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THE RELEVANCE OF SUSTAINABLE DEVELOPMENT PRINCIPLES AND GOALS THROUGH A CASE STUDY OF GOLD FIELDS AND LIVING

GOLD

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MASTERS OF BUSINESS ADMINISTRATION (ENVIRONMENTAL
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By

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prevailing applications for South African
mining industries - the balanced bottom line

ABSTRACT

The conventional definition of sustainable development as proposed by the Brundtland Report (United Nations, 1987), involving the integration of economic, social and environmental components, is widely accepted. Presumed benefits of these current framework applications tend to perpetuate a business as usual status, with no real sustainable development occurring. The growing debate surrounding this topic makes the case for relevant and contextual inputs to be included into sustainable development objectives.

A case study, of Gold Fields and Living Gold, attempts to create a deeper understanding of the components of this debate, and begins to contextualise sustainable development principles, goals and their outcomes. This is carried out through an enquiry of the use of cultural development as a fourth sustainable development category. The case study includes the opinions of a directly affected local community entity (Living Gold) in order to observe the difference between the two organisations (Gold Fields and Living Gold). During the study, the focus began to move away from purely unabated growth impacts and looked to the creation and fostering of resilience and flexibility by the use of adaptive management. In breeding states of resilience, it was recognised that cultural impacts played an important role in ensuring long term systemic resilience.

The case study involved assessing the feedback and responses of strategically selected individuals at both organisations, with Gold Fields representing a more western centric entity and Living Gold a formal representation of a traditional/ indigenous community. Similarities and differences were assessed in order to understand how current sustainable development criteria might differ between organisations that have different end objectives in mind, yet are dependent on each other. The findings resulted in a perspective of how culture could be used to describe the qualities of a local community, and how to begin aligning development goals with affected communities. The result was the development of the Integrated Resilience Sustainability Method and the consequent development of the Balanced Bottom Line Framework, which seeks to promote sustainable development along the lines of economic, social, environmental and cultural development.

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CHAPTER 1
INTRODUCTION

1.1. BACKGROUND

Sustainable development gained prominence after the commissioning and release of the Brundtland Report in 1987 (United Nations' World Commission on Environment & Development – WCED) (United Nations, 1987). The Brundtland Report defined Sustainable Development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987: 43). Both in the Brundtland Report and the subsequent Agenda 21 (a document composed at the Rio Earth Summit in 1992 as a strategy to address concerns raised in the Brundtland Report) three development components were proposed as necessary to promote sustainable development. These three components were highlighted as 1) Economic Development and concerns, 2) Environmental Development and concerns, and 3) Social Development and concerns (United Nations, 1987; Earth Summit, 1992).

Within this idea of sustainable development, there appears to be a growing sentiment that this contemporary and widely accepted model of sustainable development may be inadequate in addressing a holistic application of sustainability and missing the essence of what sustainable development is attempting to address. Hence sustainable development is increasingly being regarded as evolving from conventional economic literature, which appears to ensure business-as-usual without any real change (Escobar, 1996).

1.2 SUSTAINABLE DEVELOPMENT EVALUATION

There is growing concern and scepticism surrounding the ideals of sustainable development, as it has borne no observable and definite environmental and social benefits of any real significance or created any long-lasting effects, besides promoting the access of resources, markets and the neo-liberal economic policies of the developed world (Castro, 2004). Escobar (1995) postulated that sustainability in the guise of development has continued to be a top-down, western ethnocentric and technocratic approach. Progress and development are measured against predetermined objectives, which are designed by institutions that do not entirely understand the

contextual operations in very specific environments (Escobar, 1995). Thus, the literature suggests that program goals, targets and decisions have to conform to a set of program ideals that have been developed by institutions which do not necessarily have any understanding or experience of certain realities that exist in local communities and economies.

As sustainable development paradigms begin to shift and no longer serve the context in which people find themselves operating, and continued sustainability becomes more pertinent, the focus of sustainable development goals would appear to need to be redressed. Accordingly, differences exist along various lines such as language, race, economic needs, relative importance of life goals and physical capacities, where each culture values certain development needs differently (Escobar, 1995). It would therefore seem that there is a need to address these cultural and value differences that occur in different contexts.

According to Capra (2005a), sustainability does not need to be formulated, where he believes that “we can learn from societies that have lived sustainably for centuries” (Capra, 2005a: website). Here Capra (2005a) is referring to not only human communities but other living systems that have managed to sustain themselves for “centuries” with little or no impact upon the environment. Human beings and our institutions form part of these larger, dynamic ecosystems. We rely on these ecosystems for inputs and generate outputs that are fed into these very same ecosystems. Human beings and our institutions are part and parcel of larger and smaller systems generating direct and indirect impacts upon these systems. Sustainable development in its current guise does not appear to take into account the contextual specifics and implications of development objectives. “Systems’ thinking”, as Capra terms it, requires thinking in terms of relationship, connectedness and context (Capra, 2005b).

Current responses to contextual applications are however beginning to find prominence through environmental management tools such as technological assessments, where an emphasis is placed on a local area’s ability to produce and assimilate goods or services. Assessing an area’s capacity to produce goods and services leads to a localisation of intrinsic and extrinsic needs of communities and

whether these can be met, predominantly, by themselves. These can be witnessed through alternate theories of sustainability such as the Sustainability Process Index (Krotscheck & Narodslawsky, 1996) and the Natural Step Framework (Robèrt, 1989).

Businesses do not operate in isolation but within communities and are dependent on the environment. Perceptions of sustainable development and sustainability may vary considerably between interested and affected communities and companies, particularly where companies with global footprints operate in different geographical locations. For companies to operate effectively and efficiently, they will need to be accepted by the communities in which they operate. Local perceptions will invariably be required as the alignment of these perceptions, between both parties, would be required when planning for sustainability. To date there has been very little research into alignment strategies of sustainable development between businesses and communities in which they operate.

Companies tend to exert far-reaching impacts across the planet. Another area of focus has been to ascertain what developments have occurred and are occurring in businesses which are effectively responding to the ideal of sustainability, if at all. In this regard, a number of questions need to be answered, and certain assumptions have to be made. The main assumption made throughout, is that in order to effectively change current unsustainable environmental and social practices, strategic planning is required to institute sustainable business practices. To further expand on this assumption, for an organization to truly make the shift, the shift would have to become part of an organisation's strategic objective.

The mining industry is an excellent model for such an investigation as most large companies within this sector operate globally, in multiple social contexts and mining operations are ultimately finite, as all mines have a specific lifetime. Hence planning for eventual closure, particularly in terms of the sustainability of local economies and communities, is essential for socially responsible and sustainable operations.

1.3. THE CASE: GOLD FIELDS

1.3.1. Mining

Lazo (2002) states that ecosystems provide a wide range of goods and services which improve human welfare and these changes imply change across generations. Accordingly these changes in welfare can be viewed as either benefits or costs to human wellbeing (Lazo, 2002). Mining is an industry that has extreme influences and impacts on both society and the environment (Hilson, 2006). Mining makes substantial use of a variety of scarce resources which apply stresses and impacts upon the environments and ecosystems in which they operate (Hilson, 2006). It should therefore be the responsibility of the mining company to carry out operations in a manner which inflicts as little negative impact upon the surrounding environment as is possible (Sampad, 2005). The demand for environmental accountability is increasing globally along with improvements in technologies which are able to internalise environmental costs (Hodges, 1995). In Mexico, a country viewed in a similar light to South Africa with regard to development status as well as having similar reliance upon mining for GDP contribution, there is increasing focus on the contribution of mining to social and economic development (Suppen *et al*, 2006). Recently, the Mexican mining industry has begun to introduce Life Cycle Assessments (LCA's) as a tool to be used for evaluating environmental impacts (Suppen *et al*, 2006). It would therefore make sense to begin using such measurement tools in assessing the impact of mining activities against such life cycles, whereby costs and benefits could be analysed across different generations. As such, it would be necessary to expand the scope of the LCA well beyond the operational phase of the mine.

1.3.2. Gold Fields

Gold Fields is a locally based gold mining company with the bulk of their operations in South Africa (Driefontein, Kloof and Beatrix). They have international operations in Ghana (Tarkwa and Damang) and Australia (St Ives and Agnew), as well as developing operations in Peru (Cerro Corona), Finland (Arctic Platinum Project), Burkina Faso (Essakane), Canada (Comaplex) and Venezuela (Bolivar). The company's revenue for the fiscal year ended 30 June 2005 was R11,76 billion, having produced 4,2 million ounces of gold and employed 43 942 people (Gold Fields, 2005).

As a mining company operating within the mining industry, Gold Fields is highly reliant on the environment for its core product, as well as being dependent on the surrounding community for its operations. The current scope of sustainable development planning appears to have been stimulated by initiatives such as the King Report on Corporate Governance (King II) and the advent of Corporate Social Investment (CSI) (Institute of Directors in South Africa – IoDSA, 2003). Subsequently, 2003 marked a watershed year for Gold Fields with regards to reporting on sustainability issues and specifically environmental reporting (Gold Fields, 2003). Gold Fields' interdependence upon the environment was acknowledged as such by CEO Ian Cockerill in their 2003 Sustainable Development Report (Gold Fields, 2003). Consequently, global best practices were adopted as company standards and reporting done according to criteria as stipulated by the Global Reporting Initiative (Gold Fields, 2003). Again this was reinforced by Ian Cockerill's ascension that "it's important that when we walk away, we leave something behind that is useful and benefits the community" (Gold Fields, 2004b: 45). Further to this, the alignment of objectives and goals is seen as integral to Gold Fields achieving sustainability. The aligning of different perceptions and objectives between Gold Fields and interested and affected communities is acknowledged by Rosemary Nogé (nee Moffat), Gold Fields Sustainable Development Manager, as in order "to achieve sustainable development goals we (Gold Fields) need effective partnerships and universal understanding" (Gold Fields, 2004b: 61). The dependency and integration between company and community is ultimately solidified by Terrence Goodlace, Gold Fields senior vice president of strategic planning, who states Gold Fields has "to benefit the communities that surround our mines and we must have a plan of action to stimulate the local economy once the mine is closed" (Gold Fields, 2004b: 63).

1.3.3. Living Gold

As a direct and indirect result of their sustainability strategy, Gold Fields made a substantial investment in the development of Living Gold, an organisation that is based within the Carletonville/ Khutsong area and community, which seeks to generate new revenue opportunities by creating a sustainable business (Goldfields, 2004). Living Gold is a social investment organisation that has also been created to diversify the career opportunities and industries open to the interested and affected community. By providing seed financing and the use of unused Gold Fields land,

Living Gold is focussed on growing roses, with plans to expand production to growing filler plants and possibly other agricultural produce. Living Gold is a direct response to Gold Fields' intention to develop agricultural initiatives to empower local communities by creating an agricultural hub in the surrounding area (Gold Fields, 2004). The initiative has already created 300 permanent jobs for retrenched Gold Fields' mineworkers, their families and local community members (Gold Fields, 2004). As part of the mandate, Living Gold needs to be financially viable and economically sustainable, as well as provide a catalyst for other locally situated businesses (Gold Fields, 2004). On the surface Living Gold would appear to address the concerns surrounding economic sustainability of the Carletonville/ Khutsong community after closure of the mine, but no research has yet been conducted to determine to what extent it meets the broader sustainability needs or desires of the community.

1.4. RESEARCH OBJECTIVES

There appears to be a gap between the essence of what sustainability is attempting to achieve and the burden it is currently placing upon economies, ecosystems, communities and their capacity to adapt their behaviour to appease external influences. Goals seem to be dictated to these communities and objectives are set according to impersonal structures. There is also a growing need for alternative avenues of revenue growth in the South African markets, whilst promoting a greater scope for beneficiation for disparate communities across the country. It is therefore pertinent that in order for South African industries and businesses to provide and address the needs of these markets effectively, a closer assessment of the actual needs of society and affected communities (hence its influence on cultural perspectives) should be made and planned for, in order to ensure long-term feasibility and sustainability in a South African context.

The goal of this research is to contribute to the development of better alignment between the perceived ideals of sustainability of mining companies and the communities in which they operate. Related to this goal, the aims of the research were to:

- ♦ Compare the sustainability ideals of Gold Fields and the community (through Living Gold) in which they operate using more culturally and contextually relevant criteria.
- ♦ Contribute to the development of an updated framework for sustainable development.

1.5. THESIS OUTLINE

Before the research was initiated it was necessary to perform an extensive review of the literature on the topic. The literature review was carried out in Chapter 2, which covered, broadly, the burgeoning debate surrounding sustainable development and a variety of environmental and sustainability topics that were relevant to the Gold Fields case study. The methods used to carry out the research are described in Chapter 3. In Chapter 4, the results of the research are presented and discussed, helping to clarify implications and possible deficiencies in the realm of sustainable development. The case study was used to assessing the context, relevance and alignment of development goals, and in Chapter 5 general conclusions, research recommendations and general recommendations were able to be made.

CHAPTER 2
THE EVOLVING FORM OF SUSTAINABLE DEVELOPMENT -
LITERATURE REVIEW

2.1. AN OVERVIEW OF SUSTAINABLE DEVELOPMENT

2.1.1. Progression of Sustainability and Sustainable Development

The sustainable development has been guided primarily by the principles set forth in the United Nations World Commission on Environment and Development report known as the Brundtland Report (United Nations, 1987) and the “commitments” made at the 1992 World Summit on Sustainable Development: Earth Summit 1992 (Rio de Janeiro), and set forth in Agenda 21 (Earth Summit, 1992). The debate revolves around creating development in a sustainable fashion, in order to ensure a future for human existence on this planet and subsequent generations. The most widely used definition of sustainable development as stipulated in the Brundtland Report is noted as “development that meets the needs of the present without compromising the ability of future generations to meet theirs” (United Nations, 1987: 43). Three main areas are highlighted as necessary for promoting sustainable development and have been stated as development which addresses 1) Economic development and concerns, 2) Environmental development and concerns, and 3) Social development and concerns (United Nation, 1987; Earth Summit, 1992).

It appears that sustainable development needs to respond to the requirements of countries, companies, communities and people by forging a more complete and holistic approach to sustainable development and the understanding of sustainability in these different contexts, benefiting all, directly or indirectly.

2.1.2. Critique of Sustainable Development

Strategically, companies/ businesses are set up to ensure the maximisation of shareholder wealth, which is achieved through the process of growth, in turn achieving capital expansion. One of the priorities of capital expansion *should* be to ensure that environmental conditions are managed in order to provide the necessary natural capital and future resource availability. It is in this dynamic yet subtle shift of focus that the exposition of a weakness is exhibited; that of trying to adapt sustainability to current operational and organisational paradigms. The current

prevailing economic system is predominantly set up to enforce continued capital expansion above all else, even though other concerns may require more urgent attention (Castro, 2004). The World Bank and other seemingly “Western” institutions have attempted to ensure the increased influence of their bureaucratic powers whilst at the same time providing the agendas for governments and their state agencies (Fergusson, 1990). Castro (2004) seeks to understand the apparent unaligned goals and objectives of sustainable development. The field of sustainable development has been seen as a symptomatic response which has evolved out of a “reaction to the radicalism of the environmental movement” (Castro, 2004: 196).

The post-structuralist critique of sustainable development states that people and the environment are treated as objects which can and must be managed, instead of as highly diverse, dynamic and complex systems in constant states of flux and change (Ferguson, 1990). Progress and development are measured against pre-stipulated objectives, which have been designed out of context by institutions who do not entirely understand the contextual intricacies and operations in very specific environments (Escobar, 1995). The general assumption made by economists is that all things remain equal and this can create the misconception that even culture is the same throughout the world (Castro, 2004). This in turn creates problems when attempting to generate sustainability objectives in specific contexts. Culture and economy must be seen as two separate concepts, with each culture valuing certain sustainability objectives differently (Escobar, 1995).

In turn, Western proponents of sustainable development have entrenched their position of power and control over developing nations through well established and deep rooted practices (Escobar, 1995). This unquestioning acceptance of sustainable development is akin to the acceptance of the commodification and commercialisation of the environment, in turn leading to current levels of ecological degradation (Escobar, 1996). However, indigenous communities have information to share, as they have reached a point where cultural practices are identified as a principle of productivity for the sustainable use of natural resources (Escobar, 1996). This concept of co-evolution, which is a consequence of the evolution of separate systems in a society, occurs at separate rates and should thus be differentiated apart from one unidentifiable whole (Norgaard, 1994). Currently general objectives are applied to

each aspect of development without allowing for dynamic and separate evolution. These different systems need to be engaged according to unique and locally responsive systems that are dynamic, and not some predetermined system to be managed (Norgaard, 1994).

In the Penguin Reference Concise English Dictionary (2004: 234) “development” is defined as “*the act of or an instance of developing or being developed*”, and the definition of “develop” is “*to go through a process of natural growth, differentiation, or evolution by successive changes*”. Against this terminology Allenby (1992) stated, in O'Rourke, Connelly & Koshland (1996: 91), that: “*a state of sustainable development is approached and maintained. It consists of a systems view of human economic activity and its interrelationship with fundamental biological, chemical, and physical systems with the goal of establishing and maintaining the human species at levels that can be sustained indefinitely - given continued economic, cultural, and technological evolution.*” It is with these two definitions in mind that a nexus of sustainability will be investigated in order to understand how all function in a culturally informed context.

2.1.3. Challenges Faced: Sustainability - Sustainable Growth Dilemma

Economic growth is realised to have been met when the total value of both goods and services purchased have increased, in a specific economy. The necessity of these goods and services is hardly ever questioned with the only apparent value that they create being measured against capital expansion. If a revaluation were to be carried out, seeking to lower real Gross Domestic Product (GDP) figures by the amount of damage incurred by these goods and services, including rehabilitation caused by damage, a totally different picture would be observed (Douthwaite, 1997). Although current GDP figures are appearing to grow, real GDP and Quality of Life figures have decreased (Douthwaite, 1997). Are companies' indicators effective in helping them respond to dynamically changing conditions or are they concerned with achieving their objectives, no matter the cost?

Sustainable development has been given impetus through principles set forth in the Global Reporting Initiative Sustainability Reporting Guidelines (GRI) (GRI, 2002), the King Report on Corporate Governance for South Africa (King II) (IoDSA, 2002)

and the Johannesburg Securities Exchange Socially Responsible Investing Index (JSE SRI) (JSE, 2004). The advent of the King II Report has also brought about more accountability faced by companies, which has also been made enforceable through the use of more stringent legislation and regulation (even enshrined in the South African Constitution) (RSA, 1996).

2.1.4. Culture and the Environment

The premise of an intimate and influential relationship between culture and the environment is explored throughout this dissertation. The intimate link between these two aspects is assessed against current sustainable development implications and business responses to sustainability.

2.1.4. a. Cultural Relationships with the Environment

A causal relationship has been established between the physical environment (cause) through the impression it generates, which leads to action and activities of integration and management with an impact on the resultant culture (effect) (Wissler, 1912).

Culture can be seen as the result of conscious activities of the individual mind (Wissler, 1912). Goldenweiser (1916) furthered the argument with the supposition that culture was the expression of the relationship between an individual in a societal setting and their environment (habitat). This assumption was made against the evident truth that certain cultures were determined by their physical, material environment, which indicated a physical boundary (Goldenweiser, 1916). Phases of culture can be mapped according to how people make successful adjustments to the natural environment and their social constructs (Bernard, 1930). This is observed where unusual or difficult environments require unusual and distinctive cultural changes, in order to adapt to their environs (Bennet, 1944). An example would be the different uses and value placed on water by the Lapp of the Arctic Circle and by the San of Southern Africa. The significance of this is that all cultures place a high value on the assimilative capacity of an area, with higher diversity in an ecosystem being more able to support and sustain a population (Bennet, 1944). Thus it can be understood that cultures do not necessarily seek to fully exploit an environment, as it may be important for their survival to sustain its resilience (Bennet, 1944).

2.1.4. b. *Indigenous and Traditional Knowledge*

“Indigenous knowledge is that knowledge which is the expression of the vibrant relationships between people, their ecosystems, and other living beings and spirits that share their lands. . . Indigenous knowledge is *the way of living* within contexts of flux, paradox, and tension, respecting the pull of dualism and reconciling opposing forces... Developing these ways of knowing leads to freedom of consciousness and to solidarity with the natural world” – (Battiste and Henderson, 2000: 42, in McGregor, 2004).

Indigenous and traditional knowledge and science are both abstract (indigenous) and concrete (science) ways of knowing (Levi-Strauss, 1962 in Berkes *et al*, 2000). Accordingly the interaction between scientific knowledge and indigenous knowledge has always been in a state of flux and tends to be used as political sway (Harris, 1997). These interactions and assessments of relevant knowledge applications and use need to be looked at against the process of transfer, through cultural relationships (Harris, 1997).

Traditional and cultural behaviours (and observations) have a value to add to any system (organisation, ecosystem). This value can be assimilated through the qualitative valuation of the dependent community, and their long-term monitor of an ecosystem. This is an important valuation component that would need to be acknowledged and incorporated into any environmental valuation methodology, as the established community and culture would have a longer-termed perspective of changes, fluctuations and resource uses within the ecosystem (Berkes *et al*, 2000). As indigenous and traditional knowledge begins to permeate its way through a culture, social institutions are important for fostering the transfer of relevant knowledge throughout social structures and with its heavy spiritual component, allows for cultural internalisation (Berkes *et al*, 2000). Interestingly, the process of cultural development is the result of asserting a cultural identity in relation to a “world-view”, in which differing principles can be compared, relatively, and valued according to relative societal behaviours and institutions (Berkes *et al*, 2000:1257). Continual development is evidenced by ongoing experience internalisation and experimental applications, regulated through taboos and transferred through the use of stories, practices and behaviours through a cultural “script” (Berkes *et al*, 2000:1257).

Knowledge and information are key elements in any management process and it's the effective use of all this data that will increase the flexibility and resilience of a system. Indigenous knowledge is usually transferred through, 1) traditional knowledge (generational), 2) empirical knowledge (observation), and 3) revealed knowledge (spiritual, talents) (McGregor, 2004). These methods of knowledge transfer are "responsibilities that one would assume would ensure the continuation of creation (or what academics or scientists might call "sustainability")" (McGregor, 2004:389). Here emerges the idea of cultural practices used in order to ensure continued survival of life and creation, and recognised as sustainability.

2.2. BUSINESS RESPONSES TO SUSTAINABLE DEVELOPMENT

2.2.1. Strategy and Sustainability

Within the fields of strategic management and sustainable development, the concept of sustaining is important to both bodies of knowledge. Strategic management, however, concerns itself with sustaining growth of above average returns. Sustainable development attempts to provide scope and a methodology in addressing current operational impacts to sustain human habitation. Any organisation is a social structure and predominantly dependent on human activity and on human interaction. Differences in social interaction (behaviour) are able to be witnessed, formed and perpetuated through cultural values and norms. Metrics can be assigned to these values (qualities) via market systems by economic valuation. Over-reliance on economic measurements as the only feedback mechanism indicating feasibility, viability, health and sustainability can be detrimental, and as Capra (2002: 5) states; "no individual organism can exist in isolation." All systems are ultimately interdependent to "maintain conditions conducive to life" (Capra, 2002:5). Other indicators are therefore required to create a fuller understanding of sustainable development.

2.2.2. Strategic Management

Strategic management is based on the premise that "it is the art and science of formulating and implementing value-creating strategies within hyper-competitive, turbulent and hostile environments, which seek to exploit core competencies to give an organisation a sustainable competitive advantage as a basis for above-average returns and fulfilling its strategic intent" (Staude 2004: lecture). The intent of strategy

is “the leveraging of a firm’s resources, capabilities and core competencies to accomplish the firm’s goals” (Hitt, Ireland & Hoskisson, 2005: 21). A vision helps create a relative description of this strategy; the “vision provides guidance about what core to preserve and what future to stimulate progress toward” (Collins & Porras, 1996: 66). It is an emotive, rational and engaging function, used to create the perceived future goal of what the company has to achieve and resemble.

A working synthesis of the writings of Collins & Porras (1996) combined with Campbell & Yeung (1991), developed by Staude (2004) states that a mission should encompass the four elements of 1) Purpose, 2) Strategy, 3) Values and 4) Ideology. From the above it emerges that organisational objectives are not random, but based on a set of values, principles and objectives. It is important to remember that strategy is dependent on multiple variables, not a singular item (i.e. maximisation of shareholder wealth), and these objectives are necessary in achieving sustained growth of above average returns. This level of sustained growth requires long-term planning and has implications on short-term actions. Thus sustainability of operational capacity is vital to any business.

2.2.3. The Process of Shifting Paradigms

As paradigms no longer serve the contexts in which organisations find themselves operating, continued sustainability becomes pertinent. Strategy is influenced by values, which inform the mission. According to Capra (2005a), sustainability does not need to be formulated/ discovered, as “we can learn from societies that have lived sustainably for centuries”. Reference is made to human communities and other living systems that have sustained themselves for “centuries” with little or no impact upon the environment (Capra, 2005a). The idea of inter-connectedness is not new, and is gaining prominence to understand and minimise human impacts on the environment. Individuals are themselves systems and are collectively part of a larger system and in turn part of an even bigger ecosystem. “Systems Thinking” can begin to look at thinking in terms of relationship, connectedness and context (Capra, 2005b). With this systemic approach relating to ecosystems it follows that any part of a system is in turn a network of relationships. With this subtle shift in focus from the part (Company) to the whole (Industry and Ecosystems), thinking becomes highly contextualised in the immediate environment, as the system will have an affect on the whole (Capra, 2002).

2.3. RESPONSES AND TOOLS FOR SUSTAINABLE DEVELOPMENT

Shifts in paradigms have lead to a variety of strategic, value based shifts in how a company can operate. Responses to these dynamic, changing conditions of doing business provide workable applications of how best to adapt these frameworks to a way of doing business that is inherent to the way the company behaves.

2.3.1. Natural Capital

Natural Capital is a term that has gained prominence since the mid 1970's with the publishing of a book "Natural Capital", written by Amory Lovins. It has been an attempt to provide a "road map" which can be used and adapted to begin the process of a new sustainable strategy formulation. Accordingly, the reason that companies haven't yet valued and taken proper cognisance of ecosystem services is that they are not part of a company's balance sheet, and thus appear to add no value (Lovins *et al*, 1999). There are no known substitutes at any price for the overwhelming majority of services provided by the ecosphere. Natural Capitalism has been termed as such because of what "capitalism might become if its largest category of capital – the ecosystem – were properly valued" (Lovins *et al*, 1999: 72).

Four major shifts of business practice are as necessary, which are:

1. Increase the productivity of natural resources,
2. Shift to biologically inspired methods of productions,
3. Change to solutions based business models (*service*), and
4. Re-invest in Natural Capital.

These shifts are further accentuated by the scarcity dilemma, where people are not scarce but a productive ecosystem is (Lovins *et al*, 1999).

2.3.2. The Natural Step

The Natural Step is the movement away from thinking in terms of linear operational and production systems and a move toward thinking in terms of circular systems. The Natural Step aims to create higher stakeholder buy-in and participation, raise enthusiasm, eco-efficiency, allow for greater flexibility and resilience, generate scope for product innovation and to ultimately begin thinking in a whole systems approach to business (Robért, 1989). Key to the continued application of the Natural Step is consensus, and specifically consensus between science, business and various elements of society. This cultivates an approach of attempting to find the best solutions for each

individual context, whilst continually improving to latest developments (Robèrt, 1991). It promulgates that each application attempt to 1) eliminate contributions and concentrations of Earth substances into the atmosphere, 2) eliminate contributions and concentrations of substances produced by society, 3) eliminate contributions to the physical degradation through over-utilisation and manipulation, and 4) contribute as much as they can to meeting human needs by substitution and regeneration in meeting the first three objectives (Robèrt, 1989).

2.3.3. Sustainability Process Index

Similar to the Natural Step, the Sustainability Process Index (SPI) approach to sustainable development is carried out by assessing the technological capabilities and material flows in a specific context (Krotscheck & Narodslawsky, 1996). The SPI attempts to ensure “1) material flows do not exceed local assimilation capacities as well as be lower than natural, ecological fluctuations, 2) material flows should not alter the quality and quantity of global material cycles, 3) renewable resources to be extracted at a rate that doesn’t exceed local fertility, and 4) the natural, indigenous biodiversity should be sustained and / or improved” (Krotscheck & Narodslawsky, 1996: 243-244).

2.3.4. Transformational Organisation

The modern myth is that society should be organised around the economy (Harman, 1995). However, the economy and society operate under very different assumptions. Economic assumptions appear to work when progress leads to benefits for people in general, but currently these benefits appear to accumulate to a few and tend to penalise the majority (Harman, 1995). Values are changing. The way people are living is changing, and this in turn will lead to changes to the organisational structure. The idea of “imaginal” cells developing (imaginal cells are the cells of a caterpillar that disintegrate when the metamorphosis process changes it into a butterfly) in current business organisations will lead to new structures being able to support new business paradigms (Harman, 1995). These disintegrative business cells will enable organisations to be less fearful of change and more adaptable to disruptive change. The key to the development of these cells is moving from the thinking of having complete dominion and moving toward the ideal of stewardship (Harman, 1995). This allows for business units to be more flexible and resilient in the face of changing

conditions, as well as providing the scope for adaptive management.

2.3.5. Green Design

Designers across the globe are increasingly being called upon to respond effectively to the state of rapid environmental degradation, that directly and indirectly is a result of their products (Wildhagen, 1995). Generally designers do not concern themselves with the consequences of their designs, and perhaps find the idea overwhelming and intangible (Wildhagen, 1995). The market for green products is largely being driven by the demand pull of consumers, with product innovation generating the most value and therefore product attention (Chen, 2001). It is the promise of a “green consumer” that is leading the charge. Yet what are they looking for? How can “greenness” be gauged and measured?

2.3.6. Life Cycle Assessments

LCA's are seen as important measurement tools in assessing impacts of goods/ products upon the environment. The “cradle-to-grave” process is measured for its energy impacts, as well as the extraction process and waste absorption processes. This creates a valuable measure of the entire life cycle of impacts exerted by a product on the environment, which can be measured and priced. Impacts can then be provided for, further adding to the decision making process, effectively being used to help make strategic and operational decisions. LCA's also allow for the solving of different design and planning problems (Lewandowska & Foltynowicz, 2004). LCA's have the distinct possibility of offering and providing real results for management and policy objectives. However due to certain weaknesses involved, Risk Assessment tools should be assimilated to ensure complete assessments are carried out, offering the best measurements possible (Sleeswijk, Heijungs & Erler, 2003).

