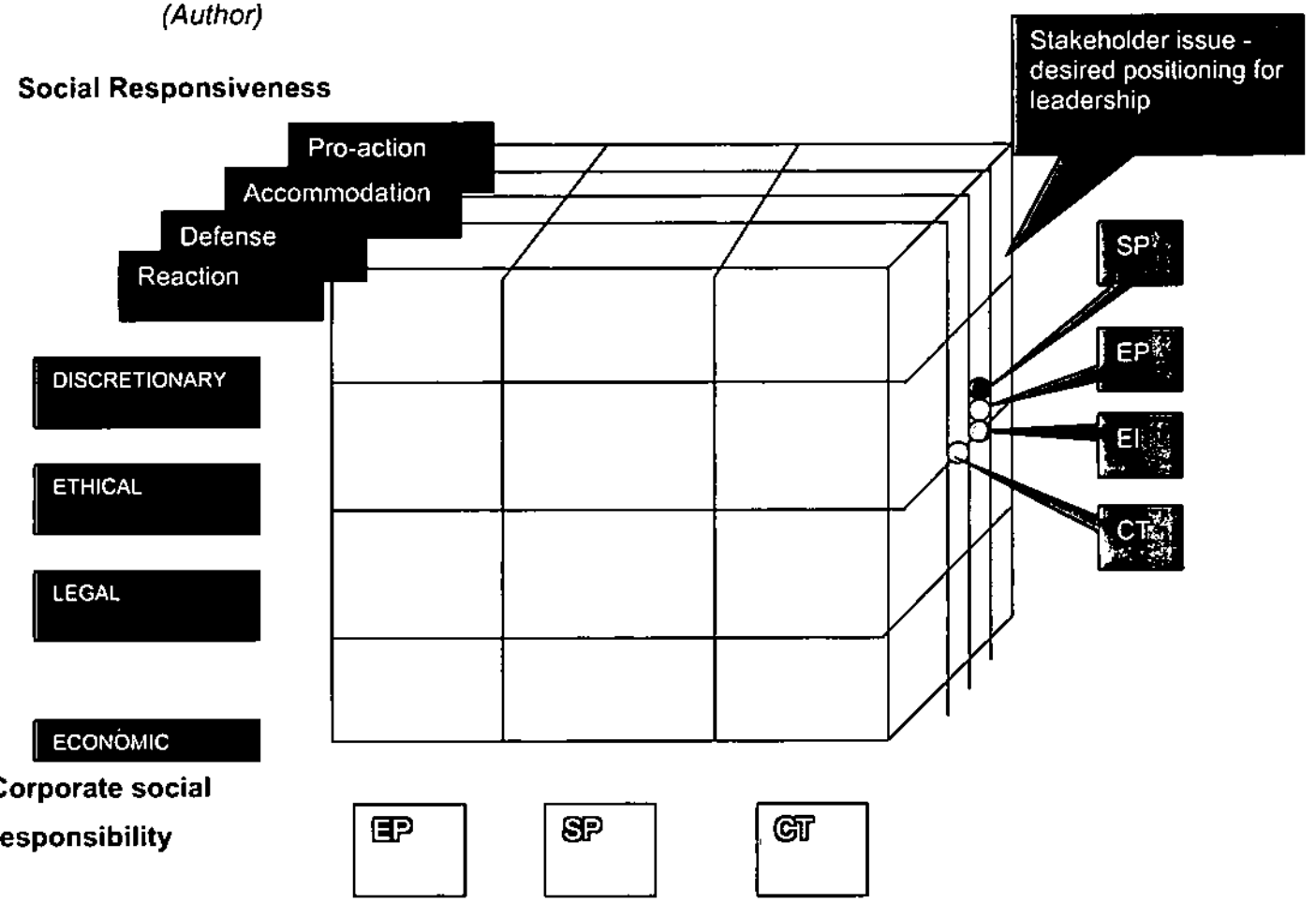
The results of the descriptive statistical analysis indicate that the industry has achieved limited to moderate progress in CT. However, Chi-square analysis could not be used to determine whether a statistically significant relationship exists between the CT and the EI measures. Results of the Kolmogorov-Smirnov test indicate that the EI and CT distributions are significantly different. The industry's limited to moderate improvement suggests that the CT is positioned at the interface between the 'reaction' and the 'defence' categories on social responsiveness dimension (See Figure 6.1).

Summary

It is noted, that although moderate improvement has been achieved in the past decade, all three the environmental sub-components of EP, SP and CT fall short of the desired positioning for industry leadership. Even if higher ratings for the corporate social responsibility dimension were assumed, the desired leadership position has not been achieved by industry. This suggests that significant scope for improvement exists and that the industry should seek to develop strategic capabilities to improve its environmental performance.