In Mexico, mining companies are facing increasing legislative pressure to minimise impacts and meet sustainable development targets (Suppen *et al*, 2006). Life Cycle Assessments (LCA's) are increasingly being used to narrow the discrepancy gaps between different generation values. If the entire life cycle value of an input, product and/ or waste item can be properly measured and accounted for, companies can begin to understand the full internalised costs implications of their impacts (Suppen *et al*, 2006). Scope then becomes a key stage of any LCA, with consequent actions having

impacts across different stages of the life of a goods or services (Suppen *et al*, 2006). “Green” accounting methods might offer a method to help formulate costs for use by companies in financial and economic decision making scenarios.

LCA’s help in making more informed decisions and judgements regarding impacts on eventual costs. LCA’s make use of environmental impacts and seek to quantify these impacts usually in the form of energy and material flows. It is at this level that financial implications can be applied to the process (Góralczyk & Kulczycka, 2000a). However, it is never a true match (just perhaps the closest). They are usually used for differentiating financial investments which are equal (Góralczyk & Kulczycka, 2000a). Mitigation measures are needed at the earliest stage of design for thorough innovation to pay the largest dividends. The consequent adoption of green technologies are being pre-empted by the economic viability of eco efficiencies throughout a variety of industries (Newtown, 2005).

The most universal and holistic model of being able to measure energy flows within an ecosystem and economic system is thermodynamics. If the environment is addressed as part of the production process and system, then emissions and discharge are seen as energy flows which are treated inefficiently (Bakshi, 2000). Of course only a certain level of energy is always available, and it is the efficiency of energy usage that becomes the focus. Industrial systems would also follow the same behavioural patterns as natural ecosystems, yet it is the values of these systems that are taken for granted. Costanza (in Bakshi, 2000) states that, economic and environmental systems are very similar as they are both examples of self-organised systems. The environment provides the inputs of scarce resources into the production process, thereby illustrating the dependency on the environment. However the economy still does not yet pay adequately for the use of these services (Bakshi, 2000). Industry clusters would serve as the ultimate prize, with a community of companies working in conjunction or beside each other, each one being able to form part of a closed loop waste material input cluster (Audretsch & Feldman, 2004).

2.3.7. Industrial Ecology

Industrial Ecology is often referred to as the science of sustainability. It is the analysis of the material flows and energy flows between input, production and outputs of a

process and planning these systems to fully exploit the outputs, making use of industry clusters. A deeper understanding of industrial ecology has been said to lead to an increased understanding of sustainability impacts and thus to a decrease in the impacts on the environment (Ehrenfeld, 2004). Nakajima and Vanderburg (2005) have highlighted and developed 7 levels of strategies that could be developed to maximise the benefits of operating as sustainably as possible. They indicate that most organisations do not operate anywhere near the first 3rd and 4th levels, but that at least they provide a framework and steps which can be applied and lead to dramatic strategic shifts in the core business of an organisation (Nakajima & Vanderburg, 2005).

Mitigations of environmental impacts are increasingly being sought at planning stages of the operations, with more holistic frameworks being applied to the system of the company (O'Rourke *et al*, 1996). These frameworks involve the incremental improvement in sub system designs, as well as redesigning entire systems in order to fully maximise benefits. These processes look to minimise wastes, maximise energy and material efficiencies and consumptions (O'Rourke *et al*, 1996). Once these changes have been effected, other social and economic implications arise, and hence the economic implications of these changes will affect changes globally by opening new markets, closing out others and beginning to compete on other product attributes (O'Rourke *et al*, 1996).

Waste has been a noticeable component of all operational systems (pollution, solid waste etc) (Dale, 2006). Ecological efficiencies are targeted as initially low hanging fruit, which can be achieved through minimal planning. It is these eco efficiencies that are providing economic incentive of system restructurings, with the simple conclusion that if you use less you pay less (Dale, 2006). This implies that the type of information being used to make key strategic and design based judgments needs to be relevant, effective and correct. Information and metrics need to be assimilated into the entire system to align design and operations with beneficial results (Yashiro, Hirao & Kraines, 2004). Material flows become integral to the design of any such system, with the least invasive flows being able to mimic natural flows (Allen, 2003).

The idea of sustainable communities can be expanded to include and make judgements on companies that operate under such conditions. These would involve

complementary types of operations, with not too many similar industries being located together (Dunn, 1998). Public organisations focus on sufficiency, yet private organisations (companies) focus on efficiencies, as that is where the growth in the economy may be seen (Themelis, 2006). Externalities are not taken into account yet and when they are internalised only then will there be a need to regroup and adapt (Huber, 2000).

Market failures that have resulted in externalities being borne by the public are now becoming areas of competitive advantage, with healthier environmental policies seen as adding value to the environment, economy and the individual (Reinhardt, 1999). The scale for these changes is still at the micro level, with further separation being made between company and the individual, with very definite drivers playing a role in new markets (Andrews, 2000). Andrews (1999) further expands on the similarities between the systemic nature of both ecology and economy as both operating under fierce competitive conditions, employing survival strategies made up of complex structures. This further illustrates the similarity and necessity of the evolutionary processes being exhibited and driven by a system itself to adapt to its specific context.

2.4. MEASUREMENT MECHANISMS

In order to prepare and manage strategic shifts, metrics and indicators need to be relevant to the objectives. An understanding of the impacts placed on the environment, society and the economy must be had to devise suitable indicators.

2.4.1. Current Sustainability Indicators

The majority of indicators adopted as sustainability indicators have been adapted from the Agenda 21 by the Global Reporting Initiative (GRI) globally, and Johannesburg Securities Exchange Socially Responsible Investing (JSE SRI) locally (GRI, 2002; JSE 2004). Organisations who are applying these indicators are using them as a measure of their sustainability. These indicators are able to provide help in guiding decisions by providing measurement feedbacks for operational actions (United Nations, 2001). The GRI has provided a variety of indicators that can be used to help measure organisations sustainability. They cover areas of economic performance, environmental management, social impacts in previous guidelines (GRI, 2002) and currently also include human rights concerns, labour practices and product

stewardship in current literature (GRI, 2006). The local application of these GRI indicators are found in the JSE SRI Indicators, which are founded on a base of corporate governance and likewise provide parameters for developing metrics for economic, environmental and social corporate performance (JSE, 2004).

A key flaw contained in these indicators is that they are reliant on the assumption that human-created capital can be directly substituted for natural resource capital. This has led to the current focus of sustainability shifting towards reporting and auditing, with not much focus being applied to control and management of actual sustainability (Zingales & Hockerts, 2001).

Therefore indicators and metrics would need to be provided for, at a strategic level, in order to manage outcomes and impacts of the company. In order to achieve company objectives and goals, a company would need to develop and exercise relevant business strategies. The resulting operations would therefore need to be measured and feedback generated to help assess whether these strategic objectives are being met (Rohm, 2002). A framework which has been used in helping assess strategy and operational impacts is the Balanced Scorecard.

2.4.2. Strategy Indicators (Sustainable Balanced Scorecard)

The Balanced Scorecard (BSC) has provided a methodology of creating indicators in order to measure strategic objectives and goals against the operational and financial results of an organisation. The BSC provides four key perspectives (1 financial, 2 customer, 3 internal organisational, and 4 learning and growth) of any organisation to be measured, providing a feedback loop to gauge whether strategic objectives of the organisation are being met or where they lie (Kaplan & Norton, 1992). It widely used as the main tool to measure and guide strategy objectives. There is growing body of knowledge which seeks to “Balance” the Balanced Scorecard to include aspects of the environment and social implications. The Sustainable Balanced Scorecard (SBSC) has been proposed by various authors with different yet similar proposals, which provide the possibility of a cohesive procedure to address this imbalance.

Sustainability and Corporate Social Investment (CSI) are usually perceived as a cost constraint that needs to be provided for, instead of providing an indicator of the

requirement to change practices. One of the key considerations is “Does it pay to be green” raising the question of eco-efficiency, and its consequent effect on the financial single bottom line. If it does not then sustainability will not be an issue for a business. However, sustainability should be highly relevant to all top management (Zingales & Hockerts, 2001). The Centre for the Management of Environmental and Social Responsibility has devised an extremely competent and coherent diagram of the strategy implementation, process and concerns that would be used to develop an SBSC (see *Appendix A*) (Zingales & Hockerts, 2001). This is an invaluable tool for furthering the understanding and planning for the process of applying a sustainability strategy (Zingales & Hockerts, 2001).

Bieker and Gminder (2001) have noted that corporate sustainability remains separate from any core business strategy. The BSC is an implementation and measurement tool and not a formulation tool, and therefore strategy policies and objectives need to be formulated by top-level management (Bieker & Gminder, 2001). A business case relies on the concept of eco and social efficiency as a method of ensuring economic stability, whilst a human case suggests the idea of continued, long-run survival of the human species, and a green case provides for the basic survival of a habitable environment even if humans no longer exist (Bieker & Gminder, 2001). Naturally the implications for businesses being able to adapt to these changes in strategy, operation, measurements and outputs require a greater understanding of the entire business chain.

2.5. IMPLICATIONS FOR BUSINESS

2.5.1. Environmental Burden

The premise for developing strategies in attaining a framework of sustainable development makes use of the equation popularised by Ehrlich and Commoner, namely Environmental Burden expressed as: $EB = P \times A \times T$; where EB =environmental burden, P =population, A =affluence and T =technology (Hart, 1997). Environmental burden or impact exerted by human behaviour and activity on this planet is a function and product result of the population size, the affluence and technology. This optimistic view of technology as a solution is not shared by both the United States National Academy of Sciences and the British Royal Society (Daily & Ehrlich, 1992).

The core idea postulated is that technology is the only factor that humans can affect, with population control being touted as draconian, and affluence as a direct substitute for poverty (Hart, 1997). However there are rather glaring consequences resulting in population failure (species extinction) if the idea of population control is not addressed (especially assessed against current affluence targets). This becomes evident when we begin to look at carrying capacity in relation to the impacts faced in different contexts. Ehrlich (1982) already stated in 1982 that the Earth was probably exceeding its global carrying capacity as technology was highly dependent on non-renewable resources (i.e. fossil fuels). Economists exist with the idea that humans are able to create their own environments through technological advancement, and provide the argument for perpetual growth (Barret & Morse, 1963 in Ehrlich, 1982). However, the loss of another more relevant and often overlooked non-renewable resource would result in a population crash scenario - the biological diversity of the planet (Ehrlich, 1982). Arrow *et al* (1995) (in Daily *et al*, 1996), also emphasises the element of multi-disciplinary (economists, academics, ecologists, behaviourists, technologists) collaboration, deemed necessary to begin finding effective strategies for managing these holistic systems. This is supplemented by the view of needing to reassess the changes required in consumption patterns, technological interventions and population growth (Daily *et al*, 1996).

If the world was mapped proportionately to the affluence of the planet, we would be able to see that affluence and energy consumption follow similar patterns (Smith, 1995). Affluence and the energy consumed in attaining affluence appear to be correlated. Energy use and consumption is also a rough indicator of environmental impact (i.e. ecological footprints), with energy being directly proportional to affluence (Smith, 1995). The burden placed on the environment in attaining a worldwide level of affluence commensurate to that of the “developed” world would be catastrophic. The ideas of development goals are promoted through developed nation agencies, which inform the level of what affluence is (Daily & Ehrlich, 1992). Affluence in turn is measured against these standards and cultural values. Yet the assimilative capacities of different environs is different the world over implying different implications.

2.5.2. Carrying Capacity

Carrying capacity can best be defined as the maximum rate of resource and waste generated that can be sustained in the long run without degrading the quality and integrity of ecosystems (Rees, 1996). To reach a state of sustainability, humans, as well as organisations, have to realise that they are ecological beings. In a world with a finite resource capacity (both renewable and non-renewable), economic assessments should be informed by some level of both ecological and biophysical analysis (Rees, 1996). Will the physical output into the environment of the Earth's remaining species (including business systems) and consequent processes be sufficient to sustain future expected economic demands yet still be able to support life (Rees, 1996)? Can the Earth carry (sustain) the current lifestyles being exerted upon it?

According to the Second Law of Thermodynamics, complex systems remain in a state of non-equilibrium through a state of continuous dissipation of available energy and material extracted. Due to the entire biosphere constantly seeking to restore that energy from a state of disequilibrium, certain reactions may be caused in other complex systems. In economic terms this can be described when growth proceeds past a specific point, with this continued growth being exercised at the expense of continued disorder in other complex systems (environment). As the global economy begins to exceed its natural income and deplete its natural capital, it will begin to exceed the carrying capacity of the Earth to provide states necessary for continued existence of people, in the long-term (Rees, 1996).

A worrying indicator is if the entire planet was to be developed according to the standards required by development standards, we would require between 3 and 4 planets to provide the resources to enable that target to be reached (Hart, 2000). This would seem to raise questions about conventional ideas of affluence.

2.6. MINING AND SUSTAINABLE DEVELOPMENT

It is from these intrinsic, value orientated perspectives that a company will need to make the shift to more sustainable operational practices. These shifts in paradigms, values and strategies will necessitate a shift in operations (where impacts are felt).

2.6.1 Life Cycle of a Mine

In order to fully prepare for the eventual closure and consequent liabilities to which a mining company will be exposed (even after closure), the life cycle of a mine should be considered. This would help in highlighting the specific phases that a mining company would move through, as well as highlighting the processes that should be carried out (Neba, 2006). The generalised phases of a mining operation are indicated in Figure 2.1.

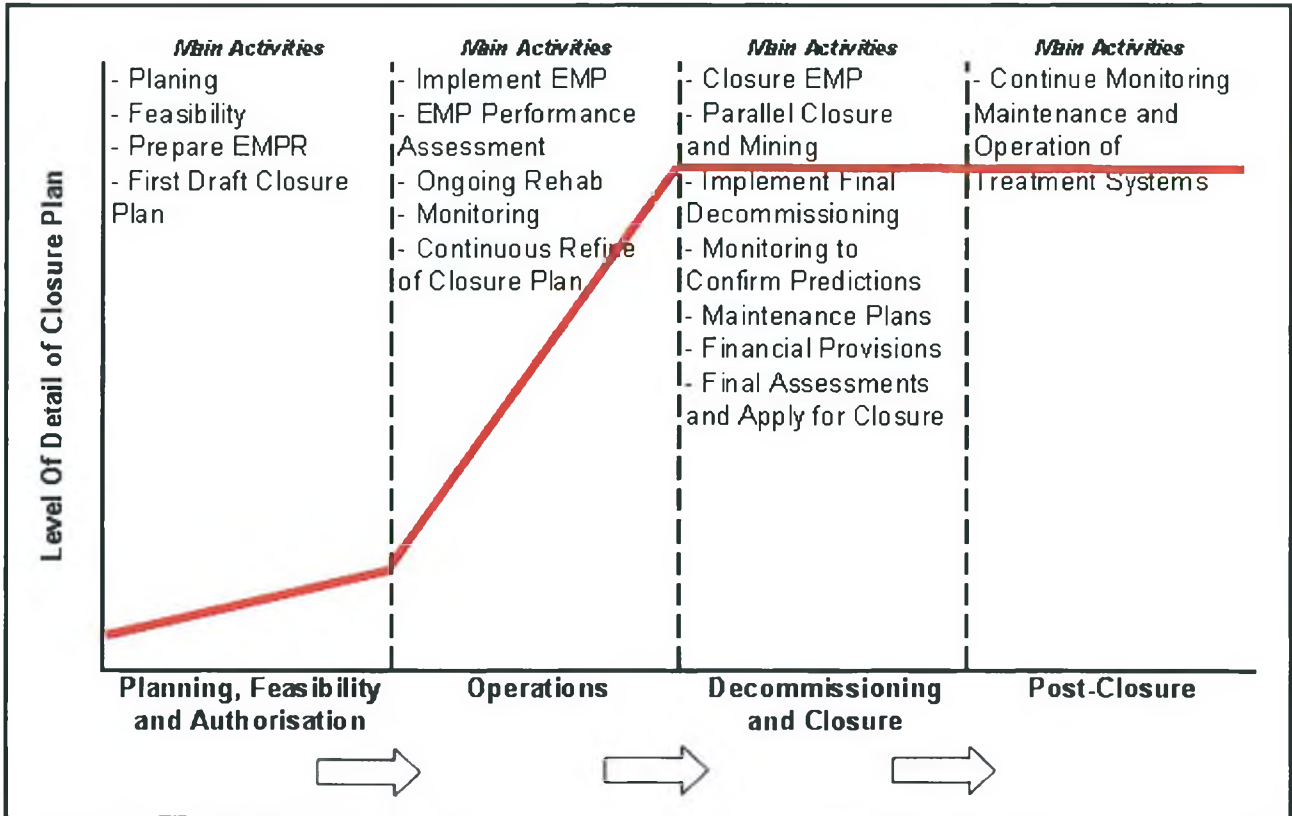


Figure 2.1: Life Cycle of a Mine - Mine Closure Planning Tool. (adapted from Neba, 2006)

From this we can see that a mining operation moves through distinct phases, namely 1) Planning, 2) Operations, 3) Closure and 4) Post-closure. Each phase has separate and specific functions that would need to be carried out to be able to effectively prepare for the eventual closure of the mine. Interestingly, these four phases may be able to operate in conjunction with the four phases of the adaptive management loop (see section 2.6.5 Figure 2.2), indicated above. What becomes more evident is that the value of the environment in which the mine operates may change over time as the quality begins to be eroded due to resource extraction.

2.6.2. Mining and Intergenerational Equity

Solow (1986: 141) states that societies which invest in “reproducible capital” will enjoy “constant consumption” streams into the future. The question arises as to how much of the non-renewable resources can be used by current generations (Solow, 1986). In order to make these comparisons, *utility* is what needs to be measured and not necessarily consumption (Solow, 1986). The value of non-renewable resources can be found in their intrinsic scarcity (Cairns, 1986). Scarcity determines value. The consequent liabilities faced by companies who increase that scarcity, are minimal. Intergenerational equity is reliant on economic growth, enabling the provision of rents being invested for future benefits (Barry, 1991). There is a danger in this thinking as it seems to promote unabated consumption provided the price for the consumption is correct at all times. All costs are not internalised and therefore real costs of this consumption can not be covered with any certainty. Assuming consumption is constant; investing the profits of the consumption of non-renewable resources should be made to mitigate ethical concerns (Hartwick, 1997). Change in valuation of the ecological goods and services plays a telling role in costing correctly, as they tend to change over generations (Lazo, 2002). Ecosystems provide a variety of services, on which humans are entirely dependent (Lazo, 2002). However these values are not sufficiently captured in the open market, as externalities get passed on to the public (Lazo, 2002).

In an economy with a high reliance on non-renewable resources, intergenerational equity can be maintained without any noticeable technological progress and no population growth, provided these profits are reinvested into natural capital reproduction schemes (Okuguchi, 1981). Mining is one industry that has an immense impact on both community development and environmental quality (Hilson, 2006), as well as reducing non renewable resource deposits. The debate around the sustainability of mining is a contentious one in that mining is inherently unsustainable as it involves the extraction of a non renewable resource (Hilson, 2006). It would therefore seem that restrictions (mitigation, rehabilitation and remediation) and ultimately diversification are imperatives for mining companies.

There are two methods of restrictions, in the form of direct restriction (barriers to access, tariffs etc.) and indirect restriction (quotas, limits etc.), which essentially pose

one or another type of tax implication through, one would presume, legislation and regulations (Chakraborty, 2004). Certain companies are proactive and have consequently set up and developed annuities and trusts as mechanisms to provide for proper planning and assimilation of rehabilitation costs over the life of (the mines) operations (Fitz-Maurice, 2000).

2.6.3. Environmental Costs

In Kenya mining has been found to threaten the social structures of predominantly indigenous people (Rights & Democracy, 2005). The findings in a Canadian study, which can be inferred to most mining operations across the globe, highlighted the hidden costs of mining as being 1) a loss of biodiversity, 2) pollution of air, land and water, 3) unfair tax concessions and 4) the health costs, tending to all be borne by the public at large and not by the company responsible (Kuyek, 1999). With an increasing awareness of the “Polluter Pays Principle”, given effect through legislation, the liability of remediation costs are increasingly being passed on to the company responsible for the operational impacts (Moran, 2000: 01). The incentivisation of environmental good practice is being driven by both regulatory pressure and pressure placed on companies to comply through liability, risk and insurance costs (Moran, 2000).

Jaffe *et al* (1995) state that perception regarding regulation is that it will decrease company competitiveness and efficiencies and products may become more expensive as a result. The common treatment of regulations is that they are costs to be minimised, as opposed to being treated as mechanisms which seek to increase the productive capacity of the environment (Jaffe *et al*, 1995). Findings have however shown to be contrary, as Meyer (1992) quoted in Jaffe *et al* (1995: 157) states, there “appears to be a moderate yet consistent positive association between environmentalism and economic growth”. Regulations invariably fail because the costs and administrative functions that they entail are cumbersome, and are difficult to enforce (Hunt, 1996). This problem can often be witnessed in immediate environments with enforcement being the leg of the framework that tends to let the system down. This appears to be more common in developing countries, as their financial and economic focus tends to be on more perceived pertinent issues (such as health, education etc.).

2.6.4. Rehabilitation Costs

Former and old mines still pose a threat to their surrounding environments. Reasons vary from having poor inventory stocks, to lack of understanding regarding the process of remediation. Closure of mines is usually treated with a sense that there is no specific date in mind when operations need to stop, and so preparations are not put in place for the closing of the mine. As a result of closure additional economic and social impacts are felt without having sufficient remediation measures in place in mitigating the cost for a mines shutdown (Mining, Minerals and Sustainable Development, 2002). What may occur is that because rehabilitation cannot be met, compensation is offered. However, the focus then shifts to stressing compensation only, which is a short term measure without any long term rehabilitation planning (Downing, 2002). Rehabilitation is seen as a necessity in order to ensure that the land is not wasted, with productivity being a necessary criterion to ensure that intergenerational equity is upheld. The Australian Department of Minerals and Energy (1995) recommended that rehabilitation costs be included in the cost accounting during the operational life of a mine. The aims were to ensure planning of eventual mine closure, and to keep the control as a separate line item in the financial statements (Australian Department of Minerals and Energy, 1995). In order to effectively plan for long term effects, legislation needs to be put in place so that future generations are able to receive an environmental quality which they are able to utilise in the same manner as current generations (Office Of The Parliamentary Commissioner For The Environment Te Kaitiaki Taiao A Te Whare Paremata, 1997: iii). Will the benefits of mining be advantageous for general societal development, now and into the future, by ensuring environmental resilience and utility? What is the best way of achieving this?

2.6.5. Resilience, Flexibility and Adaptive Management

Resilience is a term used to describe the interactions between people and nature, with the movement away from purely focussing on stability and rather seeking to operate within changing environments (Carpenter, Walker, Anderies & Abel, 2001). Resilience, described by Gunderson (2000), is the ability of a system to reorganise itself and withstand changing conditions – adapting to changing conditions. The premise of assessing resilience is to describe a state of disequilibrium, and just how far from a current state of disequilibrium the ecosystem is in relation to a state of equilibrium (Gunderson, 2000).

Panarchy –coined by Gunderson and Holling (2001) – has been used to describe the over-layered (or hierarchical: level upon level, overlaid systems) processes dependent and interlinked in ecosystems. Emphasis is placed on diversity of species which are important for the resilience of an ecosystem, with interaction between different species systems happening across multiple temporal and spatial scales (Gunderson & Holling, 2001). The process of managing adaptation and resilience (adaptive management) happens across these various systems and scales (Weeks, Rodriguez & Blakeslee, 2004).

The process of adaptive management happens across multi-layered, dynamic and complex systems (Holling, 2001) (refer to *Figure 2.2* and *Appendices C, D & E*). Complexity is either approached as: 1) as anything we do not understand (Roe, 1998 in Holling, 2001) or 2) the combined or cumulative result of smaller, controlled interactions (Gunderson & Holling, 2001). The properties evident in an adaptive cycle are stressed as 1) potential (wealth), 2) connectedness (controllability) and 3) resilience (adaptive capacity) (Holling, 2001). These ultimately operate under four specific phases in the adaptive management loop, namely 1) r = Exploitation, 2) K = Conservation, 3) Ω = Release and 4) α = Reorganization.

An integral phase that over-exploited systems exhibit is when a stage of collapse (release) is reached having reached a threshold which is unable to support over-exploitation (Holling, 2001). Adaptive management requires relevant information to make effective adjustments to management functions. This information can be gained from local communities and indigenous knowledge, usually transmitted through cultural practices and behaviours.

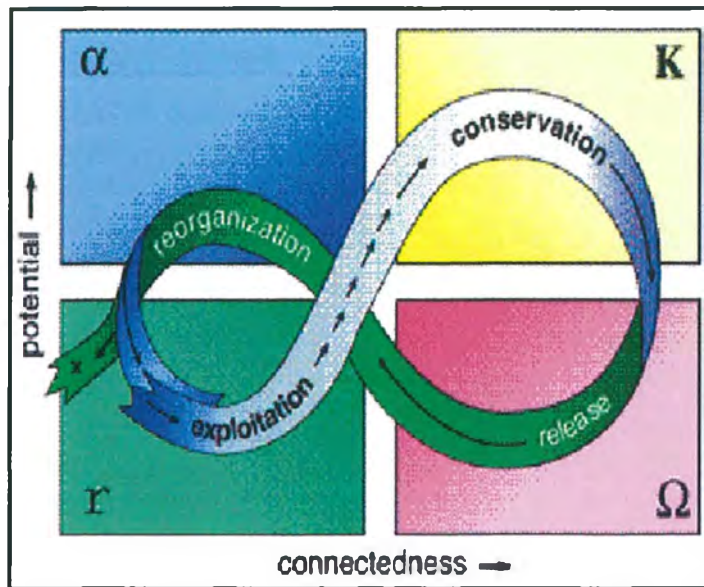


Figure 2.2: The Resilience Model (Weeks *et al*, 2004)

Where: r = Exploitation; K = Conservation; Ω = Release & α = Reorganization

The Resilience Model in Figure 2.2. originated from disturbances in natural systems and how they then reorganise themselves. The model has been developed for application in an industrial context, but not specifically to the mining industry. Planning is essential to the long term sustainability of any organisation (system), and specifically planning for the reorganisation phase. It would seem that part of the early planning in any company would be to conduct a study into the life cycle and alignment of the organisations objectives with that of its context.

2.7. SUMMARY

2.7.1. General

Sustainable development has evolved out of the necessity experienced by organisations, groups and governments that the current state of Earth might not be able to sustain human existence into the future. Generic fields of development have been touted as necessary. The application has borne little significant change in behaviour. It appears to exhibit a business as usual scenario. Companies use old strategic paradigms as a response to current changing conditions. There are increasing legislative and regulatory steps being taken, which are creating responses from different fields as to how these paradigms might shift and produce effective results. Adaptive management treats each system as unique and seeks to ensure long-term health through systemic resilience. This requires multiple fields of information, such

as local cultural values and indigenous and traditional knowledge; to be used in ensuring local conditions are relevant for local community benefit. Mining provides an important avenue for employment, revenue and benefit for South Africa, and exerts a fairly large impact on society and the environment.

2.7.2. Challenges

The components of sustainable development treat separate environments as common, and the application tends to be a one size fits all approach. Of course different environments, societies and cultures behave in different and complex ways. To attempt to treat these as generic may shift focus away from relevant responses and promote unbalanced ideals. The challenge would be to provide an environmental quality that was available for long-term future utility through proactive management.

2.7.3. Adaptive Management

In shifting the focus away from rigid and generic management forms and using a more locally integrated, responsive method, companies can begin ensuring long term sustainability of the surrounding habitat, thereby perpetuating human existence, health and consequently corporate profitability. Systems can be treated as individual, with the best interests being sought for and by the relevant (complete) community (including businesses). In ensuring a resilient state, ecosystems will be able to evolve at a rate that will ensure continued health and sustainability.

2.7.4. Questions and Objectives

Questions begin to emerge as to how long lasting and relevant sustainability will be achieved, especially in the South African context:

1. How are Gold Fields responding to sustainability of mining in South Africa?
2. What are the differences in perception between Gold Fields and Living Gold?
3. How can a shared vision of sustainability, between Gold Fields and Living Gold, be achieved to benefit all?
4. How should Gold Fields respond to the challenges of sustainable development when planning new mining operations?

These questions helped in formulating the objectives of the dissertation and highlight the need for the research undertaken in the next chapter. An adaptive management model is only truly successful if all stakeholders agree on the desired outcome.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. RESEARCH OBJECTIVES

The goal of the research is to acquire a more context specific and relevant understanding of sustainable development by assessing the alignment of sustainable development goals between Gold Fields and Living Gold. The aims are to develop a more relevant understanding of sustainable development in the context of the South African mining industry (specifically Gold Fields). It aims to investigate the extent to which Gold Fields' ideals of sustainable development are aligned with the community (Living Gold) in which they operate. This will be realised through a case study of Gold Fields Limited (Gold Fields) and an interested and affected community organisation (Living Gold) that is highly reliant upon Gold Fields. The case study will assess different peoples' perceptions and attitudes of sustainability and specifically being applied to the Driefontein mine situated in and around Carletonville. The interested and affected community comes from the Carletonville area (and Khutsong Township) represented by Living Gold. Living Gold is a social investment organisation that has been created to diversify the career opportunities and increase the economic sustainability of the affected area.

3.1.1. Research Goal

Assess the degree of alignment of sustainable development ideals between Gold Fields and Living Gold to develop a more relevant and contextualised understanding of sustainable development.

3.1.2. Research Aims

- ♦ Compare the sustainability ideals of Gold Fields and the community (through Living Gold) in which they operate using more culturally and contextually relevant criteria.
- ♦ Contribute to the development of an updated framework for and understanding of sustainable development.

3.2. CASE STUDY METHODOLOGY AND RESEARCH PARADIGM

A qualitative, evaluation research method is employed, which is useful when using contextual knowledge (Babbie & Mouton, 2004), in order to help achieve the objectives of the research whereby multiple varying knowledge can coexist (Guba & Lincoln, 1994). The research was to seek to expand and increase the knowledge debate surrounding the topic, as well as lead to the development of a more contextual understanding of development initiatives. The research is carried out in a constructivist paradigm where the ontology is relativist and realities are assessed “in the form of multiple, intangible mental constructions, socially and experientially based, local and specific in nature” and where constructions are “more or less informed and/ or sophisticated” (Guba & Lincoln, 1994: 110).