Figure 6.1: Industry's positioning – corporate social performance model

(Author)



6.2 NATURAL RESOURCE-BASED THEORY – INDUSTRY POSITIONING

Hart's (1995) natural resource-based theory draws linkages between the interconnected and sequentially developed environmental strategies of pollution prevention, product stewardship and sustainable development, see Figure 6.2. According to Hart (1995), the associated driving forces, key resources and competitive advantages are embedded and overlap with progress from pollution prevention to sustainable development. See Table 2.2.

The pollution prevention strategy - compliance driven

Results of the descriptive statistical analysis and measures of association between the EI and each of EP and SP indicate that the industry has embedded a pollution prevention capability, but has not achieved the proactive environmental positioning, which is necessary for sequential progress to the product stewardship capability. The analysis, however suggests that the industry has to some extent made inroads on aspects of product stewardship. This progress is largely due to the raised standards required to achieve legal compliance, which have recently emerged. The industry however, is well positioned to progress beyond legal compliance and to implement a product stewardship approach fully.

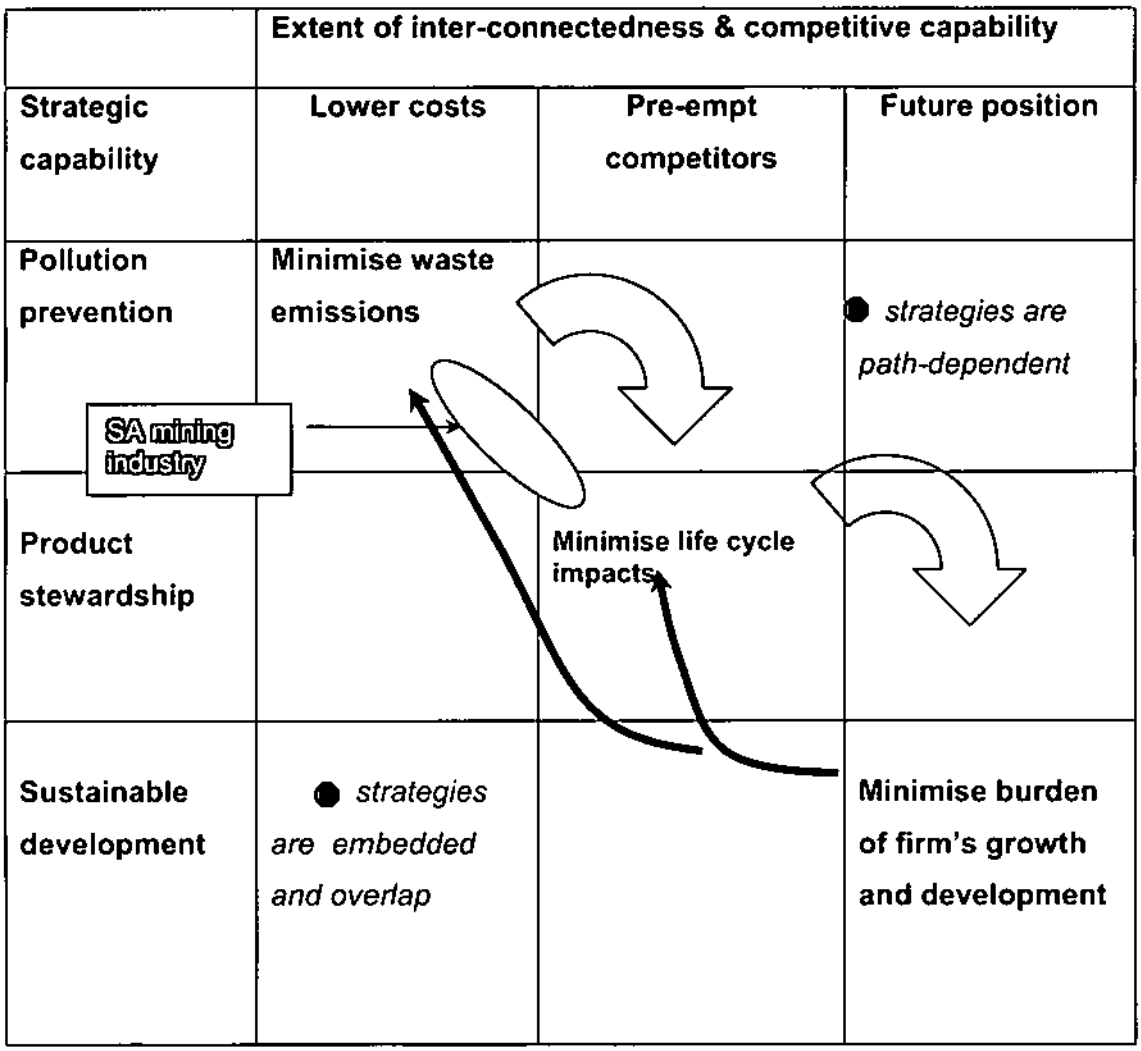
Product stewardship and sustainable development

Industry progress towards product stewardship is largely dependent on its capacity to implement clean technologies and engage with secondary stakeholders on environmental issues across the product life cycle. The descriptive statistics indicate that industry has made limited progress on the CT measure. This, together with the absence of a statistically significant link between EI and CT measures, suggests that industry has only established initial inroads into the product stewardship quadrant, and has yet to develop product stewardship as a strategic capability.