The research is dialectical in nature, where constructions are extracted and “refined through interaction between and among investigator and respondents” (Guba & Lincoln, 1994: 111), whilst attempting to gain a consensus between the research, theory and investigation. This serves as an attitudinal study, which furthers the aims by highlighting relevant criteria and examining the difference of these criteria by using interviews. This case study research will investigate current criteria for sustainable development and compare the differences between different groups. It will help assessing gaps by responding to contextual needs and burdens faced, and develop recommendations to be made in addressing short comings. The feedback from interviews is used to supplement theory development, with various data collection methods providing an avenue of validation (Patton, 1990). Results and findings of such a research are created as the process of the research unfolds where “distinction between ontology and epistemology disappears” (Guba & Lincoln, 1994: 111). It was with this assumption that context was given its importance within the study. Interviewees would respond to the stipulated and generic questions relating to their specific context. The differences in feedback were then used to understand contextual and cultural difference. These differences were given a general rating and are by no means to be used to generate statistical data, just merely general focus and discussion points.

A case study is used to investigate a current trend within a real life example, especially where the distinction between the trend and the context is difficult to

identify (Yin, 1994). From this investigation, the process of learning occurs, in order to draw generalised conclusions (Stake, 1994). The aim of using a case study is to interrogate an uncharacteristic case study example, which increases the prospect of learning from the case, as opposed to using a straight forward case study (Stake, 1994). From this learning and investigation, themes can be established and the feedback received can be used to develop the argument throughout.

3.3. POPULATION AND SAMPLE SIZE

The population for the research is the South African mining industry and affected traditional/ indigenous communities. Emphasis is placed on mining as a high impact industry (having a high burden on the environment for inputs and outputs) and on which South Africa is highly reliant on for revenue and employment. The mining industry has a high environmental impact (high demands on energy and water) and these companies generally have a global footprint with operations across the globe. More importantly, mining operations, by definition, are finite and therefore offer a challenge to the idea of sustainable development.

The selected sample is one mining company, namely Gold Fields, and the relevant, interested and affected traditional/ indigenous community dependent on their operations, represented by Living Gold. The descriptive nature of a case study also allows for development of preliminary criteria that provide scope for the research. Descriptive research attempts to place research objectives in the context of the investigation (Robson, 1993), which intimates toward relevance between objectives and findings.

Case studies should be achieved by and constrained to a limited number of respondents (Merriam, 1998) and, as such, the sample for the current research was limited to employees of both Gold Fields and Living Gold. Limitations of a case study are that they are merely influential in nature, and are unable to be used as a general rule, being used only for immediate generalisation throughout the study. This would allow for personal, in depth interviews with each of the interviewees. Relevant representation of each organisation was important in order to attain comparable feedback. Interviewees were selected by managers from each organisation and cooperation was facilitated by Gold Fields. Interviewees were identified through their

affiliation to each organisation by which they were employed. Interviewees selected from Gold Fields were chosen because they worked for Gold Fields and had a direct relationship with the Driefontein mine. Interviewees from Living Gold were chosen due to their affiliation to Living Gold, and they lived in the surrounding area.

Two options were available for the interview process, namely 1) interview a wide range of interviewees at both organisations or, 2) interview key informants in each organisation to provide relevant information. A limited number of interviewees were chosen due to time constraints of the study owing to the length of each interview.

Interviewees were chosen strategically owing to their position within their respective organisations. These interviewees were able to provide relevant feedback from each questionnaire interview process and thus allow for more efficient interview time.

There may appear to be a lack of harmony in using formal questionnaires and ratings within a constructivist research paradigm; however these have been balanced by using informal, qualitative and open-ended questions throughout the interview and questionnaire process.

Gold Fields was chosen as the case study due to their willingness to participate, which stemmed, at least partially, from their long-term relationship with Rhodes University. Furthermore, they have demonstrated their commitment to sustainable development through the establishment of an established environmental management and sustainability policy, with their Sustainability Department having published an Annual Sustainability Report. Their suitability as a Western ethnocentric organisation, having a global presence, helped provide one aspect of the research, the other being fulfilled by Living Gold, with their primary focus being to provide benefit to the surrounding community. Living Gold is based solely in the Carletonville area, with all employees also based in the area, and therefore had either a direct or indirect relationship with Gold Fields. The employee and management make-up of Living Gold is predominately indigenous/ traditional, and provides a relevant choice to compare cultural differences.

3.4. DATA COLLECTION

Data was collected through structured interviews with representatives from both organisations, and the aims achieved through feedback attained from interviewees dependent on the mine. The information assessed included evaluating current and prevailing attitudes and theory surrounding sustainable development as a basis and starting point of the research. Interviews were carried out to provide relevance and context to the South African environment. Interviewees' perspectives are central to qualitative research, with the researcher as data collector and analyser, testing the objectivity of the findings (Guba & Lincoln, 1994).

Interviews were carried out in a semi-formal discussion, with the questionnaire (*Appendix B*) being used to guide the interview process. This method was selected due to the interviewees' time constraints, access to interviewees and capacity in answering questions. The main focus of the interview process was to understand each interviewee's familiarity with sustainability, to generate a discussion around the concepts and receive a rating from each interviewee of the proposed criteria. The rating of these criteria by the different interviewees provided the illustrative impetus for the discussion.

The interviewer filled out each questionnaire sheet, with focus not on the questionnaire, but the interview and criteria rating. This allowed for a strict structure of each interview to be adhered to, and measure and discuss the variability of each rated criteria.

3.4.1. Company Records

The criteria being assessed were developed from Gold Fields Sustainability and Annual Reports from 2003 to 2005. 2003 was the first year in which Gold Fields published a Sustainability Report with the Sustainability Reports for 2004 and 2005 included in the Annual Financial Statements of Gold Fields. General trends related to the incorporation of sustainability thinking were examined and this helped establish the emerging behavioural pattern of sustainability in Gold Fields, and ensure validity.

3.4.2. Questionnaire Development

The questionnaire used during the interviews consisted of four sections, specifically

Section 1 – **General and background information** - listing interviewees' general information and attempting to discover predispositions to environmental concerns;

Section 2 – **Understanding of sustainability** - asking questions as to interviewees' own understanding of sustainability (if any);

Section 3 – **Life Cycles of the Mine** – uncovering personal reliance, sentiments and expectations from the mine;

Section 4 – **Sustainability Criteria** - asking interviewees to rate selected criteria in relation to the previous sections.

Section one began with general questions and subsequent sections aimed to achieve greater detail leading ultimately to the rating of set sustainability criteria (*Table 3.2*).

This helped manage the interview conversation from very general topics to more specific topics. It was necessary to structure the questioning process so that it would be objective in relating to both groups of interviewees.

3.4.3. Interviews

Three interviews were carried out with Gold Fields across several management levels.

Interviews were held with:

1. The Sustainable Development Manager, responsible for strategic planning and implementation of sustainable development criteria throughout Gold Fields Limited operations (in South Africa).
2. The Driefontein Sustainable Development Manager, responsible for implementing, monitoring and control of sustainable development criteria at the Driefontein mine.
3. The Driefontein Metallurgical Manager, responsible for the assessment of mineral deposit quality, feasibility and operations at the Driefontein mine.

Three interviews were carried out with Living Gold across different organisational levels, with people who are direct community stakeholders. Interviewees all live in the surrounding community of Carletonville with an entrenched relationship with the area.

Interviews were carried out at Living Gold with:

1. The Human Resource Manager, responsible for all human resource functions at Living Gold, specifically managing employee relations, expectations, concerns and career progression.
2. A Shop Steward, responsible for organising and managing work teams, and raising and representing employee concerns with Living Gold management.
3. A Grading Foreperson, responsible for managing and preparing orders of produce, by assessing produce quality and managing stock levels for sales.

3.4.4. Criteria Selection

A comprehensive list of possible sustainability criteria was gathered based on a review of relevant literature (*Table 3.1*). These criteria were subdivided into four categories in terms of sustainable development (economic, social, environmental and cultural). This aspect of the dissertation emphasised the need to use an extensive literature review as part of research. Relevant criteria needed to be highlighted and applied to the interview process to generate relevant feedback and scores. The list was then reduced to a set of criteria that were considered most relevant in the context of the case study (*Table 3.2*). This aided in generating discussion in the development of an understanding for contextual sustainable development.

Preliminary criteria (*Table 3.1*) were selected and informed by two documents:

1. the Global Reporting Initiative's draft G3 criteria (Global Reporting Initiative, 2006), which included criteria relating to indigenous knowledge and contextual concerns, and
2. PhD research being conducted into the development of sustainability indicators and assessment for mine wastewater treatment technologies in South Africa (Neba, 2006)

Table 3.1: Preliminary and initial questionnaire criteria used, per category, in developing the eventual criteria measurements.

<i>MWWT Thesis</i>	<i>GRI 3</i>
Environmental 1 Natural Resource Depletion 2 Eco-toxicity potential 3 Energy use (depletion, consumption) 4 Global warming potential 5 Pollution impact (bioaccumulation etc) 6 Waste generation (quality & quantity) 7 Effect on biodiversity Usefulness and planning of waste as by-products 8 9 Aesthetic and odour values	Environmental 1 Amount / weight of materials used 2 Direct energy consumption (renewables, efficiencies, conservation) 3 Water use 4 Land use 5 Impacts and mitigations regarding biodiversity 6 Mitigation measures for environmental impacts 7 Greenhouse gas emissions 8 Waste generation 9 Toxicity of waste and discharge (effluent) 10 Recycling capacity and choices
Social 1 Direct Employment 2 Indirect Employment 3 Health & Safety 4 Social perception of operations (mining) 5 Education & Training opportunities 6 Effect on social structures	Social 1 Mitigation measures for reduction of impacts on communities 2 Prevention of corruption practices (Transparency) 3 Public participation in major impact management decisions 4 Employee training & empowerment programmes 5 Incidents of discrimination 6 Complaints filed by communities against company (Human Rights abuse) 7 Rates of injury and occupational disease 8 Education & training (counselling) for effects of disease (HIV / AIDS) 9 Empowerment programmes & skills transfer (career planning)
Financial 1 Capital costs & outlay 2 Operational & management costs 3 Waste disposal costs 4 Safety costs for decommissioning 5 Rehabilitation costs for decommissioning	Financial 1 Economic value added to both company & community 2 Financial costs of climate change 3 Pension plan provisions 4 Financial incentives & tax breaks received from government 5 Entry level wage in relation to minimum wage (local) 6 Infrastructure investments
Technical (Culture / Context) 1 Effect on cultural heritage 2 Institutional support 3 Flexibility and adaptability of community 4 Reliance on labour 5 Effectiveness of technologies 6 Efficiency of technologies 7 Assimilative capacity of area 8 Operations in sensitive areas 9 Length of impact on area 10 Liability of company (length, responsibility)	Social / Human Rights / Labour (Context & Liability) 1 Spending proportion on local suppliers (procurement) 2 Proportion of locally hired employees (all levels) 3 Operations in highly sensitive areas (cultural & other) 4 Product stewardship and liability 5 Human rights screening for procurement 6 Incidents of violations of free movement, child labour, forced labour 7 Incidents involving infringements of rights of indigenous people 8 Incorporation of indigenous knowledge into operations 9 Ability of environment to assimilate and recuperate from impacts 10 Understanding of major communal structures and hierarchy Identification and protection of cultural, spiritual and religious areas, sites and traditions 11

The criteria were narrowed down to a final list used for the interview. Eight Financial, Twelve Social, Twelve Environmental and Thirteen Culture/ Context criteria were chosen (*Table3.2*).

Table 3.2: Criteria used to generate feedback in the interview questionnaire section 4

Category	Ques. No.	Criteria
Financial	F4.1	Economic value added
	F4.3	Capital costs
	F4.5	Operational & management costs
	F4.7	Waste disposal costs
	F4.9	Safety costs for decommissioning
	F4.11	Rehabilitation costs for decommissioning
	F4.13	Infrastructure investments
	F4.15	Financial costs and benefits of operations
Social	S4.1	Direct Employment
	S4.3	Indirect Employment
	S4.5	Health & Safety
	S4.7	Social Perception of Mining
	S4.9	Education & Training
	S4.11	Social Structures Impact
	S4.13	Mitigation of Community Impact
	S4.15	Prevention of Corruption
	S4.17	Public Participation
	S4.19	Training & Empowerment
	S4.21	Human Rights Abuse
S4.23	Skills Transfer	
Environmental	E4.1	Direct energy consumption
	E4.3	Water use
	E4.5	Land use
	E4.7	Waste generation
	E4.9	Mitigation of Environmental Impacts
	E4.11	Effect on Biodiversity
	E4.13	Impacts on Biodiversity
	E4.15	Greenhouse Gas Emissions
	E4.17	Pollution Impact
	E4.19	Toxicity of Waste
	E4.21	Natural Resource Depletion
	E4.23	Recycling Capacity
Cultural.(Context)	C4.1	Cultural Heritage
	C4.3	Flexibility & Adaptability
	C4.5	Reliance on Labour
	C4.7	Assimilative Capacity of Area
	C4.9	Length of Impact
	C4.11	Sensitive Area Operation
	C4.13	Spending on Local Suppliers
	C4.17	Locally Hired Employees
	C4.19	Understanding of Community
	C4.21	Incidents of Human Rights Violations
	C4.23	Rights of Indigenous People
	C4.25	Indigenous Knowledge in Operations
	C4.27	Protection of Cultural Sites & Traditions

3.4.5. Criteria Feedback

Criteria were rated by each of the interviewees against a Likert scale rating of 1 to 5.

1 very low	2 low	3 medium	4 high	5 very high
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Interviewees were asked to rate each criterion's level of importance to themselves, 1 being very low and 5 being very high (*Appendix B*). They could interpret the meaning of importance as they wanted, as this would indicate where their concerns lay. For example, most interviewees from higher organisational levels tended to relate criteria in terms of the implications for the organisation and then themselves.

Interviewees from lower organisational levels tended to relate the criteria to them directly. From these ratings a table of criteria and ratings was compiled. Criteria were then used to compare different interviewee responses and ratings. Ratings were then transformed into graphs to illustrate differences and encourage discussion.

3.5. DATA ANALYSIS

The idea of science being value free may be misguided, as scientists constantly make value judgements (Ehrlich, 2000). They make value (qualitative) based judgments from the choice of experiment, methodology used and interpretation of the data (Ehrlich, 2000).

3.5.1. Validity

Interviews were assessed against theory in the context of company records so validity could be established as relevant. This allows for fuller, more relevant conclusions to be drawn and provides substance to postulations. Relevancy of findings is established through testing against existing theory, archival company information and interviews. Interviews were used to help assess the significance of criteria, emphasising the attitudinal study. Structured interviews were used as a method of enhancing and identifying gaps in the developing theory, and thereby providing contextual understandings of current behaviours. Theory was used to help form the basis of research and interview approach. As Patton (1990) states, case studies make use of a variety of data collection methods, with these various sources in turn providing a policy for validation. Validity is therefore checked against these criteria.

3.5.2. Reliability - Interview Analysis

Interview questions were used to gain fuller understandings of the feedback received in context. To draw inferences from the ratings of the criteria from each of the interviewees, responses would need to be examined. Section one related to general

information and interviewee predispositions eventually evolving into an understanding of responses found in section four. Section four formed a rating given to the selected criteria, which needed to be assessed and scrutinised to ensure criteria relevance. Another method of testing the feedback ratings was to enquire why each criterion was scored accordingly. This served the function of generating a more authentic feedback rating, as interviewee's needed to be sure why they rated a criterion as they did. Interviewees were inclined to make a rating selection and when pressed for a reason why, their responses were to relate to previous answers. This had an unintentional but desired affect, as interviewees were drawing comparisons between other selections (including cross category criteria). Due to the contextual and qualitative nature of this research paradigm each observer becomes the source of observed data (Babbie & Mouton, 2004). Hence questions were asked in relevance to the interviewee themselves, and were retested by asking interviewees why they rated criteria as they did.

3.5.3. Data Interpretation

Tabulated criteria ratings for the four different categories (financial, social, environmental and cultural) were compiled for each interviewee (*Appendix H to M*). Scores were then compiled into tables for each organisation, to calculate averages (means), and standard deviations of criteria scores for each organisation. By comparing the scores for the various criteria, as given by different individuals from the same organisation and combined organisational mean scores, it was possible to obtain a more accurate idea of differences (variances) between different organisational cultures, different organisational scope and different development ideals with regards to sustainability and sustainable development. Sustainable development goals were understood to be as measurable sustainable development targets that a company would aim to achieve. Sustainable development strategies were those initiatives and strategies that would be enacted to operationalise and bring about the sustainable development goals. Each organisation has, intrinsically, a different culture owing to the company make up, context as well as strategies it follows. Therefore sustainable development goals would be heavily influenced by sustainable development strategies, which in turn were influenced by organisational culture. Standard deviations for mean organisational scores were useful in providing ideas as to the extent of agreement among different interviewees from the same organisation.

3.6. ETHICAL CONSIDERATIONS

Highest ethical considerations were followed through every step of the process, from data collection, theory evaluation and interviews, with high integrity being maintained. Ethics are intrinsic to this research paradigm as values of participants are included in the process of the research. It provides, in its methodology, a defence against deception due to the relevance and weight that interviews add to the value of the research (Guba & Lincoln, 1994). The interviewer signed each interview document in the presence of each interviewee to indicate that the information and feedback was used for furthering the process of the dissertation, and all feedback is used in a sensitive and conscious manner.

3.7. RESEARCH LIMITATIONS

The main limitations of the research, highlighted below, help to understand the context in which the research was carried out:

- ♦ Time = the time available limited the number of interviews that could be conducted as each interview lasted between one and one and half hours per interview.
- ♦ Capacity to answer the questions = some interviewees struggled to grasp complex concepts partly due to familiarity of concepts and language barrier.
- ♦ Language = most (4 of 6) of the interviewees first language was not English and the research was carried out in English

3.8. CONCLUSION

The subject matter under research is by nature qualitative, with differences in context being descriptive. This qualitative research paradigm has learnt itself to the case study methodology. The case study of Gold Fields and Living Gold has helped further the discussion and debate surrounding sustainable development, particularly within the context of the mining industry. The descriptive quality of a case study has allowed for the dissertation to be contextualised and relevant. The feedback and scores helped to illustrate and validate discussion. However they were not statistical in nature as the research was not quantitative, but was merely used to illustrate points of departure and help in stimulating discussion. It attempted to understand differences, which could be drawn from the rating scores, and provide a visual framework to carry the sustainable development debate forward.

CHAPTER 4

RESULTS AND DISCUSSION

4.1. PROGRESSION OF GOLD FIELDS' SUSTAINABILITY REPORTING

In order to prepare and assess the sustainability strategies and credentials of Gold Fields, it was felt pertinent to interrogate the progression of reporting of sustainability within Gold Fields. A historical assessment needed to be made of the type of reporting made by Gold Fields and from this further sustainability strategies could be recommended in line with their policy and the contextual understanding of sustainable development.

4.1.1. Gold Fields Sustainability Report 2003

In order to present their initial annual Sustainability Report in 2003, Gold Fields used global best practices in preparing for the reporting, making use of criteria stipulated in the Global Reporting Initiative (GRI) (Gold Fields, 2003). Criteria were initially researched and then adapted to the Gold Fields context with the intention of devising a responsive and relevant sustainability measurement and indicator system. An important note for Gold Fields in developing these measurements and indicators would be to recognise that the environment provides the scarce natural resources and surrounding communities provide the labour input needed for the final product. This entrenched their level of dependency on the surrounding environment (Bakshi, 2000).

Developing relevant measurements and indicators for Gold Fields was important as the environments in which they operate are important for the company's prolonged (sustained) profitability. They would need to ensure that the measurements and indicators used would generate relevant feedback which would then enable Gold Fields to adapt through suitable strategic and operational responses.

The first Report seemed to be done in order to illustrate Gold Fields sustainability policy as opposed to giving effect to real comparability within financial statements. It appeared as if it was treated as an educational tool, helping to present and formalise the process of developing sustainable development focus and strategy. It was commendable, but has become a matter of importance for continued company sustainability in any event.

The focus in the 2003 Report was on more qualitative aspects of sustainability, for example levels of employee satisfaction, showing that relevant accounting metrics still needed to be developed and correlated. The sustainability self-assessment was largely qualitative and made use of a limited number of quantitative metrics. The problem with this approach was that it would be very difficult to monitor progress in certain key areas from one year to the next.

4.1.2. Gold Fields Annual Report 2004

The 2004 Sustainability Report was included in the overall Annual Financial Report of 2004, indicating the raised strategic importance of sustainable development to the company. In the 2004 Report, the issue of energy utilisation by Gold Fields' operations formed the main focal point. Energy and materials are significant measurements that need to be assessed in the scope of a mine's sustainability (Góralczyk & Kulczycka, 2000). As a result, a lot more extensive energy, material and water consumption measurements and indicators were used in this report.

Energy inputs used for mining are substantial with as much as 60 GWh being used to produce 1 ton of gold at certain mines, yet others only utilising 5 GWh per ton. Mines also use a large amount of energy and water to extract their product. The exact quantity used varies from one mine to the next, depending on the depth of the ore body. Water has another direct impact on the environment. It is a key input of mining and was one of the sources of their greatest pollution. South Africa is a water scarce country and the water used in the mining process carries toxins into wider environments (Gold Fields, 2004a). It was recognised that planning for remediation and rehabilitation of water sources and effluent was needed, and that this would result in additional operational cost. The pressure of economics due to environmental degradation and consequent remediation was already starting to show signs of impact upon the financial bottom line of Gold Fields (Gold Fields, 2004a).

According to the 2004 Annual Financial Report, R331.4 million was set aside for rehabilitation of mines (Gold Fields, 2004a). This was now acknowledged as an expense for which planning was needed, making it an accounting line item and introducing stakeholders to rehabilitation costs and liability risk mitigation. Environmental costs were linked directly to the Financial Statements, with a line item

that needed to be represented in the Annual Financial Reports. This allowed for more stable market prices for Gold Fields shares, as shareholders and markets would be able to make more informed decisions regarding the practices and any future liabilities that Gold Fields may face. This highlighted the interplay between economic implications of environmental impacts and consequences. In the 2004 Report, Gold Fields tended to regard environmental concerns as essential components of sustainability. Energy consumption, water use and rehabilitation costs were the most identifiable environmental costs, presumably because they were easy to measure through consumption levels and costs paid for these inputs. All these items have environmental consequences yet the metrics used were consumption levels and financial costs to Gold Fields. These values may underestimate the true costs (externalities) and consequences to the entire environment and surrounding communities. No consideration appeared to be made for the implications of energy and water consumption by Gold Fields on the surrounding communities. This would indicate that their approach to sustainability was not based on the standard definition but tended more toward a single financial bottom line.

4.1.3. Gold Fields Annual Report 2005

With the 2005 Annual Report for Gold Fields, the issue of sustainability featured prominently with the inclusion of a specific Sustainability Report within the main body of the Annual Report. Some sustainability characteristics were categorised in the Sustainability Report, and other characteristics were included as part of the Financial Report (such as risk management). There appeared to be an attempt to make sustainability criteria part of the Annual Report, instead of merely ticking a box (Gold Fields, 2005). A concerted effort to include environmental and social impacts into the economic components of the report appeared to have been made. Detailed figures were given for energy and resource use, such as electricity, water, diesel, petrol, cyanide, timber, lime etc. Measurements and indicators of impacts, such as greenhouse gas emissions, amount of waste and type of waste, were also included for use in the 2005 Report. South African operations were all more energy, water and material intensive than their international operations (Gold Fields, 2005).

The exciting development of this report was the diversity strategy being employed by Gold Fields. Mining is not an entirely sustainable activity in that it extracts a non-

renewable resource. In line with a life cycle schedule (*Appendix G*), Gold Fields demonstrated an understanding that their mines would close eventually. To prepare for this they contributed towards rehabilitation and remediation annuities, which was in line with the industry standard. They also diversified their rehabilitation strategies and were seeking to generate economic development once their mining activities ceased. The two most noticeable diversification strategies were 1) logistics and delivery business components, and 2) agriculture. These two components have allowed Gold Fields to use their exhaustible resources and generate investments for incomes from other revenue generating streams. This was the first time they had begun to employ such strategies, with no indication of such strategies in previous reports.

4.1.4. Combined Findings

From these reports it emerged that policy was still being drafted when the first 2003 Report was compiled. The 2003 Report was a bold and commendable statement of preliminary policy direction and commitments to sustainability principles. However, it did require refinement and more comment on possible impact interventions regarding the environment and affected communities.

The 2004 Report showed progress in sustainability reporting for Gold Fields in that they decided to include the Report in their Annual Report for investors. This further entrenched their commitment to the principles of sustainability. The environmental impacts of energy, water and resource usage, and the financial costs thereof, were the main focus of this report. This showed that Gold Fields were mainly concerned with environmental impacts, with little regard for social (and cultural) impacts exerted by their operations. The reasoning behind this could have been that it would be easy to show the direct link between energy use, impact and cost.

In the 2005 Report a concerted effort was made to bridge the gaps from the previous report. The Report further refined environmental indicators by including a wider variety of measurement criteria, including pollution impact measurements. The reporting done on social impact issues and initiatives to mitigate these issues was highlighted. A variety of social interventions and investments made by Gold Fields in their operating areas appeared to acknowledge their responsibility to affected

communities. This seemed to provide an entry point for the proposed research to occur, as it would be necessary to assess the alignment of sustainability expectations between Gold Fields and a community directly affected by their actions. It also provided the required assessment of Gold Fields sustainability ideals and perceptions.

4.2. BALANCED BOTTOM LINE SUSTAINABLE DEVELOPMENT CRITERIA

For the purpose of developing the discussion surrounding the four categories of sustainable development criteria used in this case study; the format was, at this stage, termed the “Balanced Bottom Line”. Current literature referred to the three criteria of financial, environmental and social development as the “Triple Bottom Line”. Each of the Balanced Bottom Line criteria category (i.e. the financial, social, environmental and cultural criteria discussed in chapter 3) (*Table 3.1 & 3.2*) responses were assessed for both Gold Fields and Living Gold. These established the basis for the discussion, starting with an assessment of general organisational cultures. Interpretation of the research data, specifically in terms of alignment of sustainability goals, was based on a comparative analysis of the relative mean scores for each organisation, with standard deviations providing an indication of the level of agreement among respondents from each organisation.

This assessment started with highlighting main criteria differences with emphasis on organisational preferences (importance). The comprehensive table of Balanced Bottom Line Sustainable Development criteria responses can be found in *Appendix N*.

Based on the ranked data gathered during the interviews, it was evident that there were differences between interviewee responses within respective organisations as well as between interviewees from different organisations. It is important to note that scores were given as a level of “importance” and were not a measure of quantitative “value”. There was no intended financial or economic value attached to criteria. However, interviewees inevitably reduced criteria to how they might either benefit or cost themselves or society (community) financially.

4.2.1. Relative Importance of Financial Criteria -:

There was a strong similarity in responses regarding direct financial and economic benefit for both Gold Fields and Living Gold (Figure 4.1 & 4.2). However, there were interesting responses from the feedback received from Operational Costs and Capital Costs ratings between the organisations.

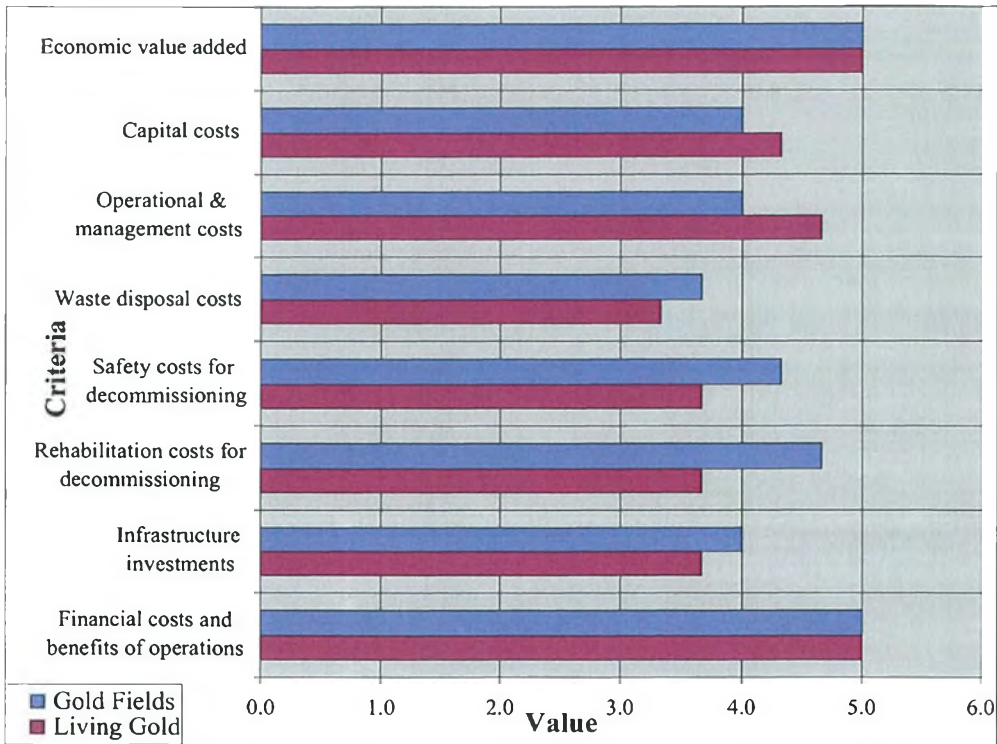


Figure 4.1: Mean score financial criteria comparison between Gold Fields & Living Gold.