Using Hart's (1995) natural resource-based theory, the industry is positioned at the intersection between the 'lower cost' competitive capability and 'pollution prevention' strategic capability, with some extension into the product stewardship strategic capability (See Figure 6.2).

Figure 6.2: Industry positioning – natural resource-based model

(Author)



Government is a key secondary stakeholder and a close relationship between industry and government is essential if industry is to embed product stewardship and gain competitive advantage in the international market. The progress of the industry towards the eventual goal of sustainable development requires an extension beyond environment-specific issues and includes wider collaboration on social and economic stakeholder dimensions. Industry sustainable development is achieved through establishing a shared vision with secondary stakeholders. Progress on secondary stakeholder social and economic dimensions is to an extent related to, but not path-dependent on progress with environmental issues.

6.3 CONCLUSION

The need for industry progress

The shift from pollution prevention to product stewardship and eventually to sustainable development requires the industry to internalise new environmental and social costs. At the opposite end of the value chain, the market is yet to differentiate effectively or to reward the development of proactive industry environmental capabilities. The misalignment between market pricing and additional production related costs has created some level of uncertainty in the business landscape of the industry. It is also feasible that this misalignment is the underlying reason for the industry's hesitant approach to implementing more proactive environmental strategies.

Internationally however, market recognition of upstream environmental costs is beginning to emerge. The energy markets in many of the developed countries offer premium pricing for electric power and liquid fuels generated from renewable sources. The incentives for promoting the uptake of renewable sourced energy serves to decrease the dependence on fossil fuels and associated release of greenhouse gasses, sulphur, mercury and other toxic emissions that impact on the natural environment. A number of developed countries also have in place market instruments for trading toxic emissions. These trading instruments act to penalise excessive emitters and reward the implementation of clean technology.

In the case of the United States, the establishment of sulphur emission caps on power utilities and a sulphur trading market have promoted the adoption of cleaner coal combustion technologies. Similarly, the European Union (EU) Emissions Trading Scheme is a market instrument aimed at reducing the emission of greenhouse gases from power utilities. The EU has more recently introduced the REACH directive that requires the Registration, Evaluation and Authorisation of Chemical products imported into the EU. The REACH directive, which is expected to come into force by 2008, sets limits on the allowable percentage of toxic elements that can be included within imported chemical and commodity products. This directive is aimed at the protection of human

health and the environment. Once fully implemented, REACH will significantly increase the cost of mining industry exports into the EU.

Key competitor mining industries

The emerging recognition of secondary stakeholder environmental costs in the market place has led the mining industries in key competitor nations, namely, the United States, Canada and Australia, to adopt a more proactive stance on environmental performance. This proactive positioning has resulted in closer relationships with government and other stakeholders to develop long-term industry roadmaps, which set milestone goals to embrace product stewardship and sustainable development. Examples include the US National Mining Association's 'Sustainable Development Pledge' and the Minerals Council of Australia's 'Enduring Value Framework for Sustainability'.

As a result of these closer relationships, the mining industries in these countries benefit from the large scale government clean technology R&D spend. The collaborative R&D leverages the synergies between government and industry. Over the longer term, these developments will serve to provide competitor industries with the ability to differentiate themselves from those national mining industries which remain stymied within Hart's (1995) pollution prevention strategic capability quadrant.

Industry – the path ahead

In the domestic mining industry, co-ordination between companies on the environmental issues is limited. Some level of collaboration on environmental policy and regulatory issues is facilitated by the Chamber of Mines. The relationship between industry and government and other stakeholders is largely fragmented and weak. There are, however, areas of good practice emerging. An example of this is the climate change long-term scenario planning exercise initiated by government. This initiative aims to deliver a collaborative national strategy on climate change and carbon mitigation. The scenario planning exercise includes representation from industry, NGO and academic communities and serves as an example on which to base higher level co-ordination on environmental issues. Leadership is required from industry and government, if the long-

term competitive benefits of environmental product stewardship and sustainable development are to be realised.

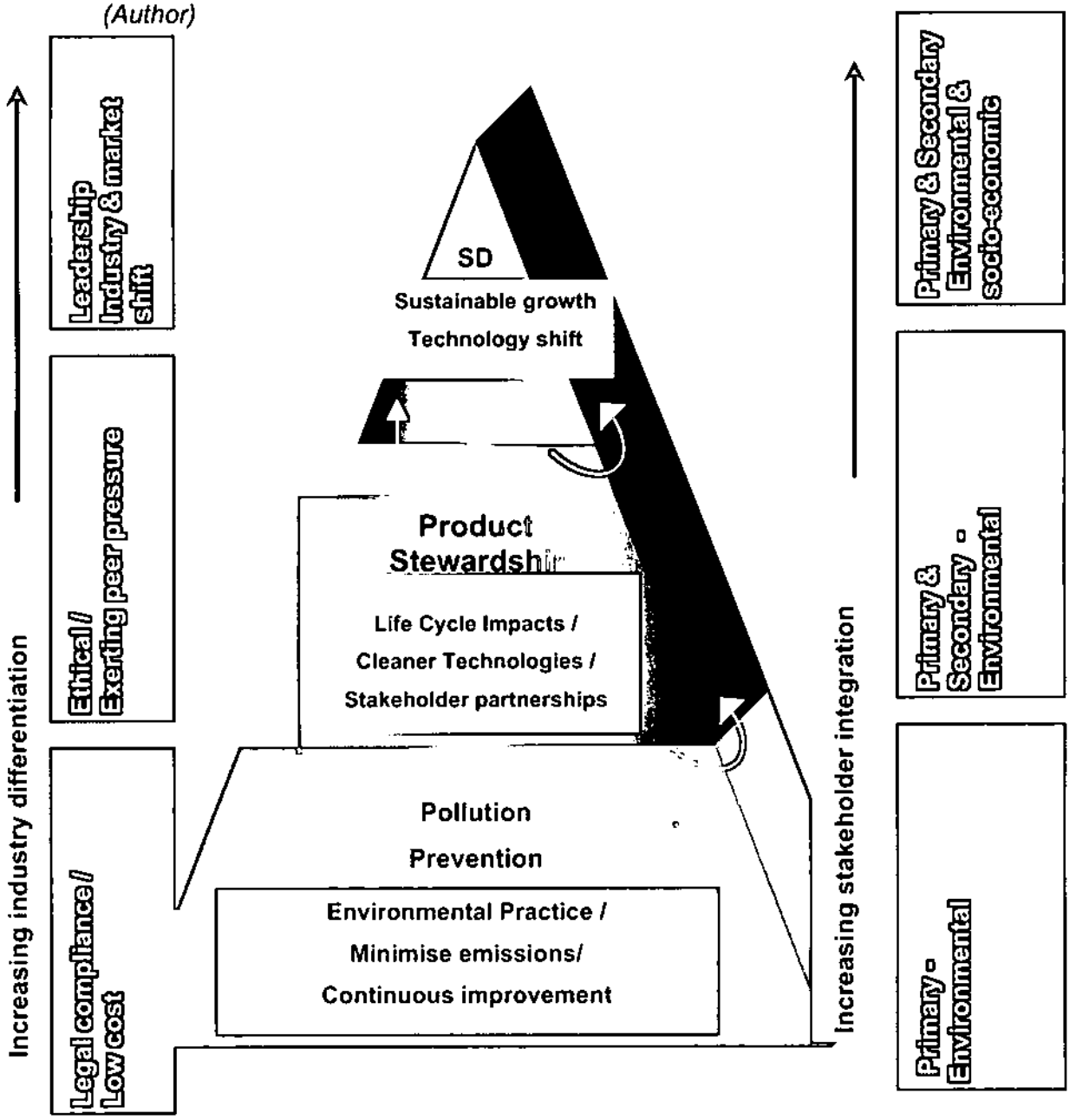
A model for sustainable environmental practice

Using the results of this research, a mining industry framework for sustainable environmental practice has been developed (See Figure 6.3). This framework integrates the theoretical concepts in Carroll's (Carroll & Buchholtz, 2003), corporate social performance model with Hart's (1995) natural resource-based theory (See Figure 6.2). The framework illustrates the key relationships between stakeholder integration, improving environmental capabilities and the industry's capacity for differentiation. Progress through the sequential strategic capabilities of pollution prevention, product stewardship and sustainable development is primarily driven through the implementation of cleaner technologies. For progress to sustainable growth, a fundamental technology shift, acceptable to stakeholders is required. Examples of such a shift include the development of zero emission fossil fuels technologies or the emergence of a zero emission hydrogen-based economy.

Although progress between the strategic capability layers is sequential, it is possible for industry that is positioned at the pollution prevention level to make inroads into each of the overlying categories. The model provides the industry with the direction and areas of focus for improved environmental positioning and the capacity to retain international competitiveness with the leading national mining industries.

Figure 6.3: Industry framework for sustainable environmental practice

(Author)



6.4 RECOMMENDATIONS

Key to implementing a progressive environmental strategy are the components of industry co-ordination, stakeholder relationships and the deployment of clean

technologies. These aspects are discussed in detail in the recommendations provided below.

Industry co-ordination

Internal industry co-ordination on environmental issues is hampered by the absence of a platform for facilitating collaboration. Several policy-orientated and commodity-specific industry bodies exist, however, the remit of such organisations is generally narrow and hence unsuited for industry-wide high level strategy development. The absence of industry collaboration could well be one of the main reasons for the limited progress in embedding a product stewardship approach.