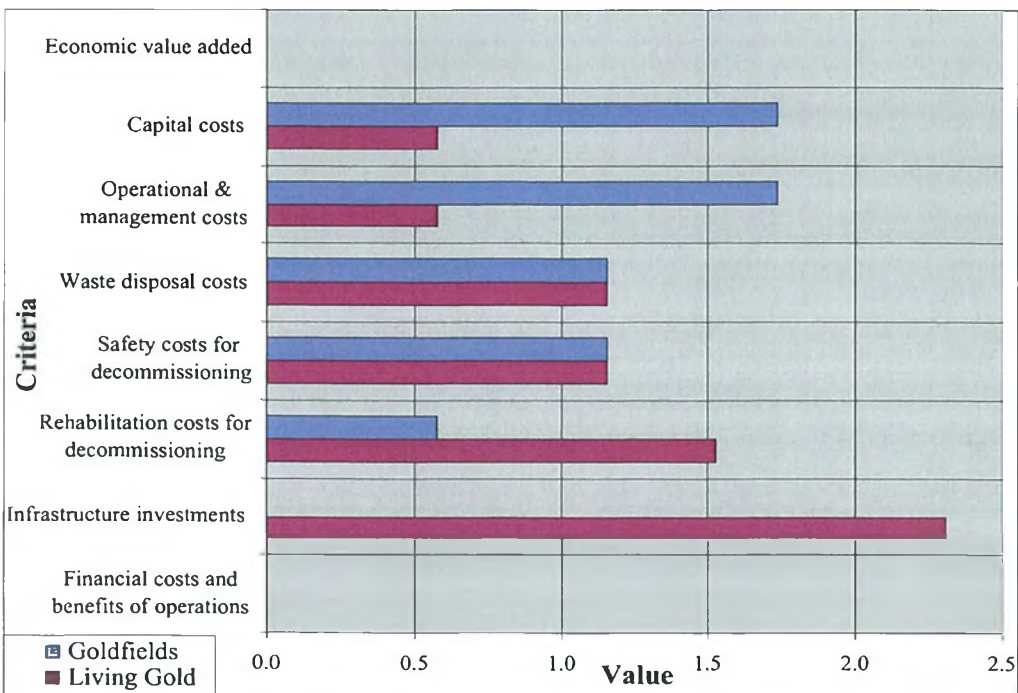


Figure 4.2: Standard deviation financial criteria score comparison between Gold Fields & Living Gold.

4.2.1. a. Gold Fields

Economic Value Added and *Financial Costs and Benefits* generated the highest scores, indicating their perceived importance to the company. Within Gold Fields both *Capital Costs* and *Operational Costs* were the criteria with the largest deviations, as differences were found to be according to organisational hierarchy. The other three criteria offered points of difference between operational concerns and planning concerns. Differences in responses may be understood against individuals' core responsibilities. Gold Fields placed a high importance on all financial criteria, except for *Waste Disposal Costs* (3.7), which was unexpected as it was thought that they would have been very concerned with mitigating environmental impacts (as per their Sustainability Report 2005) (Gold Fields, 2005). In the mining industry, waste management, environmental impacts and remediation costs are closely linked.

4.2.1. b. Living Gold

Although the mean rating for *Infrastructure Investments* was moderate (3.7) there was some disagreement amongst the respondents as indicated by the high standard deviation (2.3). *Rehabilitation Costs* also had a low importance (3.7), with this sentiment also evident for both *Waste Disposal* and *Safety for Decommissioning* criteria. *Capital Costs* (4.3) and *Operational Costs* (4.7) were highly valued with minimal deviation in response (*Figure 4.1*). Living Gold exhibited an almost identical response to Gold Fields with regards to *Economic Value Added* and *Financial Costs and Benefits* as the most important criteria with no variations between interviewees. This may be fairly evident, as currently most human interactions involve financial and economic interactions. These are measures that people are able to assign value to and hence interact with. It would follow, then, that most interviewees would value these criteria highly.

4.2.1. c. Organisational Alignment Comparison

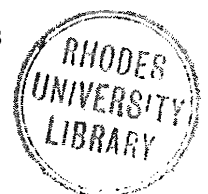
Rehabilitation Costs for Decommissioning; this criterion referred to the costs for embarking in a rehabilitation programme, and exhibited the greatest Total Mean Difference (1.0) between the two organisations. It was expected that traditional/indigenous communities would operate with a greater sense of long-term consequences and would therefore regard the rehabilitation (and therefore, associated costs) as highly important. Gold Fields valued (4.7) this criterion more than Living

Gold (3.7). Gold Fields appeared to value this criterion for the enormous costs involved in rehabilitation, and due to the regulatory pressure involved. These issues were unlikely to be of any major significance to Living Gold. They appeared less concerned with the financial implications of future rehabilitation and remediation but would probably be more concerned about having to actually live in a polluted environment over the long term. The perception may have been held that as long as the affected area was rehabilitated when operations ceased, this might be an effective mitigation of post-closure impacts. If it was perceived that rehabilitation was all that needed to be done, then affected communities might be tempted to receive compensation only without any rehabilitation occurring. It was expected that Living Gold may view the responsibility of rehabilitation as Gold Fields' duty, as the data seemed to validate. What was significant was that this issue was of mutual importance, being rated at least of moderate importance, to both organisations and therefore any long-term sustainability plans and strategies should include the issue of rehabilitation.

Table 4.1: Table of differences in Financial Mean scores between Gold Fields and Living Gold

Criteria	GOLD FIELDS	LIVING GOLD	DIFFERENCE	in favour
	Mean	Mean	Mean	
<i>Financial</i>	4.3	4.2	0.2	<i>GF</i>
Economic value added	5	5	0	-
Capital costs	4	4.3	0.3	LG
Operational & management costs	4	4.7	0.7	LG
Waste disposal costs	3.7	3.3	0.3	GF
Safety costs for decommissioning	4.3	3.7	0.7	GF
Rehabilitation costs for decommissioning	4.7	3.7	1	GF
Infrastructure investments	4	3.7	0.3	GF
Financial costs and benefits of operations	5	5	0	-

Operational & Management Costs; which are general operating expenses, with a relationship between action and impact through material usage and flow. These material flows had direct bearings and impacts on the economy, through both the direction and quality of the flows. Externalities that resulted needed to be noted both for their environmental and social impact which would involve an economic activity (Allen, 2003). This generated a sizeable Total Mean Difference (0.7) between the two organisations. Living Gold tended to value these consequence savings more than Gold Fields. There was also more variability in the responses from Gold Fields whereas Living Gold, collectively, appeared to understand the need to minimise impact actions



in terms of financial implications. This was a little surprising as it was expected that Gold Fields would stress the importance of reducing operational costs more than Living Gold would. The reason for the large variation in Gold Fields' scores was due to Gold Fields' operational management level score of 2 (Gold Fields Interview MB). It was indicated as of low concern, provided that appropriate Capital Investments were made and corrective management procedures were in place. It indicated confidence in such capacity at the operational level, as the response was given by the Driefontein Metallurgical Manager, who had a keen understanding of operational capacity (provided the correct management checks and feedbacks were in place). Even so, the ultimate goal was to minimise operational (energy and material) costs (waste) and ensure higher levels of ecological efficiency, which would be backed up by enforceable legislation ensuring longevity of ecosystems (Newtown, 2005). These outputs and consequences needed to be taken into account when assessing all industrial operations (Dewulf & Langenhove, 2004).

Safety Costs for Decommissioning; looked to ensure that provision was made for long-term health of an ecosystem at a post-closure stage, precipitated by legislation and regulation. Fairly predictable results on behalf of Gold Fields (4.3) were found as they rated this criterion higher than Living Gold (3.7). This appeared to indicate an understanding of the need for a high investment in infrastructure, especially in mining; as the planning and control authority within Gold Fields reiterated that "safety was a non-negotiable" (Gold Fields Interview PW). The scores validated this expectation, as mining was more dangerous than agricultural activities conducted at Living Gold. There were risks for both, yet mining acknowledged as more dangerous. Incentives are an effective method of appealing to companies to make the switch themselves to less harmful practices, which in turn internalises externalities (costs borne by external stakeholders from the business) (Hunt, 1996). It was expected that Living Gold would rate this as high concern. Presumably the concern that they had for Safety was outweighed by their concern for employment (see *Section 4.2.2*). They would have valued this aspect of mining impacts as important, however, in the immediate future might have preferred higher employment. Therefore, the alignment of this criterion seemed mismatched as Gold Fields rated this in terms of legislative and regulatory pressures and concerns, yet Living Gold appeared to have rated it in terms of employment and a perceived obstacle to increased local employment.

Infrastructure Investments; which were defined as investments in permanent features that would benefit the local community as a result, were regarded as important by both Gold Fields (4.0) and Living Gold (3.7). The relatively small Total Mean Difference scores between Gold Fields and Living Gold (0.3) indicated that overall organisational differences were minimal. However, based on interviews, there appeared to be a difference between organisations regarding how the respective organisations might have benefited from infrastructure investments. Living Gold understood the need for such investments. However, those investments were not seen to benefit them directly. Based on the interviews, it became evident that there was a preference amongst Living Gold for more evident and relevant benefits (examples: decent roads, lighting within the location, increased night time visibility) (Living Gold Interview MM). Gold Fields understood the use of these benefits as it would mitigate any risks to safety and operations resulting from mining activities.

Capital Costs; described as substantial money spent on immovable goods, were a well-understood concept by Gold Fields. They had a clearer understanding as to market mechanisms available to them in capital expenditure, such as investment portfolios and depreciation methodologies, ultimately to maximise shareholder wealth. This generated a low difference in mean scores (0.3). This seemed to be similar in outcome and relation to the Infrastructure Investments. Living Gold appeared to value capital more than Gold Fields as they were operating off a far lower capital base. The capital accumulated at Gold Fields was substantial in comparison to Living Gold, and how capital is utilised was important. Living Gold tended to view capital outlay and investment as intrinsic to their long-term survival, and indicated their support for more diverse strategies (not just mining and farming). Capital and its effective use in managing resilience could be understood in terms of energy. Capital, and specifically natural capital, is a store of built up energy. Energy acquisition is a key consumptive force indicating resource use and impact (Rees, 1996). Capital acquisition and the flow of energy had been altered via accumulation, and created unbalanced stores of energy in certain environments which leads to unstable releases of energy. Gold Fields had a larger deviation in responses, which indicated a level of disagreement in how to make effective use of this stored energy (capital). How this accumulated capital (energy) was released was an important function for breeding flexibility within systems and important in ensuring resilience. Perhaps investing

capital in socially (and financially) beneficial initiatives within the community would be a point of alignment of goals.

4.2.2. Relative Importance of Social Criteria -:

Both Gold Fields and Living Gold considered at least half of the social criteria to be of high importance (*Figures 4.3 and 4.4*). There were however, differences in opinion as Living Gold tended to value most social criteria more highly than Gold Fields for eight of the twelve criteria (*Table 4.2*). These criteria do link up in sentiment with the cultural views of both organisations, yet are generic social criteria that would be expected to form part of advancing humanity. Therefore they did not pose specific, cultural and traditional identity functions.

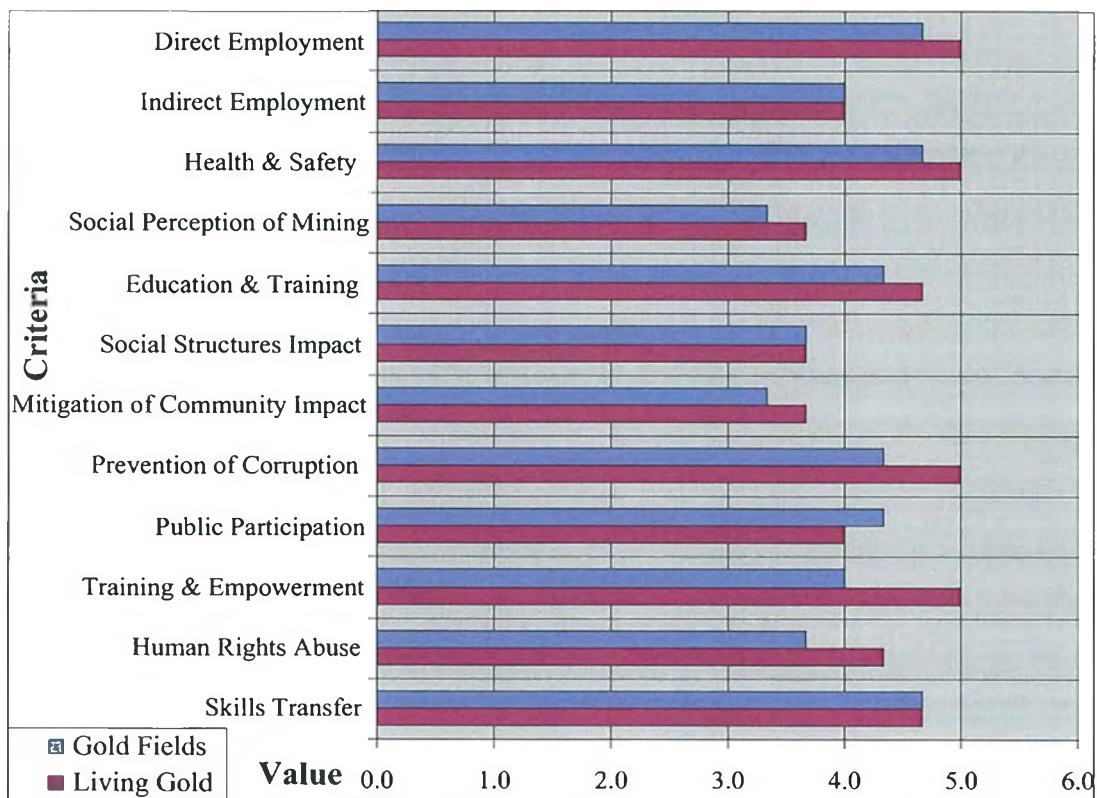


Figure 4.3: Mean social criteria score comparison between Gold Fields & Living Gold.

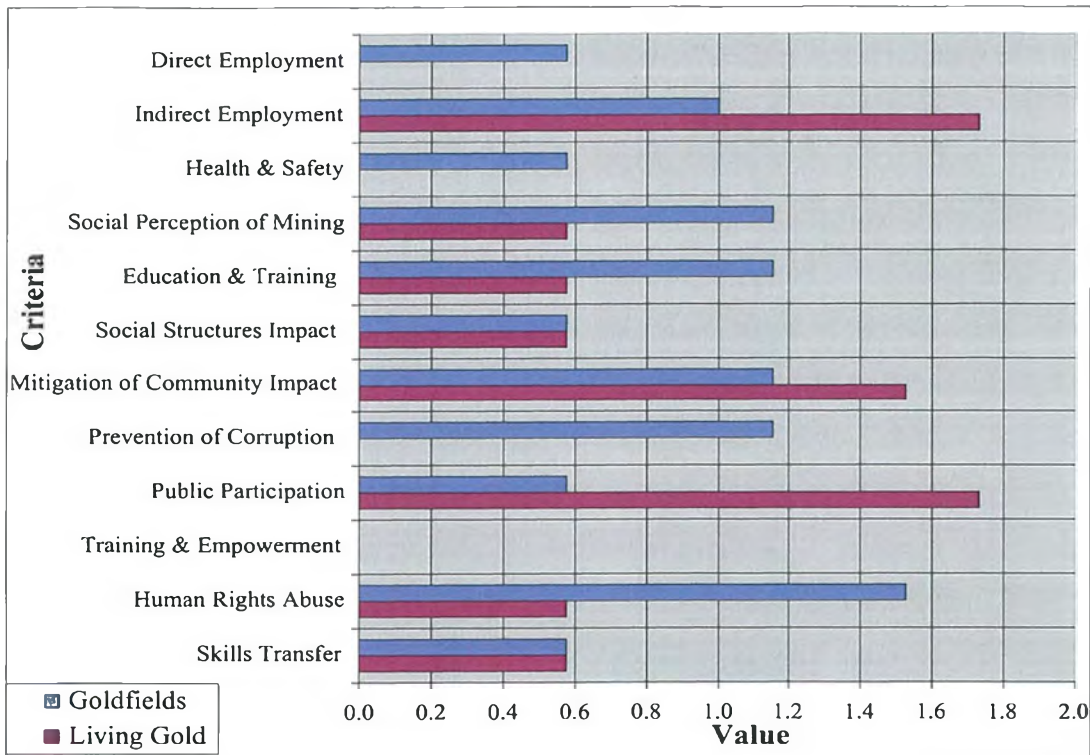


Figure 4.4: Standard deviation social criteria score comparison between Gold Fields & Living Gold.

4.2.2. a. Gold Fields

Direct and Indirect Employment were key social concerns for Gold Fields at all levels, with Direct Employment (4.7) offering a lower variable score and Indirect Employment exhibiting a “nice to have” secondary benefit. Social Perception of Mining generated a variable response with a lower mean score (3.3). Health and Safety was a non-negotiable criterion (Gold Fields Interview PW), and thus had a high Mean Score (4.7) and a low deviation in responses (0.4). Training and Empowerment generated a high mean (4.0) score with no deviation, yet Education and Training (4.3) exhibited a sizeable deviation score (1.2). This appeared to be highly valued at operational and control levels at Gold fields, yet not at the strategic level, which seemed to indicate its operational importance. This was backed up by Skills Transfer which also had a high mean score (4.7), which seemed to be more highly valued than Education. Social Structures Impact and the Mitigation of Impacts seemed to offer low mean scores as consequences were difficult to ascertain, especially due to the large numbers of migratory workers living in the area. Public Participation seemed to be more evenly distributed in this group, which had a higher mean score indicating willingness and impetus for increased public participation, furthering the aspect of

resilience. *Prevention of Corruption* and *Human Rights Abuses* generated fairly average or low mean scores, with *Prevention of Corruption* exhibiting a large deviation in response.

4.2.2. b. *Living Gold*

Direct Employment was regarded as the most important criteria by Living Gold (5.0) with no deviation in response. *Indirect Employment* was rated as highly important (4.0) and there was relatively high deviation (1.7) in the scores (**Figure 4.4**). *Health and Safety* was non-negotiable receiving a high rating (5.0) and no deviation. *Social Perception of Mining* received a low mean score (3.7) and low deviation (0.6), indicating less concern by Living Gold of the perceptions of mining. The expectation held was that the opposite would be true. *Training and Empowerment*, *Education and Training*, and *Skills Transfer* offered valuable criteria for Living Gold, with little deviation in feedback, indicating overall long-term importance and value that these criteria offered (seen as necessary). *Impact on Social Structures* and their *Mitigation* offered similarly average to low scores, with slightly more variability in responses with regard to *Mitigation of Impacts*. *Public Participation* offered a high deviation (1.7) in response, which may indicate a low concern within Living Gold. *Prevention of Corruption* (5.0) and *Human Rights Abuse* (4.3) generated high mean scores with low deviation, which showed strong concern for these aspects of social behaviour.

4.2.2. c. *Organisational Alignment Comparison*

Training and Empowerment; generated a high Total Mean Difference score (1.0) between Gold Fields (4.0) and Living Gold (5.0). Gold Fields did value it highly but appeared more concerned with more measurable and manageable criteria (such as Skills Transfer, Direct Employment and Health & Safety). These scores indicated a predisposition by Living Gold to value attributes that created long-term value (**Table 4.2**). However, in relation to Education & Training (4.7), which was valued lower, this also seemed to stress the need for rapid learning, a necessity to learn a task so it could be performed (Training) as opposed to the dynamic learning (Education) to understand how it could be performed. Gold Fields appeared to value attributes that were more in their direct control, as opposed to perhaps training someone only for them to leave once skilled. Gold Fields did value this aspect, but valued other criteria more according to their scores (**Figure 4.3**).

Table 4.2: Table of differences in Social Mean scores between Gold Fields and Living Gold

	GOLD FIELDS	LIVING GOLD	DIFFERENCE	
Criteria	Mean	Mean	Mean	in favour
<i>Social</i>	<i>4.1</i>	<i>4.4</i>	<i>0.3</i>	<i>LG</i>
Direct Employment	4.7	5	0.3	LG
Indirect Employment	4	4	0	-
Health & Safety	4.7	5	0.3	LG
Social Perception of Mining	3.3	3.7	0.3	LG
Education & Training	4.3	4.7	0.3	LG
Social Structures Impact	3.7	3.7	0	-
Mitigation of Community Impact	3.3	3.7	0.3	LG
Prevention of Corruption	4.3	5	0.7	LG
Public Participation	4.3	4	0.3	GF
Training & Empowerment	4	5	1	LG
Human Rights Abuse	3.7	4.3	0.6	LG
Skills Transfer	4.7	4.7	0	-

Human Rights Abuses; which were intrinsically linked with democratic principles, were constantly used to pre-empt discussion surrounding future generations’ rights and current community rights. The Bill of Human Rights enshrined in the South African Constitution has also provided environmental sustainability as a Human Right, stating in Section 24, that everyone has the right to an environment that was not harmful to their wellbeing and health, as well as being protected for present and future generations (RSA, 1996). Current thinking was to hold a certain amount of consumption revenues and investments in annuity for future generational benefits for remediation and rehabilitation. Generational obligations blur the argument further; many writers stating that the idea of leveraging one generation’s rights to environmental quality against another’s consumption impacts is ethically wrong (Mitra, 2003). It created a higher Total Mean Difference (0.6) with Living Gold (4.3) having a higher mean score than Gold Fields (3.7). Interestingly, the statement by Gold Fields that they are concerned with “Perception Management” was again recalled (Gold Fields Interview PW). Human rights issues are highly emotive social aspects, yet it still received a lower average score in comparison to an organisation that did not explicitly indicate this as a concern. The main deviation was as a result of the low scoring by the operational aspect of Gold Fields. This was clarified in the interview, with it being stated that effective management was in place to ensure Human Rights Abuses did not occur (Gold Fields Interview MB).

Prevention of Corruption; garnered an interesting response. The expectation was that Gold Fields would rate this higher than Living Gold, as they had stressed the need to manage perceptions. However, Living Gold rated this extremely high (5.0) and the Total Mean Difference score was telling, as it was one of the higher mean difference scores (0.7). Gold Fields have a formal policy with regards to corruption issues and therefore individuals appear not to need to concern themselves with this criterion. It appeared that Gold Fields was highly reliant on their systems to ensure policies that were enacted and adhered to, yet at Living Gold each person tended to require these as intrinsic to organisational culture and behaviour.

Public Participation; represented the formal interactions between Gold Fields and affected communities. Gold Fields had a keen understanding of what functions needed to be performed to ensure an effective operational function, whilst at Living Gold this was still in its growth stage, with the element of public participation yet to mature as part of organisational concerns. The Environmental Impact Assessment (EIA) process had also fallen short of including the affected public in participating in the process (Kuyek, 1999). This seemed to be a common complaint with the EIA process, as having a selective “public participation” process. It generated a medium to moderate Total Mean Difference (0.3) (*Table 4.2*). Public participation was adjudged more valuable to Gold Fields, with Living Gold valuing this criterion lower. It seemed to indicate assent on behalf of Gold Fields that public participation and community input was necessary in ensuring sustainability. It also indicated that Gold Fields understood the need for community involvement for successful sustainable development implementation and in terms of the EMPR (the equivalent of an EIA for a mining operation); public participation is required prior to the establishment of a mine. It was understandable, when stated, that the public tended to be the largest (indirect) investors in mining with government agencies footing the bill for cleaning and rehabilitation costs (Kuyek, 1999). It was this sentiment that made a case for increased public participation in management functions, especially where resources became scarcer and operations carried heavier burdens. Primary actions that needed to be implemented were to assess community opinion and input, which would aide in directing possible actions and investments.

Indirect Employment; was rated as moderately important by both parties and yet should be considered a key component of a sustainability strategy. It was an indirect benefit as a result of mining operations and for sustainable development to be a viable option, there had to be a natural capital saving. These savings were formulated by looking at current net savings less the value of the resources being used, less the environmental degradation, plus the value of the human capital investment: $\text{Net Current Saving} - \text{Value Resource Use} - \text{Environmental Degradation} + \text{Human Capital Investment}$ (Hamilton & Clemens, 2006). There was both a need for natural capital saving (Lovins *et al*, 1999) as well as investments in human capital (Hamilton & Clemens, 2006), resulting in larger and more diverse employment bases. There was a variety of indirect employment creating opportunities, for example by creating links to the remediation needs of the mine by establishing a community nursery to supply saplings and grass for rehabilitation efforts. They might also expand this, using the same skills, to grow other crops.

Mitigation of Community Impact; which was defined as the mitigation of adverse social impacts experienced by the affected community due mining operations, appeared to indicate a higher level of disagreement within the Living Gold (3.7) organisational culture, and indicated a more diverse group of individual opinions, whilst Gold Fields (3.3) was able to delegate certain responsibilities effectively. There appeared to be a moderate level of concern by both organisations. This seemed to highlight the level of success achieved by the aspect of public participation that is a necessity of mining operations. If values formed the basis of decision making, and were firmly entrenched, these decisions would surely be able to be carried out by independent cells (departments, unit and subsidiaries). This would indicate, that like mining companies in Mexico, South African mining companies are under increasing legislative pressure to minimise their impacts to meet sustainable development criteria. Uses of frameworks, such as LCA's, were increasingly being used to assess not only environmental but consequences of mining operations on the immediate communities (Suppen *et al*, 2006). These could offer fuller understanding of how these impacts affect the local communities' social interactions and behaviours.

4.2.3. Relative Importance of Environmental Criteria -:

Both Gold Fields and Living Gold considered approximately half of these criteria to have a high importance (*Figures 4.5 & 4.6*). Overall, Gold Fields valued environmental criteria marginally (0.1) higher than Living Gold (*Table 4.3*).

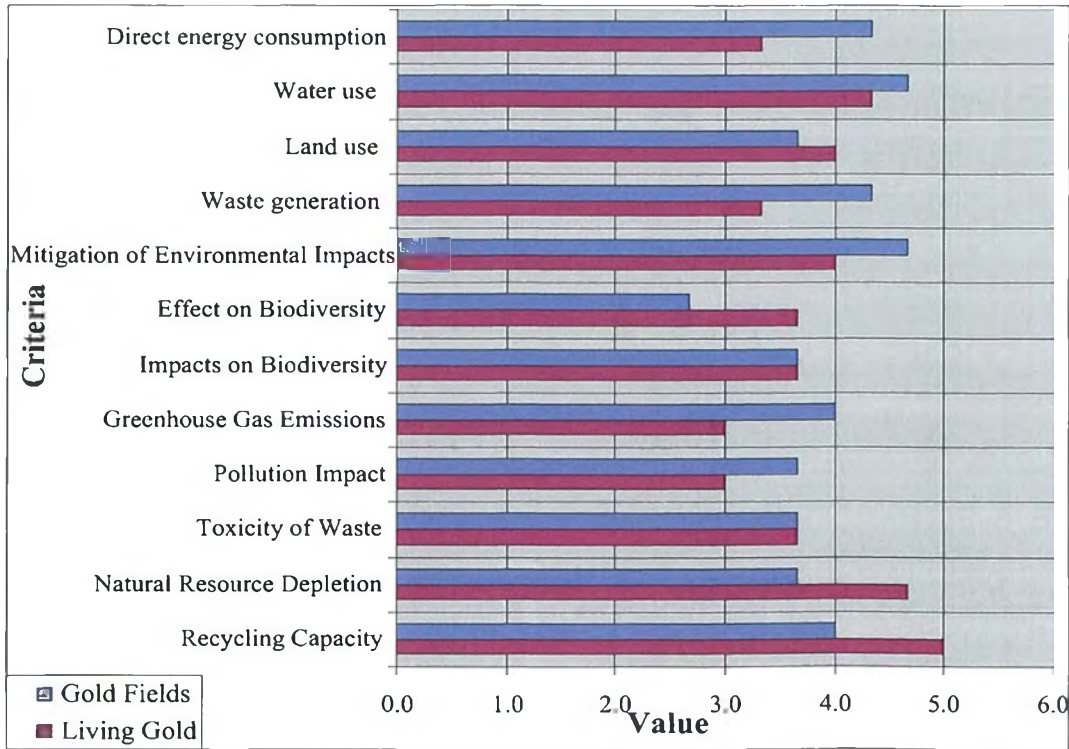


Figure 4.5: Mean environmental criteria score comparison between Gold Fields & Living Gold.

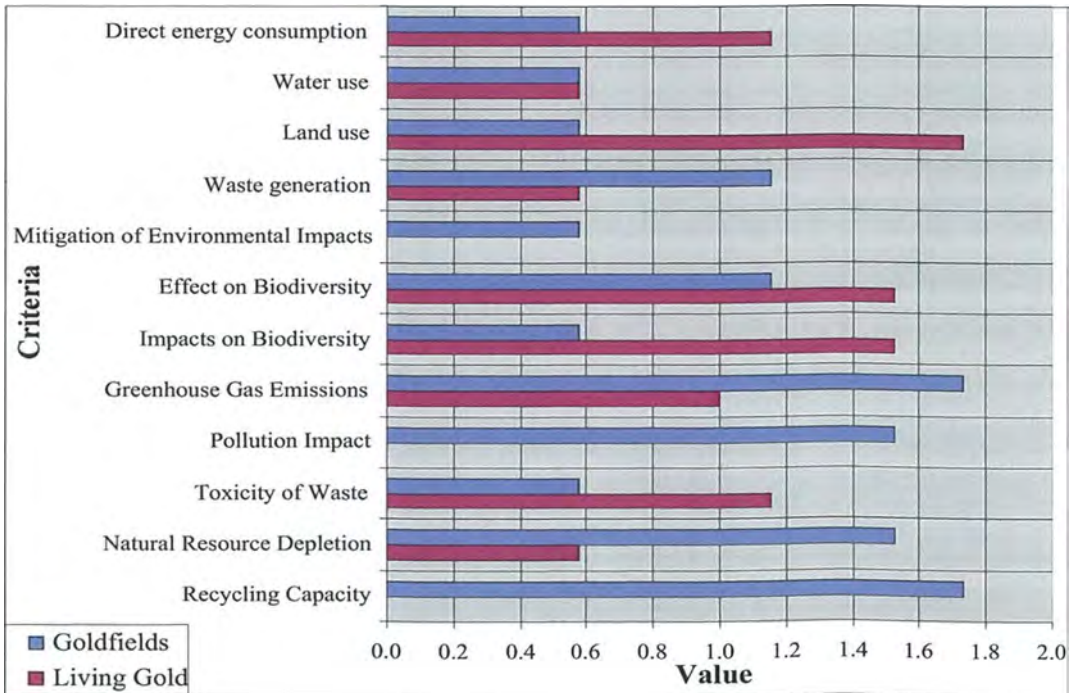


Figure 4.6: Standard deviation environmental criteria score comparison between Gold Fields & Living Gold.