It is suggested that the Chamber of Mines of South Africa initiate collaboration between the industry partners. The Chamber will however need to include non-members, in particular junior mining companies. Due to the lack of resources available to the smaller mining companies, outreach programmes and capacity development will need to be considered. The major players will need to make available resources for such an outreach programme, if industry-wide co-ordination and support are to prove successful.

A primary goal with industry co-ordination is the building of strategic product stewardship capabilities. The strategy framework should include timeframes for intermediate milestone goals. Industry should make the commitment to report progress on milestone goals publicly, irrespective of actual performance achieved. The external environmental stakeholders should be included among the target audience for such public reports.

Relationship building with secondary stakeholders

Industry needs to identify environmental stakeholders broadly, and then jointly to develop a process for engagement. The list of stakeholders should include, amongst others, representatives from national government departments, environmental NGOs, and the academic and research community. The relationship building process should be facilitated by a non-partisan third party.

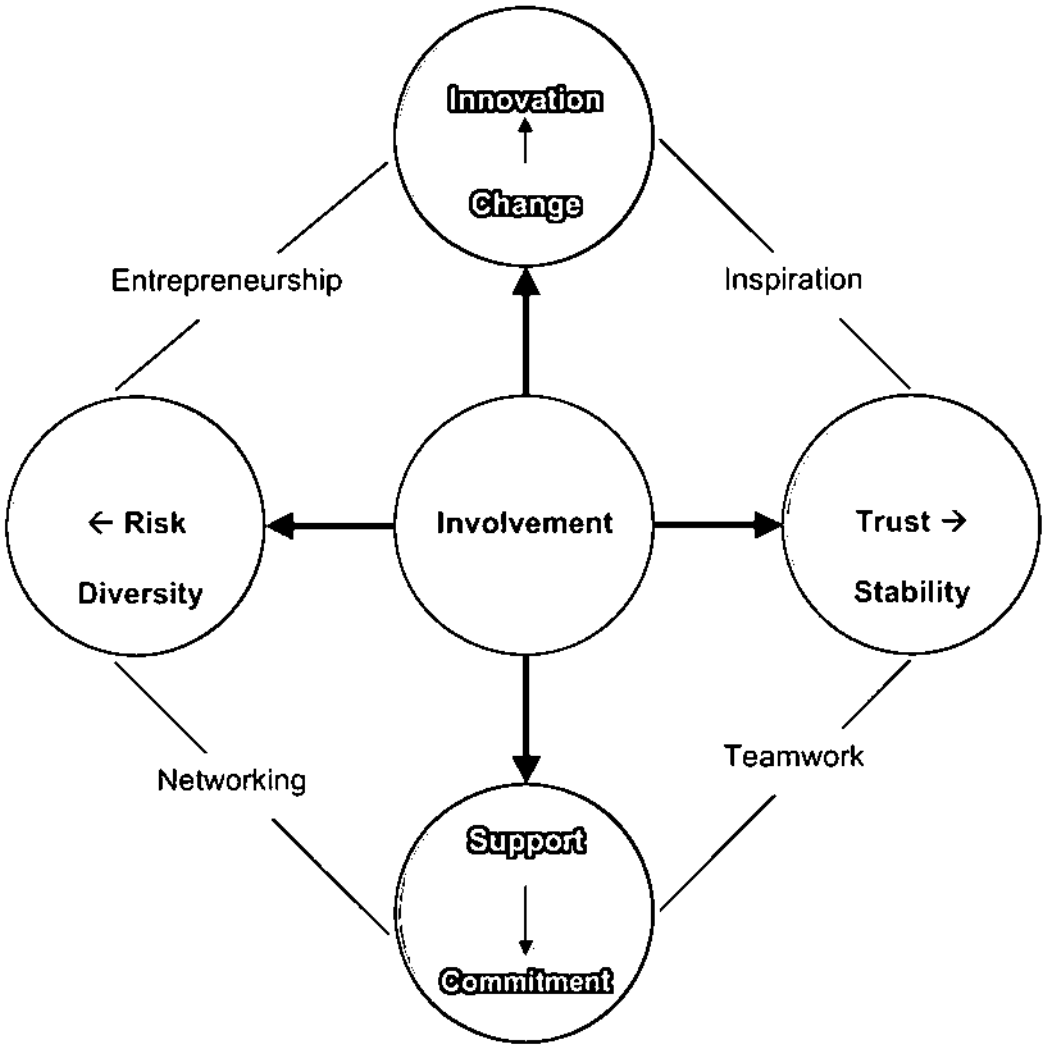
In the relationship building process, industry should seek to achieve a balance between the interests of all the stakeholders participating. The model developed by Goodjik (2003) provides a framework for stakeholder involvement and the management of balance. This model places emphasis on involvement where a balance is sought between innovation and commitment, and between diversity and stability (See Figure 6.4). According to Goodjik (2003), innovation should deliver change. However, permanent change will require the commitment and support of stakeholders. A balance should also be sought between diversity associated with risk taking and stability for gaining trust.

Advance cleaner technologies

The implementation of cleaner technologies is a primary channel for industry to reduce the intensity of emissions. It is suggested that industry, government and the research community consider the establishment of tax related and market incentives for substantially increased R&D spending on cleaner technologies. Such incentives should promote small scale efficiency gains through continuous improvement, as well as applied research and the deployment of fundamentally new technologies. The lack of progress in implementing cleaner technologies will in the longer term be detrimental to the industry's international competitiveness. The main industry competitor countries in the developed world, namely Australia, Canada and the United States, have established clean technology roadmaps, and have in the recent past implemented policies, financial incentives and market instruments to promote the research and deployment of clean technologies.

Figure 6.4: Stakeholder involvement and managing the balance

(Goodjik, 2003)



Further research

This study focused on environmental stakeholder concerns. However, for progress towards sustainable development, further analysis of socio-economic stakeholder issues is also required. Carroll's, (Carroll & Buchholtz, 2003) corporate social performance model accommodates multiple stakeholder issues and could be used for such research.

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APPENDIX 1
COVERING LETTER TO SURVEY QUESTIONNAIRE

Dear Sir / Madam

As a person knowledgeable in this field, you have been selected to participate in a survey to study the mining industry's approach to stakeholder issues on the environment. The background and purpose of the research are detailed below.

Background to survey

I am in the process of completing the MBL (Masters in Business Leadership) programme at the Graduate School of Business Leadership, of the University of South Africa (UNISA). This research survey is an important component of a Research Report which is undertaken in partial fulfillment of the requirements for the MBL degree.

Purpose of the survey

The mining industry, together with other business sectors, has over the past decade been confronted by increasing global and national pressures for improved environmental performance. The survey forms part of a study of the mining industry's response to raised stakeholder expectations.

With respect to the survey questions, please answer all questions in the context of your views of the South African mining industry as a whole. The survey does not seek to evaluate individual company performance. The survey is strictly confidential and individual responses will not be disseminated.

Structure of the Questionnaire

This questionnaire consists of two sections. Section 1 covers biographical information and Section 2 deals with the survey questions. The information in the biographical section is used to provide an indication of the respondent's involvement in environmental issues within the mining industry.

In answering Section 2, please consider each question carefully in the context of the performance over the past decade of the **South African mining industry** as a whole. For each questions, kindly indicate your response to each of the elements contained within the matrix table, based on a scale where **one (1) is strongly disagree** and **seven (7) is strongly agree.** Indicate your selection by marking the appropriate block in the matrix table with an " **X**". An example using a fictitious question is provided below.

1. **To what extent does industry provide input into national debate on environmental issues, with respect to the following:**

	1	2	3	4	5	6	7
Land rehabilitation			X				
Biodiversity							X
Waste management				X			
Energy efficiency	X						

Queries and completed questionnaire

The questionnaire will take approximately 30 minutes to complete and I would appreciate your responses by 30 July 2006. The completed questionnaire or any other queries should be submitted by e-mail to me at ypillay@angloamerican.co.za . I can also be reached by on telephone (011) 6385323 or 0827716868.

Thanking you for your participation

Y S Pillay (Stan)
UNISA School of Business Leadership (MBL 3)
Student Number - 70505322

APPENDIX 2
SURVEY QUESTIONNAIRE

Section 1. Biographical Information

For all responses, please indicate your selection by marking the appropriate block in the table with an" **X**", using a black pen.

1. Please indicate the type of mining activity you are employed in by selecting the most appropriate block.

Base Metals	Coal	Diamonds	Gold
Iron Ore	Industrial Minerals	Platinum	Multi-commodity company
Other (Please specify)			

2. Please indicate your field of employment in the mining company by selecting the most appropriate block.

Environmental	Sustainable Development	Public Relations	Government Relations
Industry Affairs	Community Affairs	Other (Please specify)	

3. Please indicate the extent of your work experience in the field of employment identified above, by selecting the most appropriate block.

Less than 1 year	Between one 1 and 2 years	Between 2 and 5 years	More than 5 years

4. Please indicate your job title by selecting the most appropriate block.

Officer	Manager	General Manager	Director
Other (Please specify)			

Section 2. Survey Questions

In answering the survey questions, please select your responses after carefully considering their context in terms of the performance over the past decade of the **South African mining industry** as a whole.

For each of the questions, kindly select your response for each of the elements contained within the matrix table, based on a scale where **one (1)** is **strongly disagree** and **seven (7)** is **strongly agree.** Indicate your selection by marking the appropriate block in the matrix with an " **X**", using a black pen.

1. To what extent has the industry modified business practices in the following areas of operation, in order to reduce impact on animal species and natural habitats?