4.2.3. a. Gold Fields

Responses from Gold Fields regarding input costs such as *Energy Consumption* and *Water Use* reflected fairly high scores and relatively low standard deviations. These criteria were identifiable costs to be managed, and would be beneficial to the environment if managed efficiently. *Land Use* had a low deviation and mean score (3.7). Land was not seen as a significant input to the mining process as most operations occurred subsurface. Waste was a high concern, especially in terms of operational cost/ liabilities, and perhaps less for altruistic environmental concerns. *Toxicity of Waste* was given a low mean score as toxicity is governed by regulation and legislation. *Recycling Capacity* had a fair mean score but a high deviation response, indicating a variety of responses, driven largely by personal opinion. *Mitigation of Impacts* was given a high score, with a low deviation highlighting an area of marginal concern for Gold Fields. *Effect on Biodiversity's* mean score was the lowest with a high deviation, indicating an inconsistent approach as how to mitigate impacts, between strategic and operational levels. *Impact on Biodiversity* exhibited a low mean score and low deviation, and helped explain the previous sentence by indicating a low concern for overall biodiversity. *Natural Resource Depletion* exhibited a relatively low mean score for a mining company, considering its dependence on natural resources, again having a high deviation. *Greenhouse Gas Emissions* and *Pollution Impact* had low to average mean scores with fairly high variations in response, highlighting apparent incoherent approaches to the implications of pollution and greenhouse gases.

4.2.3. b. Living Gold

Living Gold's responses to direct environmental inputs (*Direct Energy Consumption*, *Water Use*, and *Land Use*) appeared to be indifferent, with medium ratings best illustrated by *Energy Consumption* (3.3). A possible explanation for these scores was the perceived low environmental impact of the Living Gold operations. *Water Use* had a fairly high mean valuation (4.3), with low deviation (0.6), as one would expect a farming company to be fairly concerned with water usage. *Land Use* received a moderate mean score with high deviation (value), indicating a difference in opinions as to how land should be used or conserved. *Waste Generation* and *Waste Toxicity* had low to moderate mean scores, with the score for *Waste Generation* having a low standard deviation. *Toxicity* exhibited a fairly high concern with Living Gold so

although waste in general received a low score (value?), the quality of waste was regarded as being important. The indirect impact of these criteria was that *Recycling Capacity* had the highest mean (5.0). *Natural Resource Depletion* had a high mean score (4.7) highlighting the importance of natural resources in generating value for Living Gold.

4.2.3. c. Organisational Alignment Comparison

Greenhouse Gas Emissions; are driven primarily by energy consumption and usage (Azapagic, 1999). The amount of inputs, waste and products used and generated by the production process begins to imply that there was a variety of energy and material obligations that needed to be quantified and costed accordingly (Góralczyk & Kulczycka, 2000b). Gold Fields (4.0) tended to value this criterion more highly than Living Gold (3.0) and was highlighted by high variability of total responses of 1.4. It was evident from the Total Mean Scores that Gold Fields seemed to have a better understanding of this, with Living Gold appearing to have had a poorer understanding of the consequences of greenhouse gas emissions. Greater concern seemed to be placed on managing these operational impacts by Gold Fields. At Living Gold individuals seemed to place less concern on this aspect the more involved they were with operational functions (and the lower down the organisational scale they were situated) (*Appendix N*). Differences in understanding the complexities of Greenhouse Gas Emissions may have been evident here. Greenhouse gas emissions are cause for concern, but tend to be highly complex. A more common understanding with regards to greenhouse gas emission impacts and consequences needed to be managed between the two organisations. This would ensure a more strategic planning mechanism in place to maximise the value of the supply chain, thus mitigating costs and providing additional indirect benefits (Azapagic, 1999).

Effect on Biodiversity; generated a low Total Mean score (2.7) at Gold Fields. The reason given by all Gold Fields interviewees was that they regarded the impacts of mining on biodiversity as being relatively low as operations occurred below ground. However, this appears to be a misguided organisational opinion held as gold mining has massive impacts on aquatic biodiversity through the generation of acid mine drainage waters. At Gold Fields the operational manager (MB) and strategic manager (RN) placed relatively low importance on it, whilst the control and process manager

(PW) regarded it fairly high. Where impacts were witnessed more, a higher value was placed on maintaining a higher level of biodiversity. Use and utility were measured by consumption (Solow, 1986); hence the value of biodiversity could be measured against how it was consumed (potential). Assigned roles appeared to play an important function within formal entities, and perhaps highlighted rigidity in competency. At Living Gold the further down the managerial spectrum from which the results were received, the higher the importance placed on this criterion with an overall moderate rating of (3.7) being given by the organisation. This emphasised a need for diverse and resilient sustainability objectives for people with direct reliance on the environment for subsistence, and to enable future generations the supply of goods and services at similar utilisation levels (Solow, 1986).

Table 4.3: Table of differences in Environmental Mean scores between Gold Fields and Living Gold

Criteria	GOLD FIELDS	LIVING GOLD	DIFFERENCE	in favour
	Mean	Mean	Mean	
<i>Environmental</i>	3.9	3.8	0.1	GF
Direct energy consumption	4.3	3.3	1	GF
Water use	4.7	4.3	0.3	GF
Land use	3.7	4	0.3	LG
Waste generation	4.3	3.3	1	GF
Mitigation of Environmental Impacts	4.7	4	0.7	GF
Effect on Biodiversity	2.7	3.7	1	LG
Impacts on Biodiversity	3.7	3.7	0	-
Greenhouse Gas Emissions	4	3	1	GF
Pollution Impact	3.7	3	0.7	GF
Toxicity of Waste	3.7	3.7	0	-
Natural Resource Depletion	3.7	4.7	1	LG
Recycling Capacity	4	5	1	LG

Recycling Capacity, indicated that impacts and their consequences be taken into account. However, the more established the social relationship (Gold Fields) the less strategic management appeared to concern itself with this operational criterion. This was indicated by the valuations which were relatively higher at Living Gold (5.0) than at Gold Fields (4.0), with the expectation held that Gold Fields would want to manage and do as much as possible to lower impacts. Recycling was regarded as an initial step in increasing ecological efficiencies and appeared to be understood as such by Gold Fields. Behavioural change was seen as integral in keeping humans within the limits of the Earth’s carrying capacity (Daily & Ehrlich, 1992). Technology cannot extend

the finite biophysical capacity of this planet (Daily & Ehrlich, 1992), especially if one assesses this against the laws of thermodynamics. Increasing recycling capacity of all phases of operations may be necessary, which is correlated to technological capacity, as well as reassessing the idea of affluence in relation to “development goals”.

Attitudinal change in relation to the idea of affluence, which could be affected through culture, appears necessary (Smith, 1995). Living Gold placed a very high importance on recycling capacity of inputs and waste thereby understanding the need to diminish indirect impacts (and minimise operational costs).

Natural Resource Depletion; was an interesting inclusion here with Gold Fields giving a lower score (3.7) for this criterion than Living Gold (4.7). Gold Fields treated natural resource depletion with less concern, exhibited at the strategic management level, and was surprising in relation to the *Water Use* criterion, as they appeared to value Natural Resource Depletion (3.7) in the context of one resource only (gold), yet valued *Water Use* high (4.7), which is another natural resource. Gold Fields also appeared to view long-term sustainability as a more quantitative objective, achieving this by ensuring continued operational survival (diversifying locations), and looking to secure long-term financial health (including denominative management by reducing operational costs). Living Gold appeared to view long-term sustainability as a more qualitative objective, where natural resource availability and health were able to support their larger community (society). Gold Fields’ business is mining and with their capacity and global footprint, was able to continually prospect for other mining deposits. Therefore it appeared that Natural Resource Depletion was less of a liability concern for Gold Fields as they would be able to move operations relatively quickly. Indigenous communities were more dependent on local natural capital as a means of sustenance for the long-term as they have entrenched relationships with their local environment. The only inherited values that a community would have are natural resources found in its local environment. Value would be placed on certain resources based on the utility and scarcity of the resources. These values would be realised by entities that were able to technologically exploit and extract that value. It appeared pertinent to charge relevant rentals to Gold Fields against the revenues generated from the extraction of non-renewable resources, which could be done via capital investment portfolios and access to finance for community industries.

Direct Energy Consumption; was viewed as being of greater importance to Gold Fields (4.3) than to Living Gold (3.3), potentially as energy used in the deep level mining was a lot more intensive than farming and growing crops. There was little deviation as employees at all levels within Gold Fields had an understanding of the energy required for gold extraction, transporting the gold to the surface, cooling in the mineshafts and a host of other energy burdens. Based on the outcome of discussions with Gold Fields personnel, these concerns appeared to be driven by their cost implications and not due to their indirect global warming potential and pollution impacts.

Land Use; was more telling of a more general human behavioural character, where as a person becomes more exposed to value creating methodologies, historic patterns may exhibit themselves. Gold Fields (3.7) scored this criterion lower than Living Gold (4.0), which seemed to indicate a shift in focus of the two organisations and their respective organisational cultures. People tend to realise the intrinsic and extrinsic value that land holds, and the land becomes a valuable resource creating and retaining value, of which Gold Fields had an already accumulated as opposed to Living Gold. Land Use was a fairly holistic criterion, tending to encompass, much as the term environment does, more than just land but also what was found on that land (water, populations, flora and fauna). Effectively valuing the land may be achieved through a multi-layered approach, with economists determining the constraints for consumption, carried out using ecological efficiencies, in socially acceptable methods with relevant sustainable practices (Daily *et al*, 1996). This tends to be cumbersome and expensive.

4.2.4. Relative Importance of Cultural Criteria -:

Gold Fields tended to value cultural heritage components higher, and Living Gold tended to value contextual considerations (such as Reliance on Labour, Length of Impact, Locally Hired Employees) more. The Overall Mean Score for this category was valued higher by Living Gold (4.5), with the criteria that were valued higher exhibiting more context specific characteristics (*Table 4.4*), and Gold Fields' (4.2) scores tended to favour cultural heritage and symbolism preservation. Alignment might be achievable if these two aspects were separated and integrated.

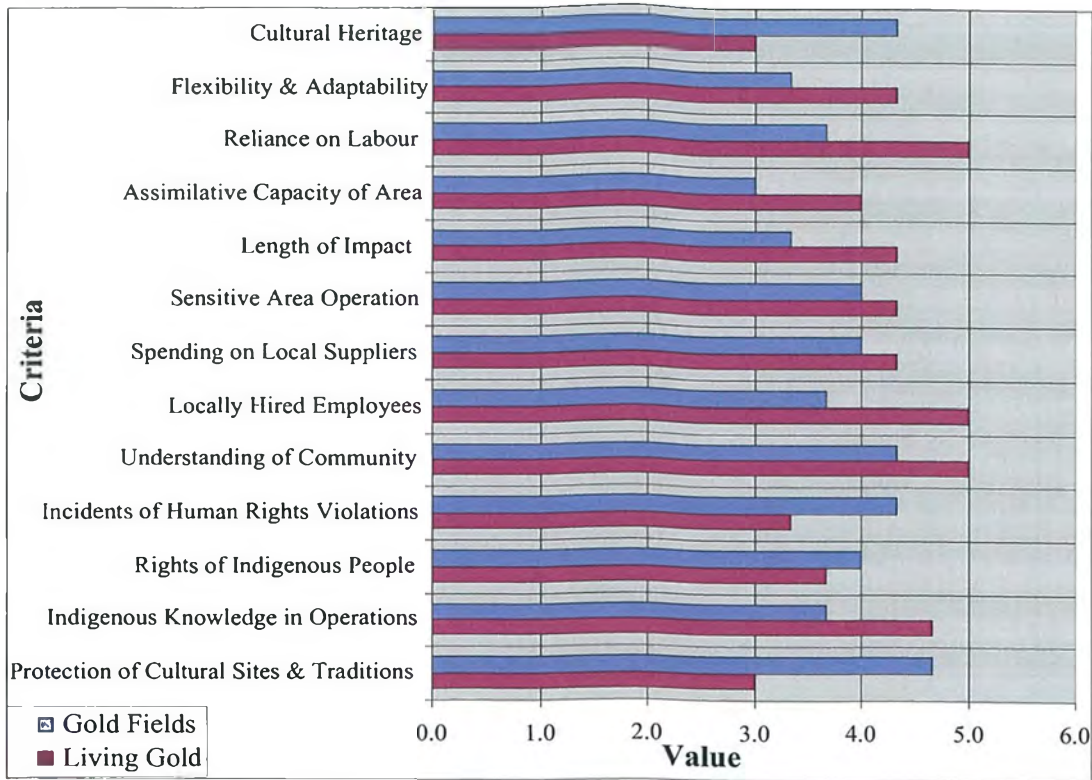


Figure 4.7: Mean cultural criteria score comparison between Gold Fields & Living Gold.



Figure 4.8: Standard deviation cultural criteria score comparison between Gold Fields & Living Gold

4.2.4. a. Gold Fields

The overtly cultural heritage criteria (such as *Cultural Heritage* and *Protection of Cultural Sites & Traditions*) seemed to generate feedback from Gold Fields that appeared commendable (i.e. high scores), but were misaligned with the priorities of Living Gold in a number of areas. *Cultural Heritage*, *Rights of Indigenous People* and *Protection of Sites & Traditions* generated mean scores that were high, with very little standard deviation. However, what has evolved as more valuable to indigenous communities, represented by Living Gold, was the need for contextually relevant and inclusive criteria. This may have included observing cultural traditions, but it definitely included ensuring that direct and indirect stakeholders were able to benefit. *Indigenous Knowledge inclusion into Operations* offered a low mean score for Gold Fields (3.7) yet high for Living Gold (4.7), as Gold Fields appeared confident in the technological capacity available to them. *Flexibility & Adaptability*, *Assimilative Capacity* and *Length of Impact* all generated fairly low mean scores (3.0 – 3.3), further highlighting that Gold Fields had a lower concern for stimulating flexibility and adaptability within and outside of the organisation. *Length of Impact* is a temporal scale that should be acknowledged when planning for any flexible state. It would have a bearing on operational life cycle and therefore time given to adapt and assimilate. This may be of concern as organisations that tend to build disproportionate reliance on competencies may become rigid as they lose resilience and then find it difficult to adapt to changes in the environment (Hollings, 2001). *Sensitive Area Operation* had a medium to high mean score with Gold Fields (4.0) having had a clear understanding of their operational impacts (such as pollution capacity, effluent discharge) in culturally (and environmentally) sensitive and important sites. These sites have historically been termed sacred with the motivation of protecting and conserving valuable resources. *Reliance on Labour* had a surprisingly low mean score (3.7), highlighting the view of clear substitutability of labour for capital. *Spending on Local Suppliers* had a higher mean score (4.0), which illustrated acknowledgement of the need to regenerate the local area. *Locally Hired Employees* also had a low mean score (3.7) as Gold Fields seemed to score this in light of the understanding they had of the migratory nature of mineworkers. It was expected that they would actively seek to recruit from the area but this did not seem to be a priority.

4.2.4. b. *Living Gold*

Cultural Heritage, Rights of Indigenous People and Protection of Cultural Sites all had relatively low mean scores (3.0 – 3.7), all showing lower concerns for issues regarding the cultural heritage characteristics, yet with high deviations, illustrating that not everyone shared similar views. However, *Incorporation of Indigenous Knowledge into Operations* scored very highly (4.7) with little deviation which, in light of the previous statement, may have indicated that such communities valued actions and behaviour over concerns and programmes. *Flexibility & Adaptability, Assimilative Capacity of Area, Length of Impact and Operation in Sensitive Areas* all generated fairly high mean scores (4.0 – 4.3) with sizeable deviations, which was not surprising as the assumption held was that traditional/ indigenous communities attempted to instil a level of flexibility within their communities. Spending on Local Suppliers was an important concern with a fairly high mean score, again promoting wider local community involvement. *Reliance on Labour, Locally Hired Employees and Understanding of Community Structures* all had the highest mean scores (5.0) with no deviation, which was as assumed, again the desire to benefit as many people in local community as possible.

4.2.4. c. *Organisational Alignment Comparison*

Protection of Cultural Sites & Traditions; generated a sizeable Total Mean Difference score (1.7), with Gold Fields valuing this criterion more (4.7) than Living Gold (3.0). Living Gold scores were interesting as they tended to appreciate this element of protection (3.0) yet it appeared that they valued the observation of indigenous knowledge and practice a lot more (Indigenous Knowledge in Operations=4.7) (*Table 4.4*). *Protection of Cultural Sites and Traditions* was seen as a quantifiable and observable criterion requiring attainable information and action, which may have been easier for Gold Fields to identify and act upon. This was an achievable objective (provided the necessary information and finances were available) on behalf of Gold Fields. Traditional/ indigenous communities have been hesitant in sharing their knowledge because, according to McGregor (2004), they “might” have felt that the knowledge would be used out of context and to manipulate. Inherent knowledge tends to be protected and people might be suspicious of its use outside of local context, tending to be “protected” (licensed) once shared and the observation of the practice was lost (McGregor, 2004). There appears to be a telling misalignment of value and

objectives between the two organisations and their assessments of these criteria. Gold Fields presumes a different strategy to that of Living Gold (which is context capacity over culture heritage capacity). Gold Fields score was higher than Living Gold’s score, and they appear to be taking a precautionary approach, which is better than if the scores had been reversed.

Table 4.4: Table of differences in Environmental Mean scores between Gold Fields and Living Gold

	GOLD FIELDS	LIVING GOLD	DIFFERENCE	
Criteria	Mean	Mean	Mean	in favour
<i>Cultural (Techno-Cultural, Contextual)</i>	4.2	4.5	0.3	<i>LG</i>
Cultural Heritage	4.3	3	1.3	GF
Flexibility & Adaptability	3.3	4.3	1	LG
Reliance on Labour	3.7	5	1.3	LG
Assimilative Capacity of Area	3	4	1	LG
Length of Impact	3.3	4.3	1	LG
Sensitive Area Operation	4	4.3	0.3	LG
Spending on Local Suppliers	4	4.3	0.3	LG
Locally Hired Employees	3.7	5	1.3	LG
Understanding of Community	4.3	5	0.7	LG
Incidents of Human Rights Violations	4.3	3.3	1	GF
Rights of Indigenous People	4	3.7	0.3	GF
Indigenous Knowledge in Operations	3.7	4.7	1	LG
Protection of Cultural Sites & Traditions	4.7	3	1.7	GF

Effects on Cultural Heritage; generated a high Total Mean Difference score (1.4) and Total Standard Deviation (1.4). These differences and deviations were a result of the deviation in responses received from Living Gold (1.7). Living Gold appeared to exhibit rigid cultural value systems, remaining inflexible. Gold Fields appeared to understand and acknowledge the impacts their operations had in relation to the cultural heritage of the local community (4.3). Living Gold as an organisation, gave a substantially lower mean score (3.0). The presumption was that Living Gold individuals (specifically MM) were not acknowledging an impact felt upon cultural heritage due to mining operations. This indicated distinct separation of cultural impacts to mining operations, especially over time. This illustrated a narrower understanding of cultural impacts and evolution, or perhaps a confidence in cultural practices withstanding any such impacts. The creation of resilient states should be fostered, adapting to change by continually developing strategies that are relevant to evolving states (through the practice of active learning) (Gunderson, 2000). Read in

conjunction with the above criterion, a pattern began to emerge, one where Gold Fields tended to value overt cultural heritage criteria. However, in order to fully exploit the alignment of sustainability ideals between Gold Fields and Living Gold there would need to be institutional incorporation of these aligned ideals (from a top level, strategic perspective) for it to be effective.

Locally Hired Employees; were valued highly by Living Gold (5.0) yet far lower by Gold Fields (3.7). The score for Living Gold was as expected as was Gold Fields', considering the high levels of migratory workers found on mines. The implication was that Living Gold wanted to increase the benefit to their local economy. It seemed natural then that the community would want Gold Fields to employ local people exhaustively before employing outsiders. This might have indirectly involved an increased level of influence within Gold Fields over the community. Hiring locally would help build capital in the community which could then be used to contribute to sustainable projects after mine closure. The spread of disease that is associated with migratory workers perhaps would also need to be investigated in more detail.

Reliance on Labour; generated the exact same mean scores (M: GF=3.7, LG=5.0) as "Locally Hired Employees" did, for Living Gold and Gold Fields. There appeared to be direct correlation between these two criteria (Locally Hired Employees and Reliance on Labour) with regards to the idea of benefiting the local community and still to a lesser degree influence on Gold Fields. If Gold Fields was to use processes which are highly reliant on labour, this would imply an increased labour portfolio. This would result in more people from the community (indirectly, Living Gold) being employed with Gold Fields. These two criteria indicate the preference of Living Gold to value contextual capacity criteria over cultural criteria. This also indicated the need to respond to the individual contemporary context and not necessarily the historical context. In terms of sustainability, it would appear that those initiatives that were more labour-intensive would be preferred over those that were highly mechanised.

Incidents of Human Rights Violations; surprisingly had a higher mean score with Gold Fields (4.3) as opposed to Living Gold (3.3). The difference in mean scores was fairly large. Further enquiry resulted in more understanding in relation to Gold Fields' corporate policy. Gold Fields did understand the need to operate in an ethically

correct manner regarding human rights violations, and thus offered a resolute response. Living Gold on the other hand gave a varied response (standard deviation=2.1) with a lower value placed on the criterion. This aspect is a highly emotive issue, with it raising “uncomfortable” levels of negative publicity. It was important for Gold Fields to manage the perceptions of mining, acknowledged by striving for best practice. Living Gold tended to indicate a lower concern for this aspect, perhaps more focussed on lower order needs such as immediate employment, health, education.

Rights of Indigenous People; Reasoning for the lower scores for Living Gold was due to the midlevel management response from Living Gold (Living Gold Interview MM). It was stated that they would prefer a more general, socially-focussed approach as opposed to one incorporating a specific category of society above another. This response appeared to acknowledge the constantly evolving and dynamic behaviour of systems (social) that do not need to stay resolute in acceptance or rejection of certain states. To exclude or overemphasise certain social aspects would be to the detriment of the entire system.

Spending on Local Suppliers; had a generally higher value when assessing all the individual responses received, and it could be observed that all local stakeholders rated this criterion as high. However, the further removed a planning authority was from local operations (i.e. Gold Fields top management) the less that authority tended to be concerned with local influences (Escobar, 1995). Interest in building capacity within a local area could result in a more resilient and sustainable state. To breed resilience, more diverse socio-economic and cultural interactions would be preferred (Bennet, 1944) with more diverse cultures making more interactive responses to surroundings. This provided a basis for promoting empowerment programmes within affected communities and fostering higher levels of public participation in management decisions. Direct benefits which lead to indirect benefits for affected communities would strengthen the sustainability of those communities.

4.3. SUMMARY OF THE BALANCED BOTTOM LINE SUSTAINABLE DEVELOPMENT CRITERIA FOR GOLD FIELDS

Mines are unsustainable as they involve the extraction of non-renewable resources (Hilson, 2006: 225). Resources cannot be replaced and profits from resources are received in the present. Once mines become less profitable, mining activities begin to slow and eventually stop. Closure has historically been treated with little preparation and as a result of closure, insufficient remediation measures are in place (Mining, Minerals and Sustainable Development, 2002). With the “Polluter Pays Principle” and legislation, liabilities of the remediation costs are being passed on to companies responsible for their operational impacts (Moran, 2000). Therefore, the implication is that mining companies have some level of responsibility to ensure sustained existence of the affected areas and communities once their operations cease. These impacts are observed directly in the environment, and felt indirectly, in the economy, society and culture of the affected community.

Mining companies need to be prepared for the closure of their mines and begin planning whilst the mine is still profitable. Gold Fields (*Appendix G, Figure 2.1*) have highlighted four phases of the life cycle of a mine: 1) planning, feasibility and authorisation, 2) operational life of the mine, 3) decommissioning and mine closure, and 4) post closure. These phases have their own activities which were acknowledged as preferential in ensuring that risks and costs, borne by both the public and themselves, were minimised. The ability to affect the greatest change in the ultimate impact and expenditure is made during the planning, feasibility and authorisation phase (O’Rourke *et al*, 1996).

The process of the dissertation worked towards developing a more relevant understanding for sustainable development which made use of the term Balanced Bottom Line to indicate reference to the four elements of sustainable development being assessed. This was the progression from the traditional idea of Triple Bottom Line reporting toward the process of balancing input and agreement between all stakeholders for a successful outcome. The discussion of the responses attempted to understand organisational cultures and their respective organisational development ideals. These ideals were then compared to see just how well (or not) they were aligned with each other.

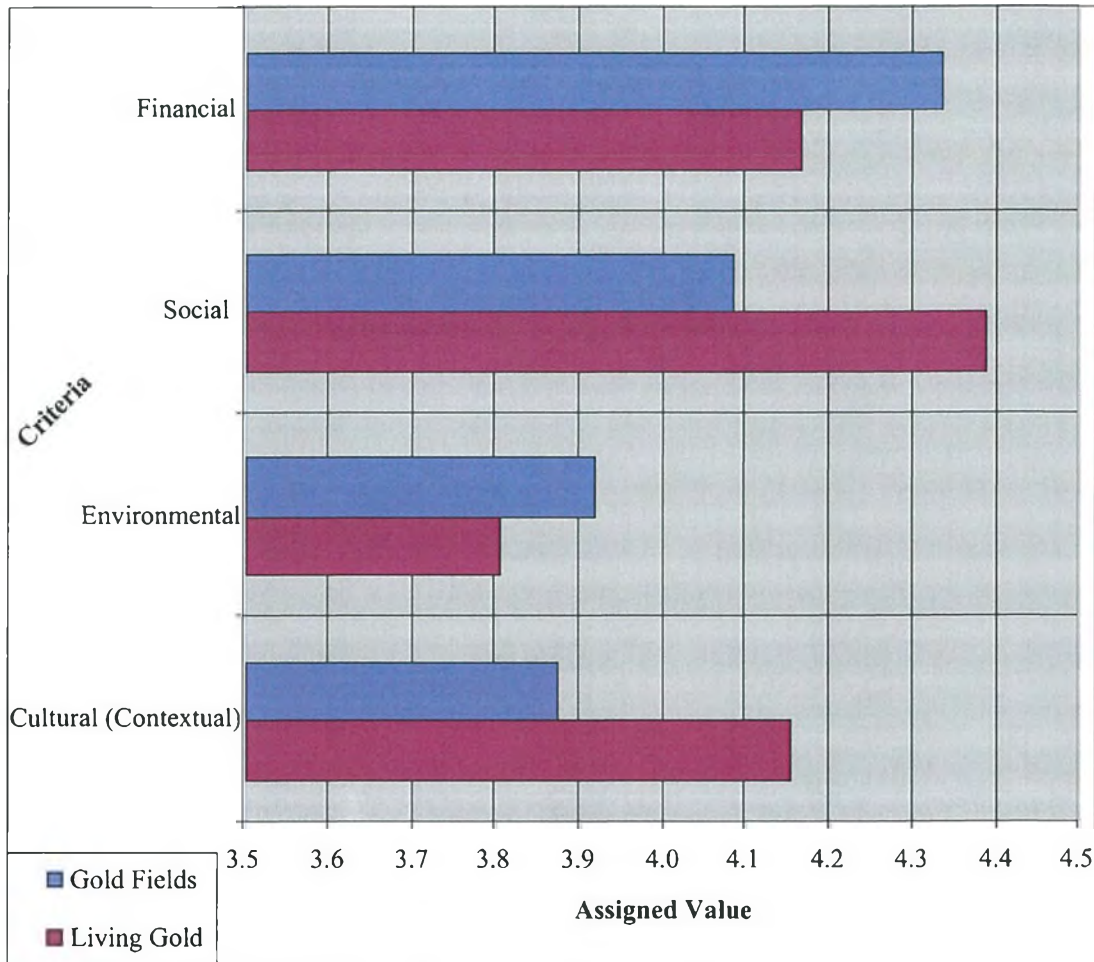


Figure 4.9: Overall Balanced Bottom Line category mean score comparisons.

Financial and Environmental Criteria tended to be, on average, more important to Gold Fields while Social and Cultural Criteria were on average more important to Living Gold (Figure 4.9). Standard Deviations (Figure 4.10) on average were higher for Living Gold, indicating a variety in responses, perhaps due to the less formal character exhibited by such an organisation. Living Gold comprised, at management level, of people who have less formal training yet closer links to affected traditional and indigenous communities. This indicated a level of diversity in opinion, especially concerning overall Cultural Criteria, where their Standard Deviation was larger than Gold Fields’.

Differences existed in the values each organisation was able to extract from their surrounding environments. Gold Fields would be concerned in generating such value for current shareholders, and it appeared Living Gold would be more inclined to see that value perpetuate itself for future generations. This highlighted the importance of

utility of resources and implications for future generations (intergenerational equity). As long as utility received by future generations was the same or similar, current consumption could proceed, provided that current generations could assure fairness in utility (Solow, 1986). Maintaining constant consumption required re-investment in order to ensure future consumption utilities were provided for (remediation and rehabilitation) (Svensson, 1986). These needed to be clearly highlighted and stipulated, especially when consumptions included non-renewable resources, by generating a rental against the scarcity of the resource – and charged accordingly (Svensson, 1986).

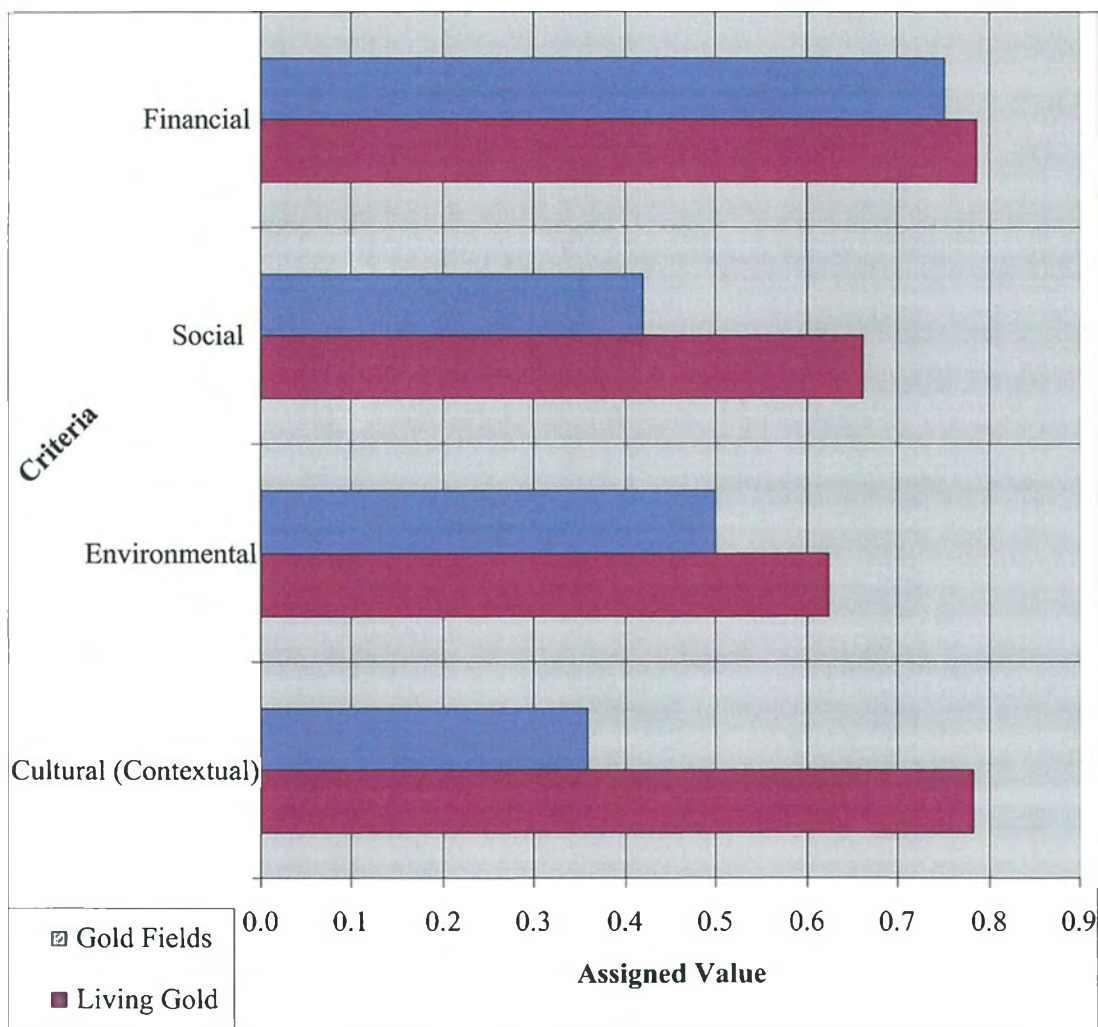


Figure 4.10: Overall Balanced Bottom Line category standard deviation score comparisons. Considering all of these implications for aligning sustainable development criteria values and ideals with the relevant affected community (Living Gold), Gold Fields could now begin developing strategic sustainability initiatives which would create greater cohesion between these groups.

4.4. ASSESSMENT OF GOLD FIELDS SUSTAINABILITY STRATEGIES

4.4.1. Current Sustainability Strategies

Current Gold Fields Sustainability Strategies were concerned with two high level categories, 1) Education and Skills Development, and 2) Integrated Community Projects and Poverty Alleviation Programmes. These initiatives were carried out in areas where Gold Fields is operational (Gold Fields, 2005). The majority of the initiatives involved direct investments in initiatives and others involved working with communities and organisations. Each of these initiatives is discussed briefly below.

Education and Skills Development

These were highlighted by support and investments in teaching institutions such as Rhodes University, Gold Fields Nursing College, Vaal Triangle Technikon, Mnyakanya Secondary School, Doasho Secondary School, Enlighten Edu Trust, and Edumap Edu Trust (Gold Fields, 2005). These projects ranged from involvement in environmental educational and training, training of healthcare workers, teacher training, provision of classes and equipment and academic enrichment programmes.

Integrated Community Projects and Poverty Alleviation Programmes

These projects were linked with the communities where Gold Fields operated. Some of these projects involved developing community member skills and providing source funding for business initiatives. They included agricultural development programmes in Lesotho and Eastern Cape, and providing home-based care for terminally ill people in Moçambique. The Paragon Project was a job creation project involved in employing disabled former Gold Fields' employees, which specialised in manufacturing safety equipment and clothing for Gold Fields' mines. A current initiative developed by Gold Fields was the establishment of Agrihold, an investment vehicle for agribusiness initiatives, which has the potential to be used as a highly integrated initiative, with many possible off shoots.

Another more integrated initiative was Living Gold, initiated as a project in 2002. Set up as a viable cut-flower business targeting export markets, it operated in partnership with the Industrial Development Corporation, and provided 320 direct jobs. Indirect employment opportunities that have evolved from Living Gold were transport, potpourri manufacture, compost sales and boiler ash utilisation for brick making.

4.4.2. Concerns with Existing Initiatives

The following issues were highlighted as possible misalignment problems with the results of the ratings:

- ♦ Most interventions appeared to operate off a base of one sustainable development principle, which were stipulated by Gold Fields.
- ♦ Local, indigenous and traditional knowledge was not used in operational or institutional contexts. Living Gold valued the incorporation of local knowledge into operations, and this provides an opportunity to help develop more responsive and relevant initiatives.
- ♦ Initiatives tended to be prescriptive rather than fully inclusive, as initiatives' strategies were informed by Gold Fields. Again making use of local and traditional knowledge might help in deciding on eventual investments.
- ♦ *Training and Empowerment* needed to be further developed, as Living Gold valued this criterion higher than Gold Fields. This aspect was evident when it was ascertained that management of initiatives was highly dependent on Gold Fields' input (and hence direction).
- ♦ Entrepreneurial capacity building appeared to be missing from these initiatives, which would be a necessary component of financial sustainability.
- ♦ Some of the initiatives did not appear concerned with continued financial operations where help in the future might be needed. This may be due to the secure capital base off which Gold Fields operates. A community might be operating off a lower capital base and require in depth capital investments as indicated by the higher value placed on *Capital Costs* at Living Gold.
- ♦ The initiatives seemed only concerned with the primary step of an initiative's own resilience process, thereby diminishing *Flexibility & Adaptability* of a project. These aspects were valued lower by Gold Fields and would need to be developed in order to align themselves with affected communities (Living Gold).
- ♦ It appeared as if Gold Fields were not actively using initiatives to diversify their strategy, rather initiatives appeared to be driven by Corporate Social Investment (CSI) responses.
- ♦ Initiatives did not appear to be incorporated as part of Gold Fields' larger company strategy; they were initiatives that could not be acted upon outside of Gold Fields' business.

- ♦ Living Gold valued the use of local suppliers more highly than Gold Fields. There would appear to be a need to increase the use of *Local Suppliers* into each of the initiatives, as, although there was reliance on local suppliers in Gold Fields' operations, there was no indication of their use in initiatives.
- ♦ *Public Participation* was not as inclusive as it could have been. There could be an inclusion of a report from an affected community body on Gold Fields' behaviour in their respective community, which could be included in the Gold Fields' Annual Report. This could serve to commit to action the *Public Participation* which Gold Fields values highly.

4.4.3. Recommended Initiatives

The current Agrihold initiative (investment vehicle for agribusiness) could be further expanded to include a variety of integrated and diverse projects making use of collective functions. It was considered a highly beneficial initiative, considering the surface land disturbed by past operations and current land lying unused due to the subsurface nature of mining. Gold Fields, therefore, had capacity to provide this land to small-scale local farmers who rent the land for farming purposes. Cooperatives could be facilitated by organising the small-scale farmers into farming collectives, creating greater bargaining power. It would empower local communities by increasing employment prospects and resultant indirect employment possibilities. These included fresh produce delivery and transport initiatives, cold storage facilities and administration services for these co-ops. This could be diversified into establishing nurseries for indigenous plant saplings. The plants could be used in current rehabilitation projects as well as providing plants to other mining companies' rehabilitation projects. A fully fledged, competitive nursery could be developed and increase the supply scope of indigenous plants species throughout the country.

Secondary industries could also be sought as both employment creation initiatives and value creating interventions. South Africa is a substantial producer of various minerals and metals (gold, platinum, diamonds, iron ore etc.), yet South African industries are predominantly involved in facilitating the selling of these resources. The result being that beneficiation is not fully realised in South Africa, as resources are exported for sale, and then imported as manufactured goods. The result is a net loss in the value chain for the South African economy.

Initiatives in the field of science and technology could be sought, by investing in science and technology facilities. These would be used to foster skills in these fields, creating direct and indirect benefits for Gold Fields, as well as providing highly lucrative diversification strategies. Examples of possible initiatives are:

- ♦ Electronic component design and manufacture.
- ♦ Jewellery design and manufacture.
- ♦ Nanotechnology research and applications.
- ♦ Fuel cell and catalytic converter manufacture.

There are a host of other initiatives which could be investigated. However, the essence of these recommendations is:

1. initiatives need to be devised along, at least, two Balanced Bottom Line sustainable development components;
2. initiatives that have diversification capabilities should be promoted;
3. industries that make direct or indirect use of gold in their manufacture should be sought; and
4. beneficiation and value adding activities should be incorporated

4.5. Conclusions

Financial viability is a necessity for any activity, yet this usually gets lumped together with unabated economic growth. If economic growth has been achieved, how come real development of all or most sectors of society and the environment has not occurred? Economists are realising that the current GDP measurements being produced may be insufficient (Douthwaite, 1997) and development should be aware that different systems develop at different rates (Norgaard, 1994).

Gold Fields was aware of the need to adapt operational and strategic focus to ensure the organisation was able to sustain itself using current sustainable development components, indicated in their reporting. Discussion was carried out by assessing the difference in organisational culture between Gold Fields and Living Gold through the interrogation of the criteria rating of the four proposed sustainable development categories. Alignment and misalignment was assessed against responses between Gold Fields and Living Gold, helping develop an understanding of contextual applications for South African industry.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1. GENERAL CONCLUSION

Companies are under increasing pressure to adapt and respond to ever changing conditions, within volatile markets, whilst being accountable for past and present operational actions. Current resource constraints are being placed on organisations, communities and organisms. It is increasingly evident that relationships between companies, individuals and overall environments need to be proactively managed in order to ensure a modicum of sustainability. There are various responses available to such conditions through legislation and regulation. However, to ensure continued sustainability, it would make sense for strategic, proactive shifts to ensure adaptability, resilience and flexibility to changing conditions for companies.

To be prepared for such change, through increased adaptive capacity and resilience, constructive change should be fostered by:

1. identifying and decreasing the amount of destructive constraints (operations),
2. preserving the experience of the system (indigenous/ traditional knowledge),
3. stimulating innovations (paradigm shifts),
4. encouraging renewal (change), and
5. encouraging communication and information dissemination (Holling,2001)

Resource professionals operate from a space of high expectations, with a low level of understanding of contextual situations (Shindler & Cheek, 1999). It has been found that indigenous and traditional local people have more relevant, contextual understandings of these contexts through established long-term relationships, which are innovative and flexible, demonstrating accountability through building trust and support among all stakeholders (Shindler & Cheek, 1999). Behavioural and attitudinal changes need to occur to ensure continued sustainability throughout any system. Culture is regarded as a mental interaction of an individual assimilating society, which results in the evolution of society and individuals' interactions (Wissler, 1912). "Culture is of great variety and hence must result from activities that tend toward the divergent and accidental ends" (Wissler, 1912:219).

5.2. SUMMARY OF THE GOLD FIELDS CASE

The Gold Fields case study has highlighted the need to adapt their behaviour to constraints being faced by all entities in the face of ever increasing environmental change. They have developed and instituted many strategic, planning, control and operational measures in a road map to achieve their sustainable development objectives. This has included the initiation of Living Gold, a financially viable company based in the Khutsong area of Carletonville, providing direct and indirect employment for this affected community.

The research focussed on these two organisations, their similarities and differences in values. Living Gold is a direct response to Gold Fields' sustainable development focus, and it was assumed there would be strong alignment of sustainable development criteria between these organisations. Interestingly, in some instances there was a high level of agreement and alignment between the organisations, and with regard to some seemingly significant criteria, there appeared to be strong disagreement. Overall Gold Fields tended to value highly the categories of financial and environmental development. Living Gold, however, valued social and cultural development categories as being of more importance than indicated by Gold Fields. It was found that Gold Fields had a better understanding of more complex issues such as greenhouse gas emissions, as well as regulatory and legislative criteria like rehabilitation costs for decommissioning. The values and opinions of the Gold Field employees also tended to be more formal, with results tending to exhibit a hierarchical pattern. Management levels knew what was expected of them as well as the organisation in general. Living Gold tended to value criteria according to their own preferences, which was witnessed through the high variability in responses received from them. Living Gold also tended to value general community benefits very highly, and were almost always more important than rating received by Gold Fields for the same categories.

The differences between these organisations were acknowledged by the difference in responses to cultural criteria. Gold Fields tended to place a higher value on the more formal, overtly cultural criteria, whilst Living Gold valued the contextual criteria more highly. Applications were made for the development of a methodology and

framework to be used for possible future use in developing sustainability initiatives and strategies.

In planning for the eventual closure of a mine, it would have been preferable for Gold Fields to have begun the strategic planning for closure when they began their operations. The life cycle of the mine could be noted and matched according to the different phases of resilience and strategies would be employed to exploit the different phase of resilience in which the operation found itself. Operational progress could be matched with each resilience stage and Gold Fields would make use of these different strategies according to the different phases (see *Table 5.1 Section 5.3.1* below).

5.3. RESEARCH RECOMMENDATIONS: MOVEMENT TOWARD A BALANCED BOTTOM LINE FRAMEWORK

“What is required to save the remaining biotic diversity of earth is nothing less than a dramatic paradigm shift – a transition to a “sustainable” or “steady-state” society” (Ehrlich, 1982: 333).

5.3.1. Integrated Resilience Sustainability Method

Ultimately the investigations, research and findings have resulted in a contextual, qualitative understanding of the four criteria stipulated and defined as:

- ☉ **Environment:** - where people are (situated),
- ☉ **Society:** - the collection of people,
- ☉ **Economy:** - the formal/ regulated interactions of society, and
- ☉ **Culture:** - the symbolic and internalised behavioural activities carried out by individuals collectively between their society and environment.

The difference between social and cultural elements is understood through acknowledging social forms as generic patterns having evolved through human interaction. “We can pool information about experiences, but never the experiences themselves. From family to nation, every human group is a society of island universes.” (Huxley, 1956: 3) Culture tends toward individuals’ internalisation of societal norms and practices, governed by societal and environmental constraints. These societal constraints are brought about by larger environmental limitations and facilitated by the flow of economic value exchange and interaction.

Ecosystems provide a variety of goods and services used in the social and economic activities of human existence. These are listed as:

1. maintaining the quality of the atmosphere,
2. regulation of weather and hydrologic cycles,
3. recycling and disposal of waste,
4. recycling of nutrients,
5. soil maintenance,
6. food provision,
7. pest control and natural population control and
8. maintaining a diverse genetic library (Ehrlich, 1982)

To maintain sustainability and resilience, a management process should seek to 1) increase the buffering capacity (protection), 2) manage multiple scales and 3) nurture renewal (innovation) (Gunderson, 2000). Assessment of a system's resilience should be done to ascertain its adaptive capacity during the periods of disequilibria and change (which is inevitable) (Gunderson, 2000). Panarchic evolving cycles exhibit four similar phases, which a system will move through:

1. r = growth (EXPLOITATION),
2. K = accumulation (CONSERVATION),
3. Ω = restructuring (RELEASE), and
4. α = renewal (RE-ORGANISATION)

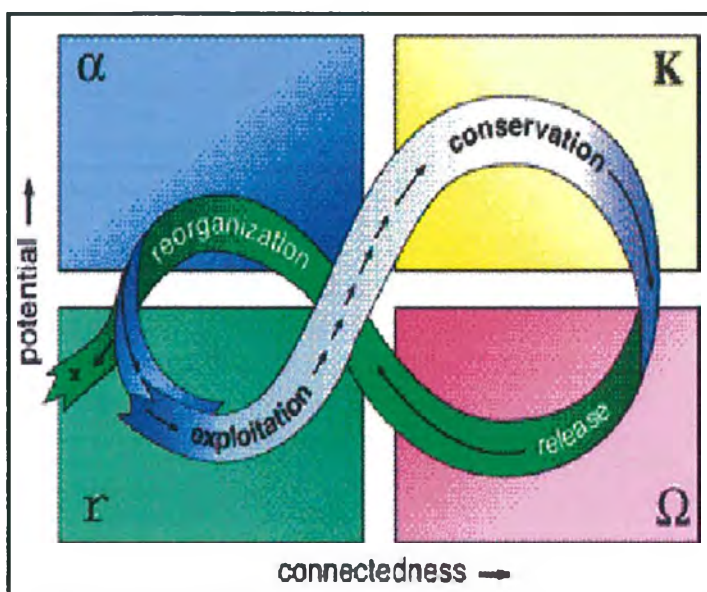


Figure 5.1: The Resilience Model

Source: Weeks *et al*, 2004 (*Appendix C*)

This realm of complexity, with local systems evolving (developing) in self-organising manners, is where resilience is managed to foster sustainability (Holling, 2001). This is tabulated in a merge with company/ product life cycles to help exhibit focal points for planning (*Table 5.1*). The following table has been compiled from general observation and found to be useful in helping to lay out preliminary strategic focus.

Table 5.1: Synthesis of Mine Life Cycle, Resilience phases and strategies

LIFE CYCLE OF A MINE	RESILIENCE MODEL PHASES	RESILIENCE STRATEGIES
1. Planning & Feasibility	1. Re-organisation	1. Dispersion
2. Operations	2. Exploitation	2. Disturbance
3. Decommissioning	3. Conservation	3. Contingency
4. Post-closure	4. Release	4. Diversity

The compilation of the Integrated Sustainability Resilience Model (*Figure 5.2*) is based on current understandings of sustainable development, making use of contemporary sustainable development implications in terms of resilience and adaptive management with the inclusion of cultural development.

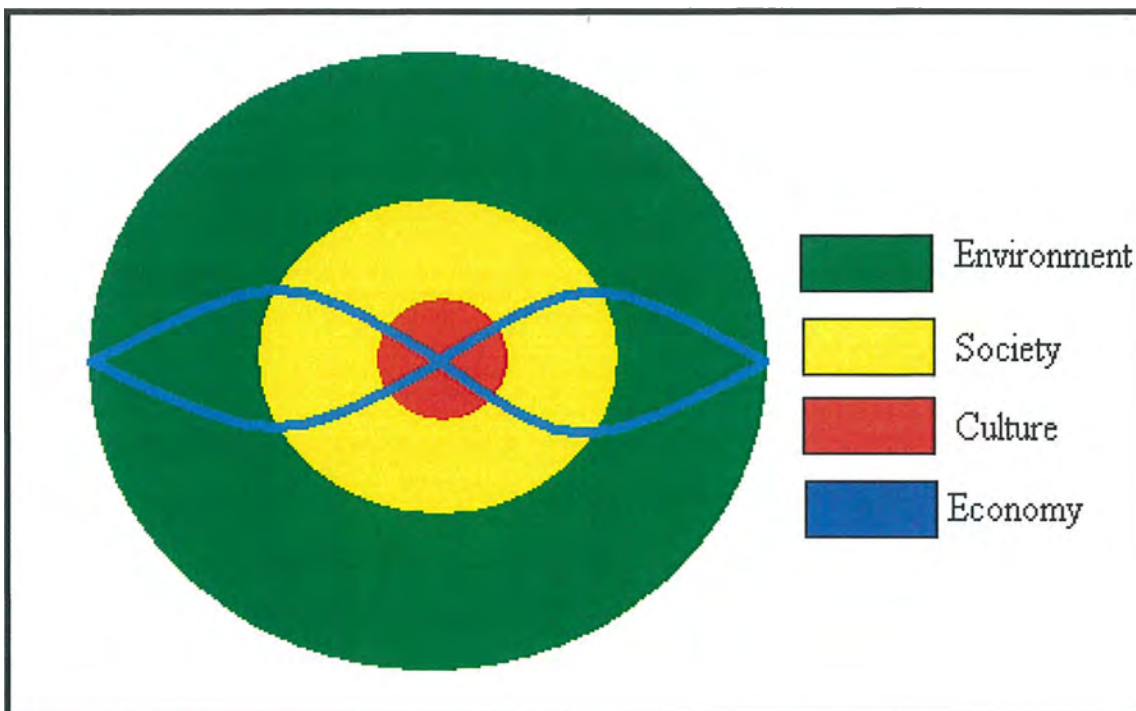


Figure 5.2: The Integrated Sustainability Resilience Method – Towards the Balanced Bottom Line

The Integrated Sustainability Resilience Method makes use of the environment as the largest system in which all others are based, constrained and dependent on. Society is dependent on the environment for long-term survival and sustainability at a smaller spatial scale. The individual forms the smallest system in this methodology, and represented by culture, illustrated as being affected by the societal regulations imposed necessary for sustainability. The economy is described as more fluid and has integration across all three spheres simultaneously. The economy serves as a formalising, quantifying and evaluating tool, in facilitating interactions and relationships between the other three components. This method offers an altered view of all four components' interaction and impacts upon each other. It stimulates the debate around the use of cultures (context, values) strategic implications for development planning. This cultural interpretation and transmission of knowledge can be performed through rituals and cultural practices, handed down through cultural traditions to promote resilience (Berkes *et al*, 2000). Traditional/ indigenous knowledge can be used effectively to breed capacity for resilient systems through qualitative management reinforced by quantitative measures. Using traditional/ indigenous knowledge in the adaptive management loop emphasises and builds a state of flexibility to avoid thresholds being breached which would destroy social and economic systems (Berkes *et al*, 2000). Planning does appear to occur for economic, social and environmental criteria, but how does an organisation plan for cultural criteria and impacts? Resilience incorporates all of these criteria and could be used as a method for helping develop sustainable development strategy, especially when used in conjunction with the life cycle of the organisation itself.

5.3.2. Balanced Bottom Line Framework

Emphasis on steady states and stability in achieving continual, sustainable, predictable yields with quantitative measurements placed on biased ("valuable") resources leading to decreased long-term adaptive capacity of systems, as the system quality and resilience are not taken into account (Berkes *et al*, 2000).

For sustainability to occur, improvements need to happen across all four elements of sustainable development. If no real value is able to be created by the shift in strategy, as soon as the organisation is under financial constraints they will discard sustainability interventions (Figge *et al*, 2002). Companies which adopt "separate and

explicit” sustainability strategies will more often than not, adopt a sustainable behaviour in the wider context of organisational behaviour (Figge *et al*, 2002). Entire areas and systems (ecosystem, land, knowledge, people) are seen as a large, single, integrated whole, with cyclical systems (long-term) exhibiting linear processes (short-term) (McGregor, 2004). Cultural progress occurs when culture makes different and divergent uses of similar resources. The assimilation and subsequent utility of resources is determined by culture (Goldenweiser, 1916). “The combination of increased mental capacity and a need for group survival facilitated the evolution of culture as a mechanism to ensure the survival of the group’s genetic code. Evolutionary adaptations that improved communication, planning and coordinated activity soon surfaced” (Vail, 2004: 10). Coordinated strategies are required to ensure that fully integrated initiatives are achieved. These strategies need to be coordinated within a framework that aligns initiatives and sustainability categories’ to ensure initiatives are not dependent on one category over another.

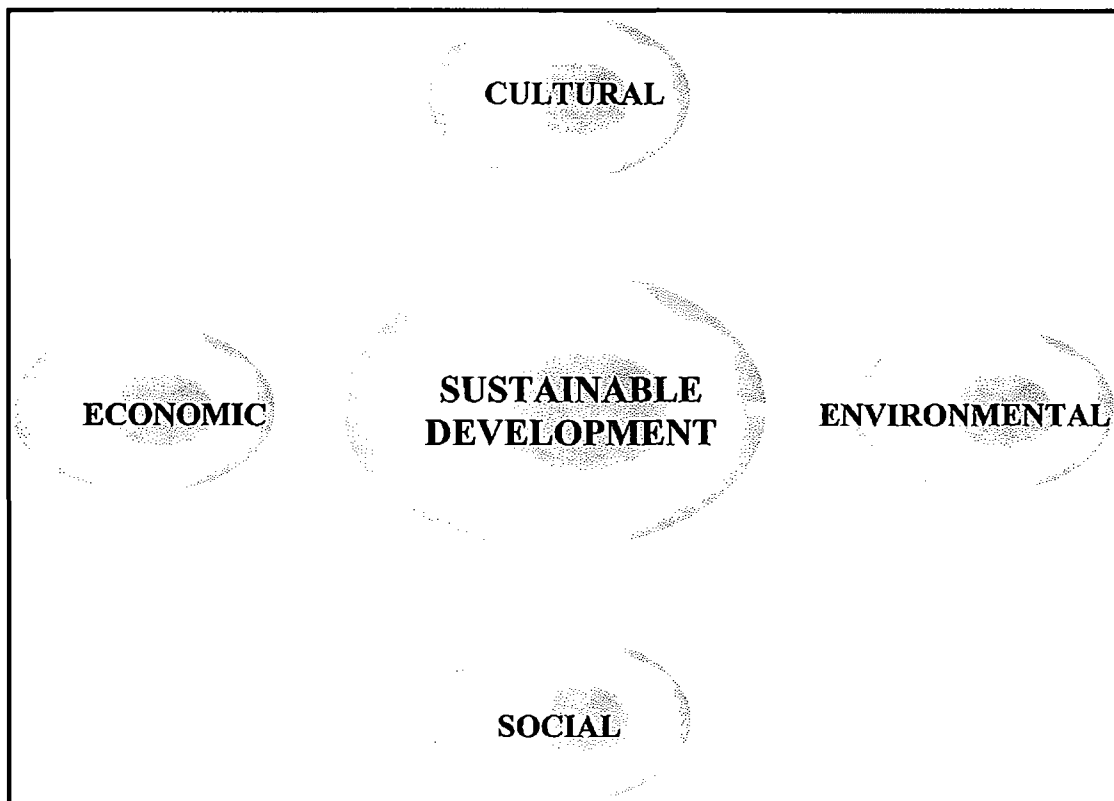


Figure 5.3: The Balanced Bottom Line Framework (Developed from Source: Venter, J.B. & Ferreira, A. in conjunction with Traditionalist Khomani San proponents – Oom Jan & Deon)

The practice of the Balanced Bottom Line Framework is set up to develop initiatives that make use of the four stipulated sustainable development categories. Initiatives are

devised separate of each other according to the sustainability categories. A variety of initiatives are developed using the above framework. Each category should have approximately eight prospective initiatives. Once the amount of possible initiatives per category is exhausted, alignment between category initiatives can be sought in order to discover preference. The more an initiative can be aligned between categories the more preferable it would be. A minimum of two categories need to be aligned in order for an initiative to be accepted. This alignment of similar initiatives forms an integrated grid of specific, combined initiatives. This would have the aspect of ensuring that each initiative is developed from a diverse base and not dependent on one category for success, apart from being financially viable.

5.4. RECOMMENDATIONS FOR OTHER MINING COMPANIES

There is growing movement to perpetuate sustained operation within systems (economic, organisational, ecological and individual) through diversity, stimulated and supported through decentralised actions, as opposed to relying on rigid structures. Shifts in strategic focus are brought about through a variety of planning and design tools, needing to be driven by value shifts. Industrial ecology initiatives offer integrated methodologies for integrating strategic focus with operational actions. Approaches adapted from Nakajima & Vanderburg's (2005) hierarchy of initiatives offer useable directions. The focus is to begin using planning and design functions to develop synergies with strategic partners, such as directly affected local communities. The development of a Balanced Bottom Line framework seeks to provide a methodology for achieving a more integrated, relevant sustainable development strategy. This involves looking at sustainable development in terms of context as opposed to attempting to remove these inherent differences. Development needs to be acknowledged as an evolving phenomenon that is driven from within as opposed to stipulated from without. As such mining companies can begin to develop diverse business strategies and units by working synergistically with local communities. Once the mining ceases, a healthy local economy has been developed and is able to sustain itself through the aide of the mining companies' investments in feasible initiatives.

Using Gold Fields as an illustrative example (*Figure 5.4*):

- ♦ Financial Initiative: Financial and Administrative Services for farming co-ops.
- ♦ Social Initiative: Development of Agricultural College.
- ♦ Environmental Initiative: Setup of an indigenous plants nursery.
- ♦ Cultural Initiative: Development of a Natural Science and History museum.

Initiatives that are closely aligned would be promoted as priority, and hence promoting the development of an Agri College and providing Financial and Administrative Services into a unifying project. The most preferable initiative is the development of an informal Agriculture College (*Figure 5.4*) which could develop small scale farmer capacity. It could also serve the function of providing financial and administrative services for the developing co-ops. The initiative would build capacity through diverse skill sets within the community.

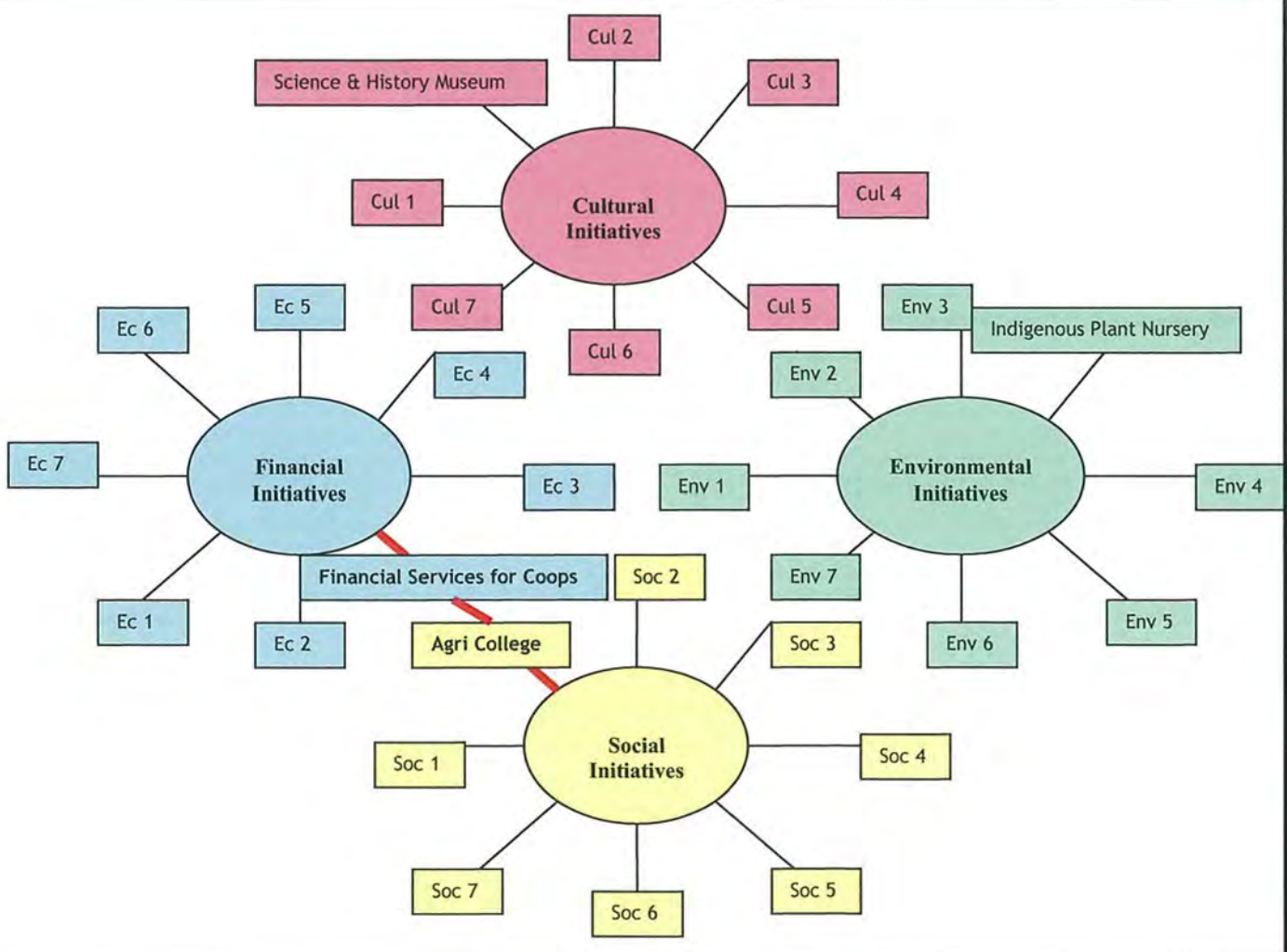


Figure 5.4: Illustrative example: planning for Balanced Bottom Line sustainability, alignment of initiatives - economic and social development

These types of strategies tend to bring about adaptable systems which look to stimulate resilience and flexibility as indicators of ultimate health. The process of life is a cyclical one, where any system will tend to exhibit these natural laws across different temporal and/ or spatial scales. The regenerative quality of life is the aspect that keeps life evolving to suit conditions conducive to the perpetuation of life on this planet. It makes sense to mimic natural laws as they have successfully ensured the constant evolution and success of life on Earth for millennia.