(Dimension Cronbach's coefficient alpha: 0.85)

	1	2	3	4	5	6	7
Mining process activities							
Run of mine beneficiation							
Transportation of product							
Exploration and prospecting sites							

2. To what extent has the industry undertaken the following voluntary actions (i.e., actions that are not required by regulations) for environmental restoration?

(Dimension Cronbach's coefficient alpha: 0.83)

	1	2	3	4	5	6	7
Restoration of organic properties of soil							
Protection of, and withdrawal from, ecologically sensitive habitat							
Disposal and treatment of hazardous/toxic wastes							
Compensation to local communities, employees, and other impacted parties for injury caused due to the company's environmental policies and accidents							
Clean-up of abandoned mine sites							

3. Please indicate the extent to which the industry's environmental practices have led to any of the following competitive benefits?
(Dimension Cronbach's coefficient alpha: 0.96)

	1	2	3	4	5	6	7
Reduction in costs *							
Improved operations**							
Improved product quality							
Product innovations							
Organisation-wide learning among employees							
Overall improved company reputation or goodwill							
Better relationships with stakeholders such as local communities, regulators, and environmental groups							

* Material costs, process/production costs and costs of regulatory compliance

** Increased process/production efficiency, increases in productivity, increased knowledge about effective ways of managing operations and process innovations

4. To what extent has the industry reduced wastes and emissions from operations as a result of the following actions.

(Dimension Cronbach's coefficient alpha: 0.81)

	1	2	3	4	5	6	7
Safe disposal of solid/hazardous wastes							
Investment in pollution/emission control equipment							
Recycling programmes							
Closed-loop waste use within the organisation							
Closed-loop waste use with other organisations							
Process modifications to reduce waste at source							
Changes in input material specifications							
Modifications of product specifications							
Implemented new technology to reduce waste							

5. To what extent has the industry established partnerships to reduce environmental impact?

(Dimension Cronbach's coefficient alpha: 0.80)

	1	2	3	4	5	6	7
Technology and research alliances with other companies							
Agreements with other companies to process waste							
Partnerships to establish environmental standards for products, processes, operations, and materials with others *							
Establishment of consultative councils with local communities/governments, and environmental groups							
Education programmes for reduction of wasteful consumption							
Partnerships in other developing countries for environmental preservation							

* Other companies; environmental groups; suppliers industry associations

6. Indicate the extent to which the industry undertakes the following actions for environmental audit, public disclosure, employee training and immunity?

(Dimension Cronbach's coefficient alpha 0.84)

	1	2	3	4	5	6	7
Periodic assessment of the environmental impact of operations							
Periodic comprehensive environmental audit							
Annual release of a public environmental stewardship report							
Inform in a timely manner everyone who may be affected by conditions that might endanger health, safety, or the environment							
Follow environmental practices according to South African regulations in developing countries where environmental regulations are less stringent							
Invest in research for environmental preservation*							

* Within company, with industry associations, or with universities and other research agencies

7. To what extent has the industry undertaken the following actions to reduce the risk of environmental accidents, spills, and releases?
(Dimension Cronbach's coefficient alpha: 0.82)

	1	2	3	4	5	6	7
Investments in equipment and control/alarm systems							
Rigorous emergency response procedures							
Training of local communities in emergency response procedures							
Fundamental changes in the design of processes and products to reduce/eliminate environmental accidents, spills, releases, and hazardous waste							

***8.* To what extent has the industry undertaken the following actions to reduce the environmental impact of its products?**

(Dimension Cronbach's coefficient alpha: 0.97)

	1	2	3	4	5	6	7
Introduced lower emission option							
Introduced technologies for reducing emissions from product use							
Introduced recycling of discards from product use							
Adopted comprehensive product life cycle analysis							
Obtained ecological certification of a product or service							
Changed product specifications in order to make production processes less environmentally damaging							

9. To what extent has the industry reduced purchases of non-renewable materials, chemicals, and components, as a result of the following actions?

(Dimension Cronbach's coefficient alpha: 0.84)

Reduction in total materials used	1	2	3	4	5	6	7
Substitution by renewable materials							
Use of recycled/waste materials							

10. To what extent has the industry reduced the use of traditional fuels, by substitution of, and research into, the following energy sources?

(Dimension Cronbach's coefficient alpha: 0.83)

	1	2	3	4	5	6	7
Substitution by renewable energy sources*							
Substitution by alternative energy sources**							
Increase in co-generation facilities							
Investment in research into alternative energy sources							

* Photovoltaic, solar thermal energy or wind power

**Natural gas, geothermal energy, methane, biomass or energy from wastes

11. To what extent has the industry reduced energy use, due to the following actions?

(Dimension Cronbach's coefficient alpha: 0.82)

	1	2	3	4	5	6	7
Retrofitting/replacement of high-energy-consuming equipment							
Changes in process technology							
Changes in product specifications							
Changes in specifications of input materials							
Better housekeeping/maintenance procedures							

APPENDIX 3

RESEARCH MEASURES

The variables as included in the research instrument for each of EP, EI, SP and CT measures are presented below.