5.5. FUTURE RESEARCH QUESTIONS

Future research questions emerged throughout the process of the dissertation. They began to emerge as to how long lasting and relevant sustainability will be achieved, especially in the South African context:

1. What aspect of human social existence indicates a difference in different environments?
2. What part does culture play in determining utility and value of resources?
3. What information best suits a local context?
4. How many levels of community inclusion would develop the best strategies?
5. Who would decide on suitability of initiatives?

Interestingly many of the questions were centred on public participation in the management sphere of the organisation. This might always be a difficult question to answer, yet there are social entrepreneurship ventures that may be able to shed some light on this.

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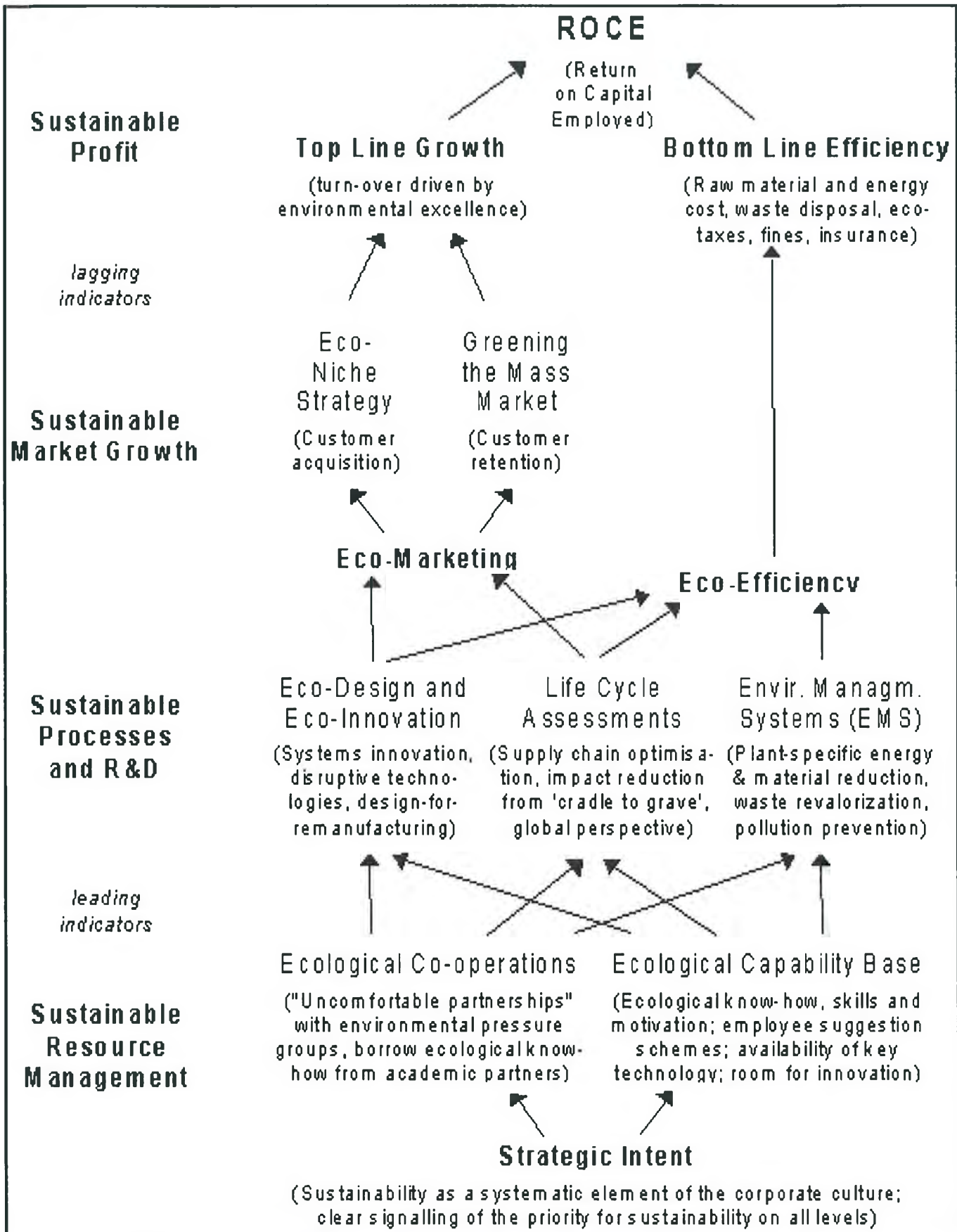
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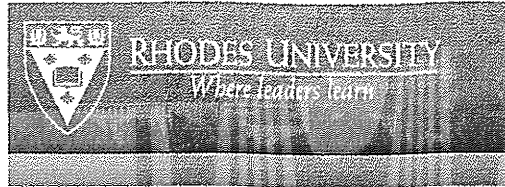
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ILLUSTRATIVE EXAMPLE: SUSTAINABILITY BALANCED SCORECARD



Source: Zingales, F., Hockerts, K., 2001. Centre for the Management of Environmental and Social Responsibility, Available: <http://www.insead.edu/CMER/research/strategy/sbsc.htm>



CASE STUDY QUESTIONNAIRE FOR UNDERSTANDING THE CONTEXTUAL IMPLICATIONS OF SUSTAINABLE DEVELOPMENT AT GOLDFIELDS

Researcher: Adrian Ferreira

Qualification: Towards MBA (Environmental) Short Thesis

Contact Details: Phone - 083 300 2196
Email - middlepath@webmail.co.za

Background

I am doing a research project for my MBA (Env) thesis through Rhodes University Investec Business School. I am doing a case study of Goldfields and their sustainable development programme and philosophies.

I am specifically looking at their context specific adaptations to sustainability by assessing the level of inclusion of the affected communities' cultural values and norms in decision making. This would involve looking at the life cycle of mining at the different strategies and impacts employed at these different phases.

Your answers and opinions will be held in the strictest confidence and only serve to help develop the thesis. I will use your answers as a means to help gain a fuller understanding of the issues, concerns and challenges facing the concepts of sustainability and sustainable development.

The interview and questionnaire should not take longer than 30 minutes, and I will provide you a copy of the questions to be asked.

Please note that all answers will be considered confidential so please answer all questions as honestly as possible.

Section 1: General and background information

1.1 Name (optional): _____

1.2 Surname (optional): _____

1.3 Date: _____

1.5 Age Group:

14-22	23-36	37-48	49-60	60 ->
-------	-------	-------	-------	-------

1.6 Sex:

Male	Female
------	--------

1.7 Home Language: _____

1.8 Education (state highest level attained): _____

1.9 Do you belong to any environmental groups / clubs / bodies?

Yes	No
-----	----

APPENDIX B

1.10 If yes, describe briefly what these are. _____

1.11 Which organisation do you work for? _____

1.12 How long have you worked there? _____

1.13 What position do you hold? _____

1.14 What is your main responsibility in your day? _____

1.15 What are your other core responsibilities in your day? _____

1.16 In which way is the job you perform important to you ?

Income	Achievement	Interest
--------	-------------	----------

Other: _____

1.17 What is your understanding of the word "environment"? _____

1.18 What activities do you do that involve a direct link with the environment? _____

1.19 How do you view the environment as part of your daily job (tasks) and life? _____

Section 2: Understanding of Sustainability

2.1 What is your understanding of the term "sustainability"? _____

2.2 What sort of information or training have you received about sustainability (environmental, social, financial) as a result of your interaction with Goldfields? _____

APPENDIX B

2.3 How do you relate these understandings with your daily tasks? _____

2.4 How do you feel the mine behaves according to your understanding of sustainability? _____

2.5 What are the financial benefits that the company has brought to your life? _____

2.6 Do you feel the company has caused a financial burden to you? _____

2.7 How has the company benefited you and your society? _____

2.8 In which way has the company cost you and your society? _____

2.9 How do you feel the company has benefited the environment? _____

2.10 How do you feel the actions of the company may have damaged the environment? _____

2.11 How do you feel the company has benefited this area? _____

2.12 How do you feel the company has damaged this area? _____

2.13 How do you feel the company has benefited you culturally? _____

2.14 In which ways has interacting with the company gone against your beliefs? _____

Section 3: Life Cycle of the Mine

3.1 How long do you envision this mine operating for? _____

3.2 Do you see the mine as part of your future?

Yes	No	Unsure
-----	----	--------

3.3 Do you feel the mine has a responsibility to you?

Yes	No	Unsure
-----	----	--------

3.4 If yes, what do you feel those responsibilities are? _____

3.5 Do you feel the mine has a responsibility to this area?

Yes	No	Unsure
-----	----	--------

3.6 If yes, what do you feel those responsibilities are? _____

3.7 Do you feel the mine is dependent on the environment?

Yes	No	Unsure
-----	----	--------

3.8 If yes, do you feel the company compensates adequately for its dependence on the environment?

3.9 Do you feel the mine is dependent on your community?

Yes	No	Unsure
-----	----	--------

3.10 If yes, do you feel the company compensates adequately for its dependence on the community?

3.11 Do you think the mine operates in a way that values the area?

Yes	No	Unsure
-----	----	--------

3.12 Give reasons for your answer. _____

3.13 Do you think the environment is coping with the mines operations?

Yes	No	Unsure

3.14 Give reasons for your answer. _____

3.11 What is your future vision for the mine and company? _____

3.12 What is your future vision for the community? _____

APPENDIX B

3.14 What would you like the company to provide for whilst the mine is still in operation? _____

3.14 What would you like the company to provide for once the mine closes? _____

3.15 Do you approve of the way the mine and company operate / behave?

Yes	No	Unsure
-----	----	--------

3.16 Give reasons for your answer. _____

3.17 Do you feel it could improve its operations / behaviour?

Yes	No	Unsure
-----	----	--------

3.18 Give reasons for your answer. _____

3.19 Is there anything else you would like to express about the mine and company? _____

Section 4: Sustainability Criteria (Considerations)

In this following section I would like to discover what are important considerations that the company takes into account in its decision making and / or its operations. This may involve part of your job and may involve your own opinions. I will ask you to rank your answers from 1 (being very low) to 5 (being very high) and then ask you for your reason as to why to rate it so.

To what extent are the following criteria important in decision-making by the company?

Financial

F4.1 Economic value added to the company and community

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.2 Why? _____

F4.3 Capital costs and outlay

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.4 Why? _____

APPENDIX B

F4.5 Operational & management costs

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.6 Why? _____

F4.7 Waste disposal costs

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.8 Why? _____

F4.9 Safety costs for decommissioning

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.10 Why? _____

F4.11 Rehabilitation costs for decommissioning

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.12 Why? _____

F4.13 Infrastructure investments

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.14 Why? _____

F4.15 Financial costs and benefits of operations

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

F4.16 Why? _____

Social

S4.1 Direct Employment

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.2 Why? _____

S4.3 Indirect Employment

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.4 Why? _____

APPENDIX B

S4.5 Health & Safety

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.6 Why? _____

S4.7 Social perception of operations (mining)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.8 Why? _____

S4.9 Education & Training opportunities

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.10 Why? _____

S4.11 Effect on social structures

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.12 Why? _____

S4.13 Mitigation measures for reduction of impacts on communities

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.14 Why? _____

S4.15 Prevention of corruption practices (Transparency)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.16 Why? _____

S4.17 Public participation in major impact management decisions

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.18 Why? _____

S4.19 Employee training & empowerment programmes

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.20 Why? _____

APPENDIX B

S4.21 Complaints filed by communities against company (Human Rights abuse)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.22 Why? _____

S4.23 Empowerment programmes & skills transfer (career planning)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

S4.24 Why? _____

Environmental

E4.1 Direct energy consumption (renewables, efficiencies, conservation)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.2 Why? _____

E4.3 Water use

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.4 Why? _____

E4.5 Land use

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.6 Why? _____

E4.7 Waste generation (quality & quantity)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.8 Why? _____

E4.9 Mitigation measures for environmental impacts

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.10 Why? _____

E4.11 Effect on biodiversity

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.12 Why? _____

APPENDIX B

E4.13 Impacts and mitigations regarding biodiversity

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.14 Why? _____

E4.15 Greenhouse gas emissions and global warming potential

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.16 Why? _____

E4.17 Pollution impact (bioaccumulation etc)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.18 Why? _____

E4.19 Toxicity of waste and discharge (effluent)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.20 Why? _____

E4.21 Natural resource depletion / use

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.22 Why? _____

E4.23 Recycling capacity and choices

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

E4.24 Why? _____

Other (Cultural, Contextual, General)

C4.1 Effect on cultural heritage

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.2 Why? _____

C4.3 Flexibility and adaptability of community

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.4 Why? _____

APPENDIX B

C4.5 Reliance on labour

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.6 Why? _____

C4.7 Assimilative capacity of area

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.8 Why? _____

C4.9 Length of impact on area

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.10 Why? _____

C4.11 Operations in sensitive areas

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.12 Why? _____

C4.13 Spending proportion on local suppliers (procurement)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.14 Why? _____

C4.17 Proportion of locally hired employees (all levels)

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.18 Why? _____

C4.19 Understanding of major community structures and hierarchy

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.20 Why? _____

C4.21 Incidents of violations of free movement, child labour, forced labour

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.22 Why? _____

APPENDIX B

C4.23 Incidents involving infringements of rights of indigenous people

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.24 Why? _____

C4.25 Incorporation of indigenous knowledge into operations

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.26 Why? _____

C4.27 Identification and protection of cultural, spiritual and religious areas, sites and traditions

1 v.low	2 low	3 med	4 high	5 v.high
---------	-------	-------	--------	----------

C4.28 Why? _____

LAST If there is anything else that you would like to mention before we finish this process please feel free to do so now.: _____

I would like to thank you very much for your time and effort throughout this interview process. Everyone of your answers are extremely valuable to this process and I greatly appreciate your honesty and time.

I, Adrian Ferreira _____, acknowledge that this interview has been given in strict confidence and honour the faith with which all the responses were given in. I will only use these answers and responses to help gain a fuller understanding of the above stated objectives and give my commitment to honour all participants.

Date: _____ Place: _____

Interviewee signature: _____

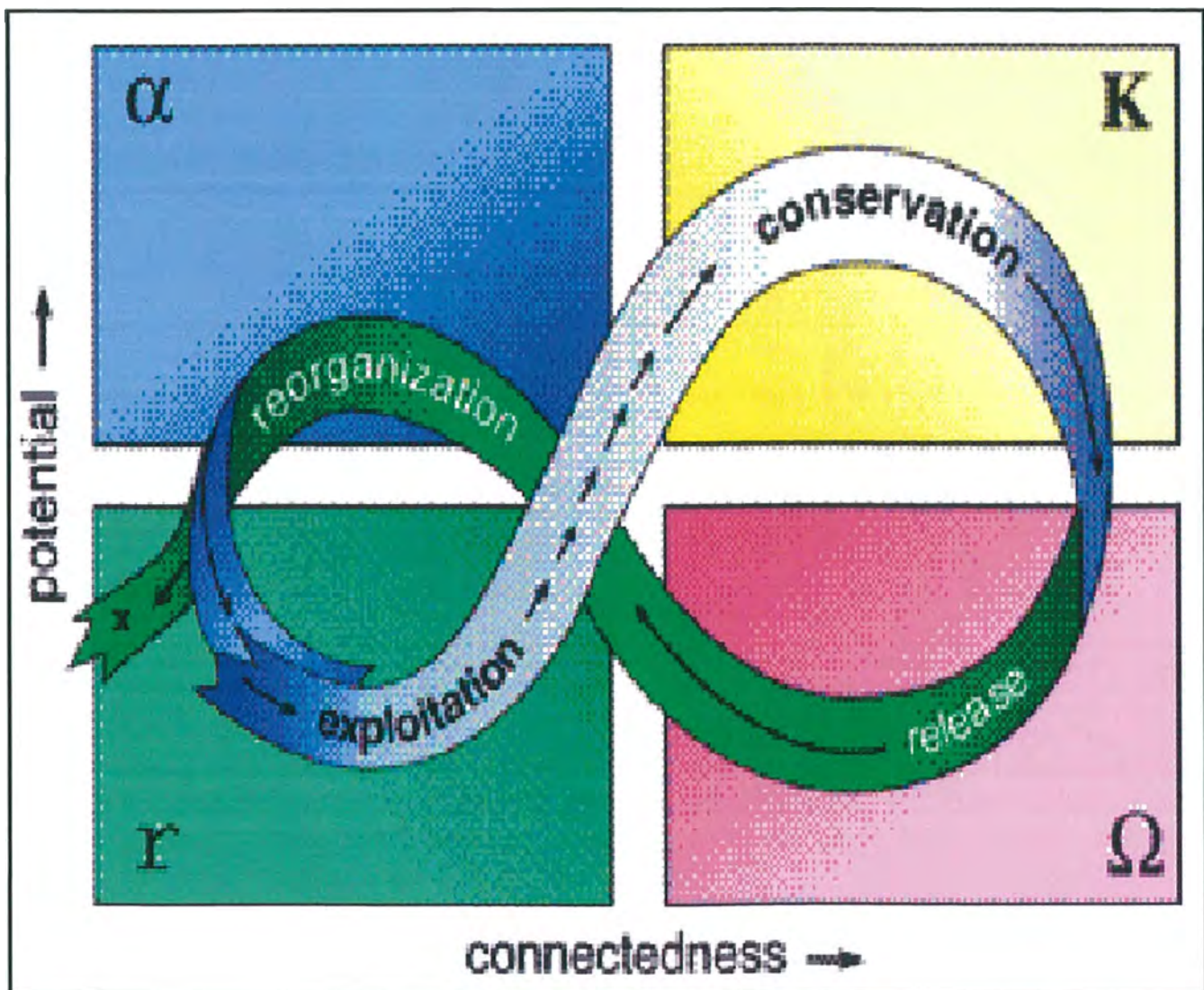
[For MBA (Env) half-thesis; A. Ferreira 2006; Rhodes University Investec Business School 2004 MBA Class]

THE RESILIENCE MODEL - ADAPTIVE MANAGEMENT CYCLE

The Adaptive Cycle, as it proceeds through the four phases:

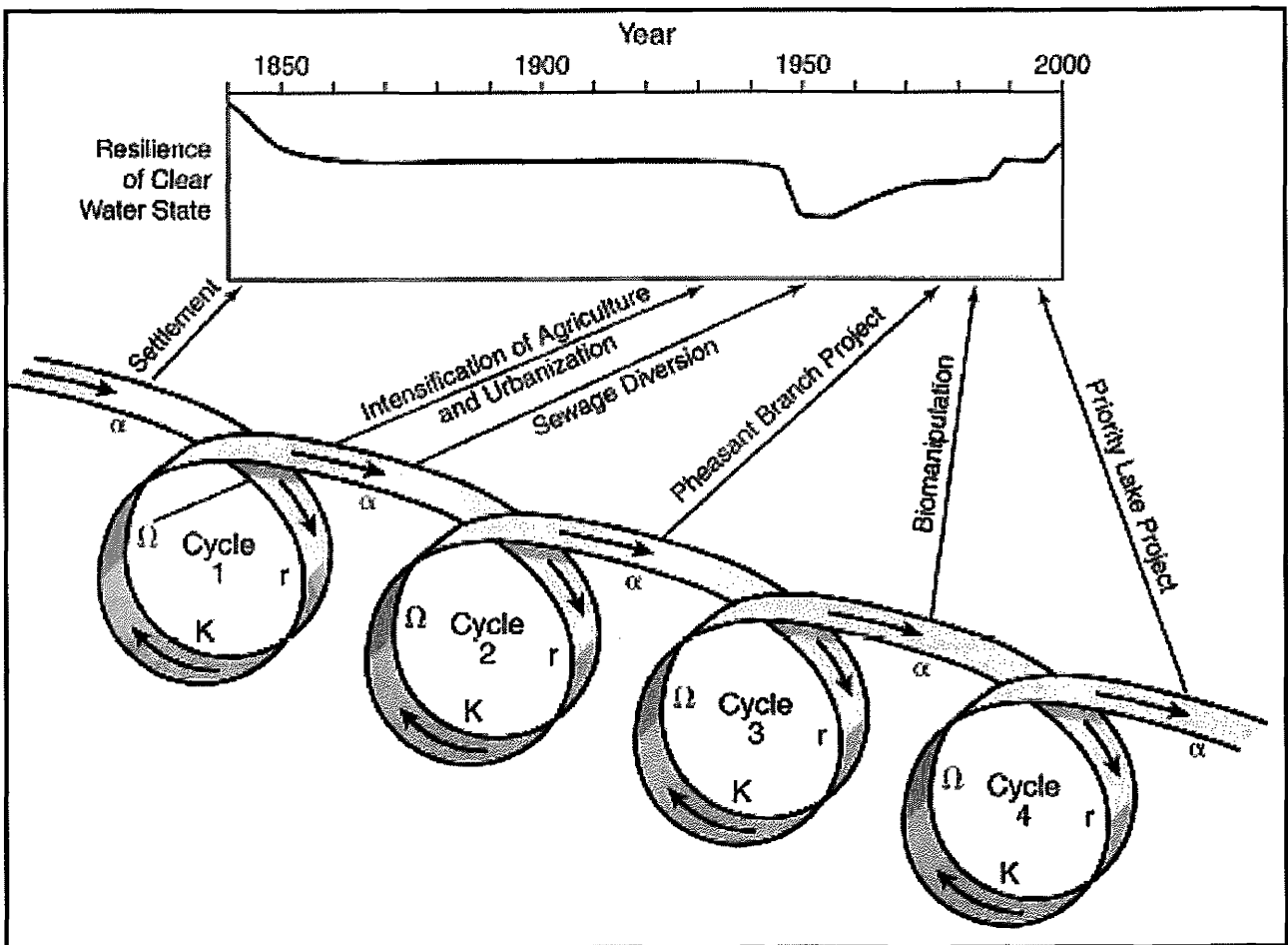
1. **r** = **Exploitation** (organization into a new system),
2. **K** = **Conservation** (maintenance and proliferation of the new system),
3. **Ω** = **Release** (revolution), and
4. **α** = **Reorganization** (regime change/a new paradigm).

The system reaches its highest potential and connectedness at the end of the conservation phase.



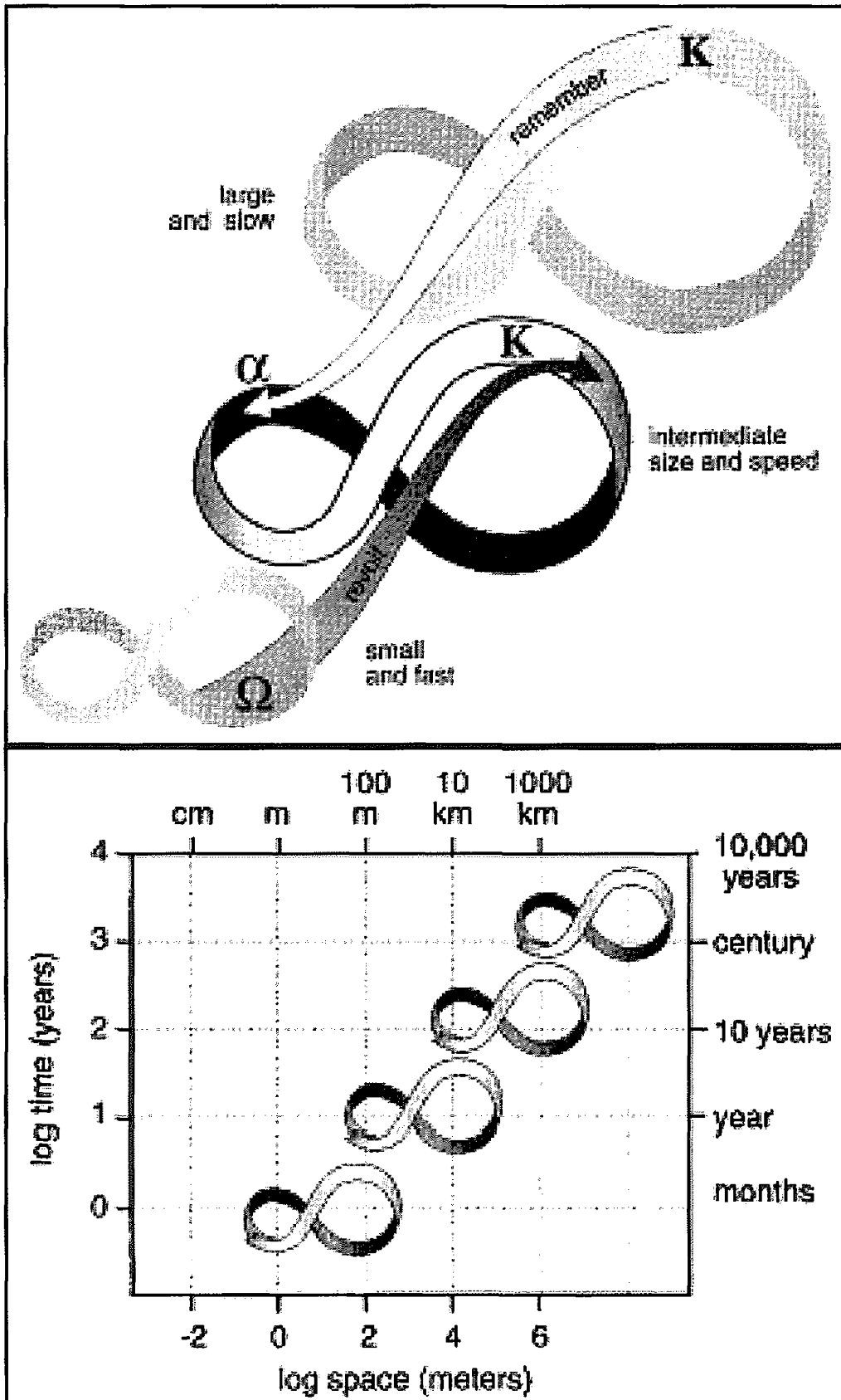
ILLUSTRATIVE EXAMPLE: ADAPTIVE MANAGEMENT CYCLES

The diagram has been extracted from the source and used to illustrate an example of the continual flow of an Adaptive Management cycle. This examples relates to the management of Lake Mendota (Wisconsin, USA) used by the Source authors for their article.



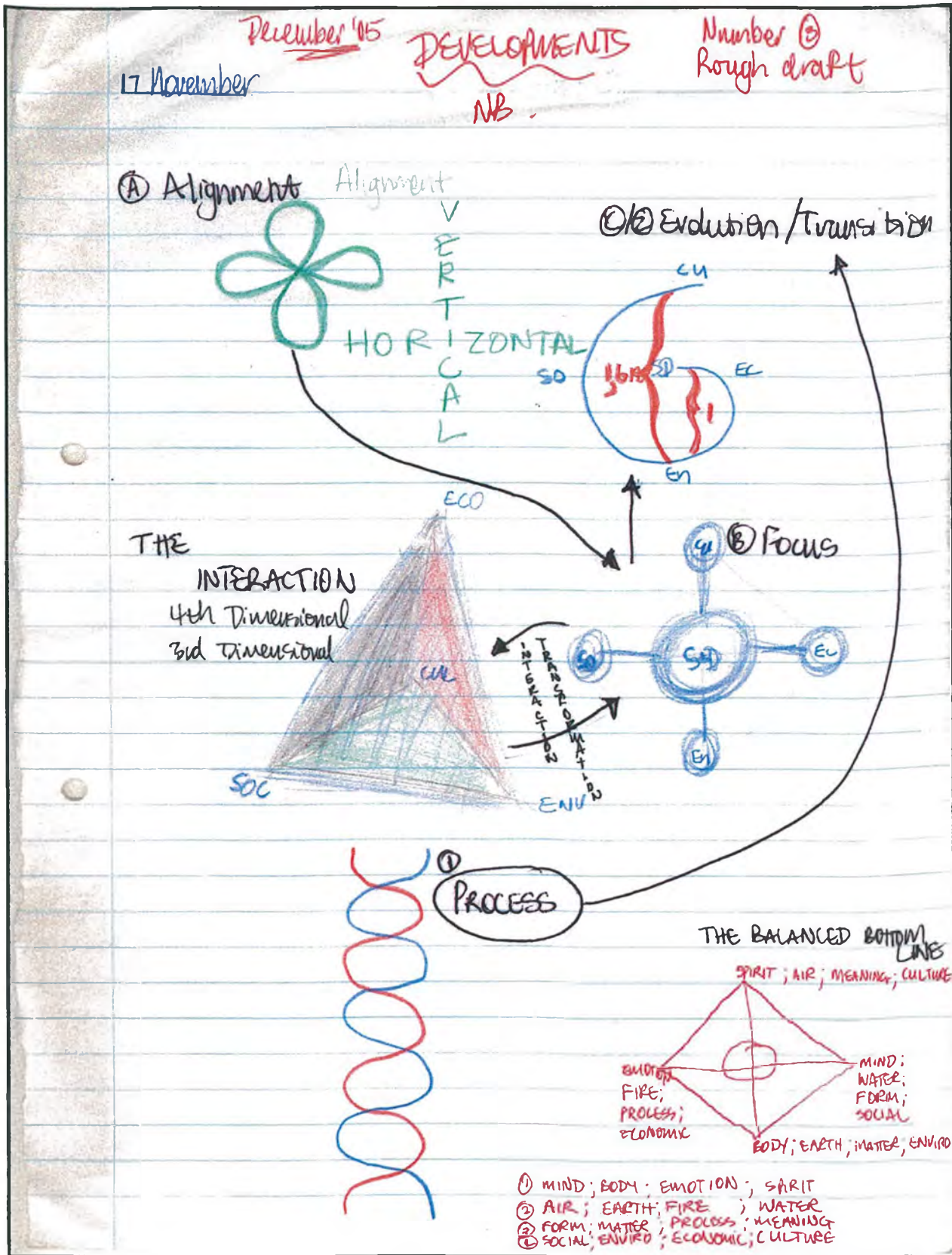
Source: Carpenter, S., Walker, B., Anderies, J.M. & Abel, N., 2001. "From Metaphor To Measurement: Resilience Of What To What?". *Ecosystems*. 4(2001), Pp. 765-781.