ENVIRONMENTAL PERFORMANCE (EP)

The first 16 items in the research instrument are used to measure the extent of change in the environmental practices adopted by the industry since 1996 to reduce environmental impacts. High scores on these items will indicate the embedding of a proactive environmental response strategy, whilst low scores on the opposite end of the scale will indicate a reactive response.

V1	Mining process activities
V2	Run of mine beneficiation
V3	Transportation of product
V4	Exploration and prospecting sites
V5	Restoration of organic properties of soil
V6	Protection of, and withdrawal from, ecologically sensitive habitat
V7	Disposal and treatment of hazardous/toxic wastes
V8	Compensation to local communities, employees, and other impacted parties for injury caused due to the company's environmental policies and accidents
V9	Clean-up of abandoned mine sites

V10	Reduction in costs
V11	Improved operations
V12	Improved product quality
V13	Product innovations
V14	Organisation-wide learning among employees
V15	Overall improved company reputation or goodwill
V16	Better relationships with stakeholders such as local communities, regulators, and environmental groups

EMISSIONS INTENSITY

Items 17 to 25 on the research instrument are used to measure the change in industry emissions since 1996, with high scores indicating an improvement (reduction) in the intensity of emissions.

rV17	Safe disposal of solid/hazardous wastes
eV18	Investment in pollution/emission control equipment
dV19	Recycling programmes
uV20	Closed-loop waste use within the organisation
oV21	Closed-loop waste use with other organisations
tV22	Process modifications to reduce waste at source
iV23	Changes in input material specifications
qV24	Modifications of product specifications
rV25	Implemented new technology to reduce wastes

STAKEHOLDER PARTNERSHIPS (SP)

Items 26 to 41 of the research instrument constitute a measure of industry and secondary stakeholder partnerships on the environment. High scores on these items indicate a proactive industry stance in establishing partnerships to reduce environmental impacts, whilst low scores will indicate a reactive response.

V26	Technology and research alliances with other companies
V27	Agreements with other companies to process wastes
V28	Partnerships to establish environmental standards for products, processes, operations, and materials with others
V29	Establishment of consultative councils with local communities/governments, and environmental groups
V30	Education programmes for reduction of wasteful consumption
V31	Partnerships in other developing countries for environmental preservation
V32	Periodic assessment of the environmental impact of operations
V33	Periodic comprehensive environmental audit
V34	Annual release of a public environmental stewardship report
V35	Inform in a timely manner everyone who may be affected by conditions that might endanger health, safety, or the environment
V36	Follow environmental practices according to South African regulations in developing countries where environmental regulations are less stringent
V37	Invest in research for environmental preservation

V38	Investment in equipment and control/alarm systems
V39	Rigorous emergency response procedures
V40	Training of local communities in emergency response procedures
V41	Fundamental changes in the design of processes and products to reduce/eliminate environmental accidents, spills, releases, and hazardous waste

CLEAN TECHNOLOGIES (CT)

Items 42 to 59 of the research instrument constitute a measure of how far the industry has adapted cleaner processes and technologies to reduce environmental impacts, including emissions in product use. High scores on these items will indicate a proactive industry stance in adopting a product stewardship led strategy to reduce environmental impacts. Items 18 to 26 on the research instrument are used to measure the change in industry emissions since 1996, with high scores indicating a reduction in the intensity of industry emissions.

V42	Introduced lower emission option
V43	Introduced technologies for reducing emissions from product use
V44	Introduced recycling of discards from product use
V45	Adopted comprehensive product life cycle analysis
V46	Obtained ecological certification of a product or service
V47	Changed product specifications in order to make production processes less environmentally damaging

V48	Reduction in total materials used
V49	Substitution by renewable materials
V50	Use of recycled/waste materials

V51	Substitution by renewable energy sources
V52	Substitution by alternative energy sources
V53	Increase in co-generation facilities
V54	Investment in research into alternative energy sources

V55	Retrofitting/replacement of high-energy-consuming equipment
V56	Changes in process technology
V57	Changes in product specifications
V58	Changes in specifications of input materials
V59	Better housekeeping/maintenance procedures

BIOGRAPHICAL VARIABLES

Mining activity by type

1	2	3	4
Base Metals	Coal	Diamonds	Gold
5	6	7	8
Iron Ore	Industrial Minerals	Platinum	Multi-commodity company
9			
Other			

Respondent's field of employment

1	2	3	4
Environmental	Sustainable Development	Public Relations	Government Relations
5	6	7	
Industry Affairs	Community Affairs	Other	

Respondent's work experience

1	2	3	4
Less than 1 year	Between 1 and 2 years	Between 2 and 5 years	More than 5 years

Respondent job title

1	2	3	4
Officer	Manager	General Manager	Director
B25			
Other			