ADAPTIVE SCALES (TEMPORAL & SPATIAL)

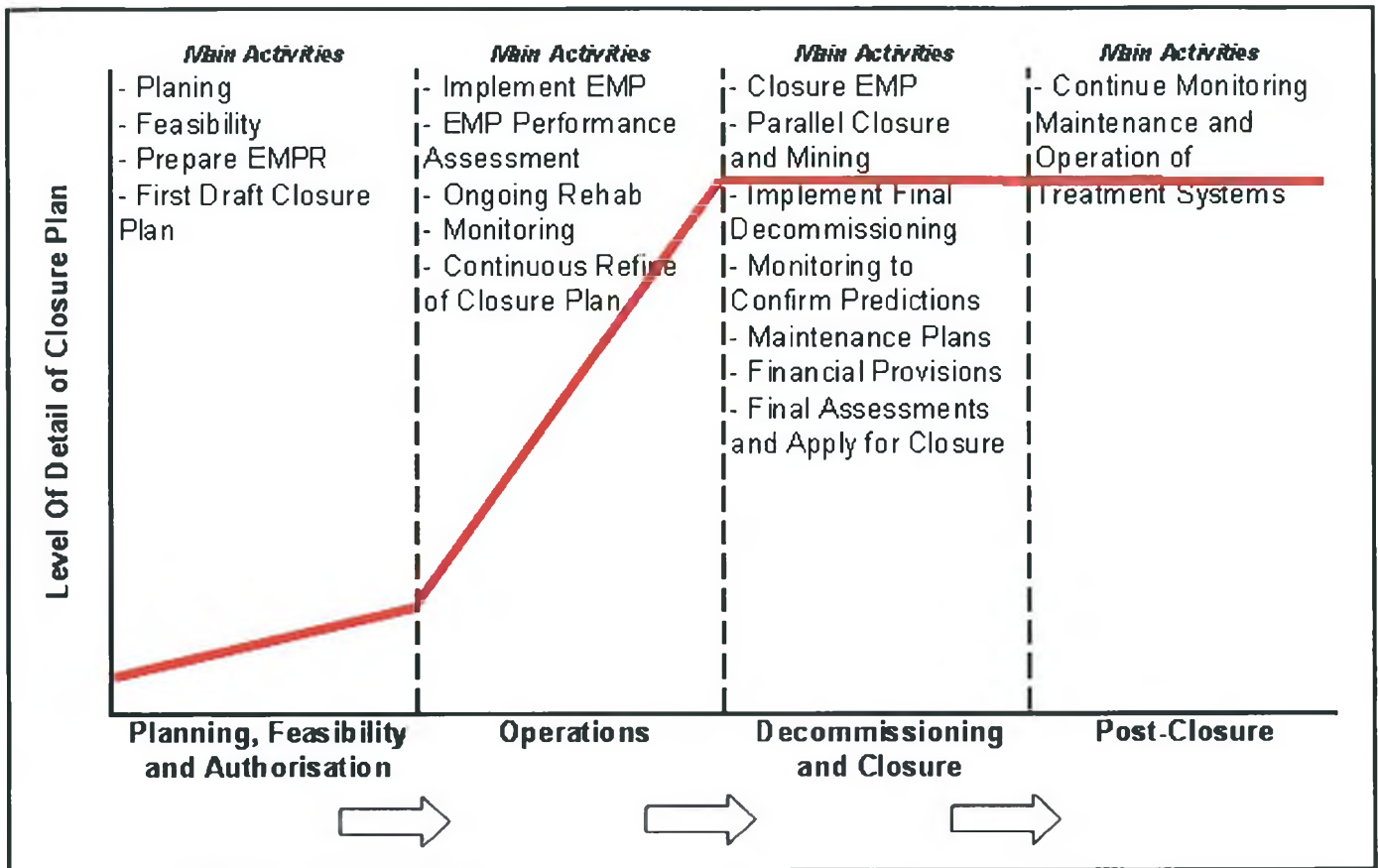


Source: HOLLING, C.S., 2001. "Understanding the Complexity of Economic, Ecological and Social Systems". *Ecosystems*. 4(2000).

THE VISUAL PROGRESSION OF THE THINKING FOR THE DISSERTATION



LIFE CYCLE OF A MINE: A PROPOSED CLOSURE SCHEDULE



APPENDIX H

GOLD FIELDS QUESTIONNAIRE FEEDBACK: RESPONDENT – RN		
No.	Criteria	Score
Financial		34
F4.1	Economic value added	5
F4.3	Capital costs	5
F4.5	Operational & management costs	5
F4.7	Waste disposal costs	3
F4.9	Safety costs for decommissioning	3
F4.11	Rehabilitation costs for decommissioning	4
F4.13	Infrastructure investments	4
F4.15	Financial costs and benefits of operations	5
Social		40
S4.1	Direct Employment	4
S4.3	Indirect Employment	3
S4.5	Health & Safety	4
S4.7	Social Perception of Mining	2
S4.9	Education & Training	3
S4.11	Social Structures Impact	3
S4.13	Mitigation of Community Impact	2
S4.15	Prevention of Corruption	3
S4.17	Public Participation	4
S4.19	Training & Empowerment	4
S4.21	Human Rights Abuse	4
S4.23	Skills Transfer	4
Environmental		35
E4.1	Direct energy consumption	4
E4.3	Water use	4
E4.5	Land use	4
E4.7	Waste generation	3
E4.9	Mitigation of Environmental Impacts	4
E4.11	Effect on Biodiversity	2
E4.13	Impacts on Biodiversity	3
E4.15	Greenhouse Gas Emissions	2
E4.17	Pollution Impact	2
E4.19	Toxicity of Waste	3
E4.21	Natural Resource Depletion	2
E4.23	Recycling Capacity	2
Cultural (Techno-Cultural, Contextual)		40
C4.1	Cultural Heritage	4
C4.3	Flexibility & Adaptability	3
C4.5	Reliance on Labour	3
C4.7	Assimilative Capacity of Area	2
C4.9	Length of Impact	2
C4.11	Sensitive Area Operation	3
C4.13	Spending on Local Suppliers	2
C4.17	Locally Hired Employees	3
C4.19	Understanding of Community	3
C4.21	Incidents of Human Rights Violations	4
C4.23	Rights of Indigenous People	3
C4.25	Indigenous Knowledge in Operations	4
C4.27	Protection of Cultural Sites & Traditions	4

APPENDIX I

GOLD FIELDS QUESTIONNAIRE FEEDBACK: RESPONDENT – PW		
No.	Criteria	Score
Financial		37
F4.1	Economic value added	5
F4.3	Capital costs	5
F4.5	Operational & management costs	5
F4.7	Waste disposal costs	3
F4.9	Safety costs for decommissioning	5
F4.11	Rehabilitation costs for decommissioning	5
F4.13	Infrastructure investments	4
F4.15	Financial costs and benefits of operations	5
Social		55
S4.1	Direct Employment	5
S4.3	Indirect Employment	4
S4.5	Health & Safety	5
S4.7	Social Perception of Mining	4
S4.9	Education & Training	5
S4.11	Social Structures Impact	4
S4.13	Mitigation of Community Impact	4
S4.15	Prevention of Corruption	5
S4.17	Public Participation	5
S4.19	Training & Empowerment	4
S4.21	Human Rights Abuse	5
S4.23	Skills Transfer	5
Environmental		54
E4.1	Direct energy consumption	4
E4.3	Water use	5
E4.5	Land use	4
E4.7	Waste generation	5
E4.9	Mitigation of Environmental Impacts	5
E4.11	Effect on Biodiversity	4
E4.13	Impacts on Biodiversity	4
E4.15	Greenhouse Gas Emissions	5
E4.17	Pollution Impact	4
E4.19	Toxicity of Waste	4
E4.21	Natural Resource Depletion	5
E4.23	Recycling Capacity	5
Cultural (Techno-Cultural, Contextual)		60
C4.1	Cultural Heritage	5
C4.3	Flexibility & Adaptability	4
C4.5	Reliance on Labour	4
C4.7	Assimilative Capacity of Area	4
C4.9	Length of Impact	4
C4.11	Sensitive Area Operation	5
C4.13	Spending on Local Suppliers	5
C4.17	Locally Hired Employees	5
C4.19	Understanding of Community	5
C4.21	Incidents of Human Rights Violations	5
C4.23	Rights of Indigenous People	5
C4.25	Indigenous Knowledge in Operations	4
C4.27	Protection of Cultural Sites & Traditions	5

APPENDIX J

GOLD FIELDS QUESTIONNAIRE FEEDBACK: RESPONDENT – MB		
No.	Criteria	Score
Financial		33
F4.1	Economic value added	5
F4.3	Capital costs	2
F4.5	Operational & management costs	2
F4.7	Waste disposal costs	5
F4.9	Safety costs for decommissioning	5
F4.11	Rehabilitation costs for decommissioning	5
F4.13	Infrastructure investments	4
F4.15	Financial costs and benefits of operations	5
Social		52
S4.1	Direct Employment	5
S4.3	Indirect Employment	5
S4.5	Health & Safety	5
S4.7	Social Perception of Mining	4
S4.9	Education & Training	5
S4.11	Social Structures Impact	4
S4.13	Mitigation of Community Impact	4
S4.15	Prevention of Corruption	5
S4.17	Public Participation	4
S4.19	Training & Empowerment	4
S4.21	Human Rights Abuse	2
S4.23	Skills Transfer	5
Environmental		52
E4.1	Direct energy consumption	5
E4.3	Water use	5
E4.5	Land use	3
E4.7	Waste generation	5
E4.9	Mitigation of Environmental Impacts	5
E4.11	Effect on Biodiversity	2
E4.13	Impacts on Biodiversity	4
E4.15	Greenhouse Gas Emissions	5
E4.17	Pollution Impact	5
E4.19	Toxicity of Waste	4
E4.21	Natural Resource Depletion	4
E4.23	Recycling Capacity	5
Cultural (Techno-Cultural, Contextual)		51
C4.1	Cultural Heritage	4
C4.3	Flexibility & Adaptability	3
C4.5	Reliance on Labour	4
C4.7	Assimilative Capacity of Area	3
C4.9	Length of Impact	4
C4.11	Sensitive Area Operation	4
C4.13	Spending on Local Suppliers	5
C4.17	Locally Hired Employees	3
C4.19	Understanding of Community	5
C4.21	Incidents of Human Rights Violations	4
C4.23	Rights of Indigenous People	4
C4.25	Indigenous Knowledge in Operations	3
C4.27	Protection of Cultural Sites & Traditions	5

APPENDIX K

LIVING GOLD QUESTIONNAIRE FEEDBACK: RESPONDENT – PM		
No.	Criteria	Score
<i>Financial</i>		35
F4.1	Economic value added	5
F4.3	Capital costs	4
F4.5	Operational & management costs	5
F4.7	Waste disposal costs	4
F4.9	Safety costs for decommissioning	3
F4.11	Rehabilitation costs for decommissioning	4
F4.13	Infrastructure investments	5
F4.15	Financial costs and benefits of operations	5
<i>Social</i>		51
S4.1	Direct Employment	5
S4.3	Indirect Employment	2
S4.5	Health & Safety	5
S4.7	Social Perception of Mining	4
S4.9	Education & Training	4
S4.11	Social Structures Impact	3
S4.13	Mitigation of Community Impact	4
S4.15	Prevention of Corruption	5
S4.17	Public Participation	5
S4.19	Training & Empowerment	5
S4.21	Human Rights Abuse	4
S4.23	Skills Transfer	5
<i>Environmental</i>		44
E4.1	Direct energy consumption	4
E4.3	Water use	4
E4.5	Land use	5
E4.7	Waste generation	3
E4.9	Mitigation of Environmental Impacts	4
E4.11	Effect on Biodiversity	2
E4.13	Impacts on Biodiversity	2
E4.15	Greenhouse Gas Emissions	4
E4.17	Pollution Impact	3
E4.19	Toxicity of Waste	3
E4.21	Natural Resource Depletion	5
E4.23	Recycling Capacity	5
<i>Cultural (Techno-Cultural, Contextual)</i>		58
C4.1	Cultural Heritage	4
C4.3	Flexibility & Adaptability	5
C4.5	Reliance on Labour	5
C4.7	Assimilative Capacity of Area	4
C4.9	Length of Impact	5
C4.11	Sensitive Area Operation	5
C4.13	Spending on Local Suppliers	4
C4.17	Locally Hired Employees	5
C4.19	Understanding of Community	5
C4.21	Incidents of Human Rights Violations	5
C4.23	Rights of Indigenous People	5
C4.25	Indigenous Knowledge in Operations	5
C4.27	Protection of Cultural Sites & Traditions	1

APPENDIX L

LIVING GOLD QUESTIONNAIRE FEEDBACK: RESPONDENT – MM		
No.	Criteria	Score
<i>Financial</i>		28
F4.1	Economic value added	5
F4.3	Capital costs	4
F4.5	Operational & management costs	4
F4.7	Waste disposal costs	2
F4.9	Safety costs for decommissioning	5
F4.11	Rehabilitation costs for decommissioning	2
F4.13	Infrastructure investments	1
F4.15	Financial costs and benefits of operations	5
<i>Social</i>		50
S4.1	Direct Employment	5
S4.3	Indirect Employment	5
S4.5	Health & Safety	5
S4.7	Social Perception of Mining	3
S4.9	Education & Training	5
S4.11	Social Structures Impact	4
S4.13	Mitigation of Community Impact	2
S4.15	Prevention of Corruption	5
S4.17	Public Participation	2
S4.19	Training & Empowerment	5
S4.21	Human Rights Abuse	5
S4.23	Skills Transfer	4
<i>Environmental</i>		50
E4.1	Direct energy consumption	4
E4.3	Water use	5
E4.5	Land use	5
E4.7	Waste generation	4
E4.9	Mitigation of Environmental Impacts	4
E4.11	Effect on Biodiversity	4
E4.13	Impacts on Biodiversity	4
E4.15	Greenhouse Gas Emissions	3
E4.17	Pollution Impact	3
E4.19	Toxicity of Waste	5
E4.21	Natural Resource Depletion	4
E4.23	Recycling Capacity	5
<i>Cultural (Techno-Cultural, Contextual)</i>		45
C4.1	Cultural Heritage	1
C4.3	Flexibility & Adaptability	3
C4.5	Reliance on Labour	5
C4.7	Assimilative Capacity of Area	3
C4.9	Length of Impact	5
C4.11	Sensitive Area Operation	3
C4.13	Spending on Local Suppliers	5
C4.17	Locally Hired Employees	5
C4.19	Understanding of Community	5
C4.21	Incidents of Human Rights Violations	1
C4.23	Rights of Indigenous People	1
C4.25	Indigenous Knowledge in Operations	4
C4.27	Protection of Cultural Sites & Traditions	4

APPENDIX M

LIVING GOLD QUESTIONNAIRE FEEDBACK: RESPONDENT – JM		
No.	Criteria	Score
Financial		37
F4.1	Economic value added	5
F4.3	Capital costs	5
F4.5	Operational & management costs	5
F4.7	Waste disposal costs	4
F4.9	Safety costs for decommissioning	3
F4.11	Rehabilitation costs for decommissioning	5
F4.13	Infrastructure investments	5
F4.15	Financial costs and benefits of operations	5
Social		57
S4.1	Direct Employment	5
S4.3	Indirect Employment	5
S4.5	Health & Safety	5
S4.7	Social Perception of Mining	4
S4.9	Education & Training	5
S4.11	Social Structures Impact	4
S4.13	Mitigation of Community Impact	5
S4.15	Prevention of Corruption	5
S4.17	Public Participation	5
S4.19	Training & Empowerment	5
S4.21	Human Rights Abuse	4
S4.23	Skills Transfer	5
Environmental		43
E4.1	Direct energy consumption	2
E4.3	Water use	4
E4.5	Land use	2
E4.7	Waste generation	3
E4.9	Mitigation of Environmental Impacts	4
E4.11	Effect on Biodiversity	5
E4.13	Impacts on Biodiversity	5
E4.15	Greenhouse Gas Emissions	2
E4.17	Pollution Impact	3
E4.19	Toxicity of Waste	3
E4.21	Natural Resource Depletion	5
E4.23	Recycling Capacity	5
Cultural (Techno-Cultural, Contextual)		59
C4.1	Cultural Heritage	4
C4.3	Flexibility & Adaptability	5
C4.5	Reliance on Labour	5
C4.7	Assimilative Capacity of Area	5
C4.9	Length of Impact	3
C4.11	Sensitive Area Operation	5
C4.13	Spending on Local Suppliers	4
C4.17	Locally Hired Employees	5
C4.19	Understanding of Community	5
C4.21	Incidents of Human Rights Violations	4
C4.23	Rights of Indigenous People	5
C4.25	Indigenous Knowledge in Operations	5
C4.27	Protection of Cultural Sites & Traditions	4

APPENDIX R

TABLES OF RESULTS

TABLE OF RESPONSES FROM INDIVIDUAL INTERVIEWEES (PER ORGANISATION)							
No.	Criteria	GOLD FIELDS			LIVING GOLD		
		RN	PW	MB	PM	MM	JM
Financial		34	37	33	35	28	37
F4.1	Economic value added	5	5	5	5	5	5
F4.3	Capital costs	5	5	2	4	4	5
F4.5	Operational & management costs	5	5	2	5	4	5
F4.7	Waste disposal costs	3	3	5	4	2	4
F4.9	Safety costs for decommissioning	3	5	5	3	5	3
F4.11	Rehabilitation costs for decommissioning	4	5	5	4	2	5
F4.13	Infrastructure investments	4	4	4	5	1	5
F4.15	Financial costs and benefits of operations	5	5	5	5	5	5
Social		40	55	52	51	50	57
S4.1	Direct Employment	4	5	5	5	5	5
S4.3	Indirect Employment	3	4	5	2	5	5
S4.5	Health & Safety	4	5	5	5	5	5
S4.7	Social Perception of Mining	2	4	4	4	3	4
S4.9	Education & Training	3	5	5	4	5	5
S4.11	Social Structures Impact	3	4	4	3	4	4
S4.13	Mitigation of Community Impact	2	4	4	4	2	5
S4.15	Prevention of Corruption	3	5	5	5	5	5
S4.17	Public Participation	4	5	4	5	2	5
S4.19	Training & Empowerment	4	4	4	5	5	5
S4.21	Human Rights Abuse	4	5	2	4	5	4
S4.23	Skills Transfer	4	5	5	5	4	5
Environmental		35	54	52	44	50	43
E4.1	Direct energy consumption	4	4	5	4	4	2
E4.3	Water use	4	5	5	4	5	4
E4.5	Land use	4	4	3	5	5	2
E4.7	Waste generation	3	5	5	3	4	3
E4.9	Mitigation of Environmental Impacts	4	5	5	4	4	4
E4.11	Effect on Biodiversity	2	4	2	2	4	5
E4.13	Impacts on Biodiversity	3	4	4	2	4	5
E4.15	Greenhouse Gas Emissions	2	5	5	4	3	2
E4.17	Pollution Impact	2	4	5	3	3	3
E4.19	Toxicity of Waste	3	4	4	3	5	3
E4.21	Natural Resource Depletion	2	5	4	5	4	5
E4.23	Recycling Capacity	2	5	5	5	5	5
Cultural (Techno-Cultural, Contextual)		40	60	51	58	45	59
C4.1	Cultural Heritage	4	5	4	4	1	4
C4.3	Flexibility & Adaptability	3	4	3	5	3	5
C4.5	Reliance on Labour	3	4	4	5	5	5
C4.7	Assimilative Capacity of Area	2	4	3	4	3	5
C4.9	Length of Impact	2	4	4	5	5	3
C4.11	Sensitive Area Operation	3	5	4	5	3	5
C4.13	Spending on Local Suppliers	2	5	5	4	5	4
C4.17	Locally Hired Employees	3	5	3	5	5	5
C4.19	Understanding of Community	3	5	5	5	5	5
C4.21	Incidents of Human Rights Violations	4	5	4	5	1	4
C4.23	Rights of Indigenous People	3	5	4	5	1	5
C4.25	Indigenous Knowledge in Operations	4	4	3	5	4	5
C4.27	Protection of Cultural Sites & Traditions	4	5	5	1	4	4

APPENDIX R

TABLE OF RESPONSES PER ORGANISATION MEAN, STANDARD DEVIATION AND VARIANCE

Criteria	GOLD FIELDS			LIVING GOLD			TOTAL		
	Mean	SD	Var	Mean	SD	Var	Mean	SD	Var
Financial	4.3			4.2			4.3		
Economic value added	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0
Capital costs	4.0	1.7	3.0	4.3	0.6	0.3	4.2	1.2	1.4
Operational & management costs	4.0	1.7	3.0	4.7	0.6	0.3	4.3	1.2	1.5
Waste disposal costs	3.7	1.2	1.3	3.3	1.2	1.3	3.5	1.0	1.1
Safety costs for decommissioning	4.3	1.2	1.3	3.7	1.2	1.3	4.0	1.1	1.2
Rehabilitation costs for decommissioning	4.7	0.6	0.3	3.7	1.5	2.3	4.2	1.2	1.4
Infrastructure investments	4.0	0.0	0.0	3.7	2.3	5.3	3.8	1.5	2.2
Financial costs and benefits of operations	5.0	0.0	0.0	5.0	0.0	0.0	5.0	0.0	0.0
Social	4.1			4.4			4.2		
Direct Employment	4.7	0.6	0.3	5.0	0.0	0.0	4.8	0.4	0.2
Indirect Employment	4.0	1.0	1.0	4.0	1.7	3.0	4.0	1.3	1.6
Health & Safety	4.7	0.6	0.3	5.0	0.0	0.0	4.8	0.4	0.2
Social Perception of Mining	3.3	1.2	1.3	3.7	0.6	0.3	3.5	0.8	0.7
Education & Training	4.3	1.2	1.3	4.7	0.6	0.3	4.5	0.8	0.7
Social Structures Impact	3.7	0.6	0.3	3.7	0.6	0.3	3.7	0.5	0.3
Mitigation of Community Impact	3.3	1.2	1.3	3.7	1.5	2.3	3.5	1.2	1.5
Prevention of Corruption	4.3	1.2	1.3	5.0	0.0	0.0	4.7	0.8	0.7
Public Participation	4.3	0.6	0.3	4.0	1.7	3.0	4.2	1.2	1.4
Training & Empowerment	4.0	0.0	0.0	5.0	0.0	0.0	4.5	0.5	0.3
Human Rights Abuse	3.7	1.5	2.3	4.3	0.6	0.3	4.0	1.1	1.2
Skills Transfer	4.7	0.6	0.3	4.7	0.6	0.3	4.7	0.5	0.3
Environmental	3.9			3.8			3.9		
Direct energy consumption	4.3	0.6	0.3	3.3	1.2	1.3	3.8	1.0	1.0
Water use	4.7	0.6	0.3	4.3	0.6	0.3	4.5	0.5	0.3
Land use	3.7	0.6	0.3	4.0	1.7	3.0	3.8	1.2	1.4
Waste generation	4.3	1.2	1.3	3.3	0.6	0.3	3.8	1.0	1.0
Mitigation of Environmental Impacts	4.7	0.6	0.3	4.0	0.0	0.0	4.3	0.5	0.3
Effect on Biodiversity	2.7	1.2	1.3	3.7	1.5	2.3	3.2	1.3	1.8
Impacts on Biodiversity	3.7	0.6	0.3	3.7	1.5	2.3	3.7	1.0	1.1
Greenhouse Gas Emissions	4.0	1.7	3.0	3.0	1.0	1.0	3.5	1.4	1.9
Pollution Impact	3.7	1.5	2.3	3.0	0.0	0.0	3.3	1.0	1.1
Toxicity of Waste	3.7	0.6	0.3	3.7	1.2	1.3	3.7	0.8	0.7
Natural Resource Depletion	3.7	1.5	2.3	4.7	0.6	0.3	4.2	1.2	1.4
Recycling Capacity	4.0	1.7	3.0	5.0	0.0	0.0	4.5	1.2	1.5
Cultural (Techno-Cultural, Contextual)	4.2			4.5			4.3		
Cultural Heritage	4.3	0.6	0.3	3.0	1.7	3.0	3.7	1.4	1.9
Flexibility & Adaptability	3.3	0.6	0.3	4.3	1.2	1.3	3.8	1.0	1.0
Reliance on Labour	3.7	0.6	0.3	5.0	0.0	0.0	4.3	0.8	0.7
Assimilative Capacity of Area	3.0	1.0	1.0	4.0	1.0	1.0	3.5	1.0	1.1
Length of Impact	3.3	1.2	1.3	4.3	1.2	1.3	3.8	1.2	1.4
Sensitive Area Operation	4.0	1.0	1.0	4.3	1.2	1.3	4.2	1.0	1.0
Spending on Local Suppliers	4.0	1.7	3.0	4.3	0.6	0.3	4.2	1.2	1.4
Locally Hired Employees	3.7	1.2	1.3	5.0	0.0	0.0	4.3	1.0	1.1
Understanding of Community	4.3	1.2	1.3	5.0	0.0	0.0	4.7	0.8	0.7
Incidents of Human Rights Violations	4.3	0.6	0.3	3.3	2.1	4.3	3.8	1.5	2.2
Rights of Indigenous People	4.0	1.0	1.0	3.7	2.3	5.3	3.8	1.6	2.6
Indigenous Knowledge in Operations	3.7	0.6	0.3	4.7	0.6	0.3	4.2	0.8	0.6
Protection of Cultural Sites & Traditions	4.7	0.6	0.3	3.0	1.7	3.0	3.8	1.5	2.2

APPENDIX R

TABLE OF RESPONSES ASSESSING DIFFERENCE IN MEAN SCORES

Criteria	GOLD FIELDS	LIVING GOLD	DIFFERENCE	in favour
	Mean	Mean	Mean	
Financial	4.3	4.2	0.2	GF
Economic value added	5.0	5.0	0.0	-
Capital costs	4.0	4.3	0.3	LG
Operational & management costs	4.0	4.7	0.7	LG
Waste disposal costs	3.7	3.3	0.3	GF
Safety costs for decommissioning	4.3	3.7	0.7	GF
Rehabilitation costs for decommissioning	4.7	3.7	1.0	GF
Infrastructure investments	4.0	3.7	0.3	GF
Financial costs and benefits of operations	5.0	5.0	0.0	-
Social	4.1	4.4	0.3	LG
Direct Employment	4.7	5.0	0.3	LG
Indirect Employment	4.0	4.0	0.0	-
Health & Safety	4.7	5.0	0.3	LG
Social Perception of Mining	3.3	3.7	0.3	LG
Education & Training	4.3	4.7	0.3	LG
Social Structures Impact	3.7	3.7	0.0	-
Mitigation of Community Impact	3.3	3.7	0.3	LG
Prevention of Corruption	4.3	5.0	0.7	LG
Public Participation	4.3	4.0	0.3	GF
Training & Empowerment	4.0	5.0	1.0	LG
Human Rights Abuse	3.7	4.3	0.7	LG
Skills Transfer	4.7	4.7	0.0	-
Environmental	3.9	3.8	0.1	GF
Direct energy consumption	4.3	3.3	1.0	GF
Water use	4.7	4.3	0.3	GF
Land use	3.7	4.0	0.3	LG
Waste generation	4.3	3.3	1.0	GF
Mitigation of Environmental Impacts	4.7	4.0	0.7	GF
Effect on Biodiversity	2.7	3.7	1.0	LG
Impacts on Biodiversity	3.7	3.7	0.0	-
Greenhouse Gas Emissions	4.0	3.0	1.0	GF
Pollution Impact	3.7	3.0	0.7	GF
Toxicity of Waste	3.7	3.7	0.0	-
Natural Resource Depletion	3.7	4.7	1.0	LG
Recycling Capacity	4.0	5.0	1.0	LG
Cultural (Techno-Cultural, Contextual)	4.2	4.5	0.3	LG
Cultural Heritage	4.3	3.0	1.3	GF
Flexibility & Adaptability	3.3	4.3	1.0	LG
Reliance on Labour	3.7	5.0	1.3	LG
Assimilative Capacity of Area	3.0	4.0	1.0	LG
Length of Impact	3.3	4.3	1.0	LG
Sensitive Area Operation	4.0	4.3	0.3	LG
Spending on Local Suppliers	4.0	4.3	0.3	LG
Locally Hired Employees	3.7	5.0	1.3	LG
Understanding of Community	4.3	5.0	0.7	LG
Incidents of Human Rights Violations	4.3	3.3	1.0	GF
Rights of Indigenous People	4.0	3.7	0.3	GF
Indigenous Knowledge in Operations	3.7	4.7	1.0	LG
Protection of Cultural Sites & Traditions	4.7	3.0	1.7	GF

