A MANAGEMENT ACCOUNTING STRATEGY FOR MINING REHABILITATION

by

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ABSTRACT

Traditional management accounting practices have not made adequate allowance for the allocation of environmental and rehabilitation expenditure. Environmental costs have been hidden and not separated from other overheads, because managements that embrace traditional values, beliefs and mindsets have regarded these costs as unimportant or unnecessary. The preferred method of evaluating input and gains has been in financial terms only, omitting non-financial indicators such as the physical evaluation of levels of pollutants in the air, water and soil. In South Africa legislation is increasingly being promulgated by central authorities with the object of preventing and combating pollution. This trend may result in enormous future financial environmental liabilities and control and failure costs if attention is not given timeously to preventive action.

The objective of this research is to develop a plan for the implementation of a comprehensive management accounting strategy for environmental and rehabilitation management in the mining industry. Apart from its significant contribution to the economy of the country, the mining industry also has an enormous negative environmental impact owing to pollution. This strategy was developed after a literature and empirical investigation of rehabilitation situations in South Africa, Africa and the leading developed countries, including Canada, the United Kingdom, and the United States of America. On the one hand rehabilitation management practices in the rest of Africa stem from a history and culture of inadequate environmental policies, accompanied by improper cost management approaches in both the short and the long term. The highly developed countries, on the other hand, have skills and technologies which have been developed as a result of a culture of awareness of continuous improvement and ecology management. These sets of information, when optimally combined, are indicative of the background culture to behaviour and decision-making.

Major strategies included in this management accounting plan are historical influences, a holistic approach, cost reduction policies, the role of authorities, total quality environmental management, research and development, ethics, the role of management, performance evaluation, reporting, feedback and continuous improvement. Since each individual mining enterprise has its own particular rehabilitation and environmental situation, allowances should be made for differing and changing circumstances within the
broad guidelines of the framework. These strategies are aimed at finding and optimising an equilibrium position between the financial and the non-financial implications of rehabilitation management; the implementation of environmental policies; environmental rehabilitation leadership; and the effect on the natural environment.

A secondary purpose emanating from this comprehensive strategy was to establish bases for adequate environmental management accounting information for management decision making. Decision-making as a result of these information structures would reflect changed cultural and behavioural patterns, which would benefit all interested and affected parties according to the Pareto optimum paradigm.

This study will enhance awareness of the importance of implementing adequate management accounting principles in support of rehabilitation and environmental management in the mining industry.
Tradisionele bestuursrekeningkundige gebruik het nie voorsiening gemaak vir toereikende toedeling van omgewings- en rehabilitasieuitgawes nie. Omgewingskoste was verskuil en is nie onderskei van ander bokoste nie, omdat die bestuur met tradisionele waardesisteme, oortuigings en ingesteldhede hierdie koste onbelangrik en onnodig geag het. Die evaluering van insette en voordele is verkieslik slegs in finansiële terme gedoen, met die weglating van nie-finansiële indikators soos fisiese evaluasie van besoedelingsvlakke in die lug, water en grond. In Suid-Afrika word toenemend wetgewing gepromulgeer deur die sentrale owerheid ten einde besoedeling te voorkom. Hierdie tendens mag in die toekoms lei tot enorme finansiële verpligtinge en kontrole- en mislukkingskoste indien daar nie betyds aandag aan voorkomende optredes gegee word nie.

Die doel van hierdie navorsing is om 'n plan te ontwikkel vir die implementering van 'n omvattende bestuursrekeningkundige strategie vir omgewings- en rehabilitasiebestuur in die mynbedryf. Behalwe vir die beduidende aandeel in die landsekonome, beleef die mynbedryf ook negatiewe aanslae weens besoedeling. Hierdie strategie is ontwikkel na aanleiding van 'n literatuurstudie en 'n empiriese ondersoek na rehabilitasiesituasies in Suid-Afrika, Afrika en die leidende ontwikkelde lande wat Kanada, die Verenigde Koninkryk, en die Verenigde State van Amerika insluit. Enersyds spruit rehabilitasiebestuursgebruike in die res van Afrika voort uit 'n geskiedenis en kultuur van ontoereikende omgewingsbeleidsrigtings, wat gepaard gaan met ondoeltreffende kostebestuursbenaderings oor die kort- en langtermyn. Die hoogsontelike lande het weer vaardighede en tegnologie wat ontwikkeld het weens 'n kultuur van bewustheid van voortdurende verbetering en ekologiebestuur. Hierdie groepe inligting behoort optimaal gekombineer te word as aanduiding van die agergrondkultuur wat gedrag en besluitneming bepaal.

Die vernaamste strategieë wat ingesluit word in hierdie bestuursrekeningkundige plan is historiese invloede, 'n holistiese benadering, beleidsrigtings om koste te verminder, die aandeel van die owerhede, totale kwaliteitsomgewingsbestuur, navorsing en ontwikkeling, etiek, die aandeel van bestuur, prestasie-evaluering, verslaglewing, terugvoering en voortdurende verbetering. Aangesien elke individuele onderneming sy eie besondere rehabilitasie- en omgewingsituasie het, behoort aanpassings gemaak te word vir
verskillende en veranderende omstandighede binne die breë riglyne van die raamwerk. Hierdie strategieë word gerig op die verkryging en optimering van 'n ewewigposisie tussen die finansiële implikasies van rehabilitasiebestuur; die implemetering van omgewingsbeleidsriglyne; omgewingsrehabilitasieleierskap; en die uitwerking op die natuurlike omgewing.

'n Bykomende doelwit wat uit hierdie omvattende strategie voortvloei, is om die basis vas te stel vir toereikende omgewingsbestuursrekeningkundige inligting vir bestuursbesluitneming. Besluitneming as gevolg van hierdie inligtingstrukture sal veranderende kulturele en gedragspatrone weerspieël wat tot voordeel van alle belanghebbendes sal wees volgens die optimum leerstelling van Pareto.

Hierdie studie sal die bewustheid van die belang van die implementering van toereikende bestuursrekeningkundige beginsels laat toeneem en so bydra tot groter ondersteuning van rehabilitasie- en omgewingsbestuur in die mynbedryf.
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CHAPTER 1

BACKGROUND AND THE RESEARCH PROBLEM

1.1 INTRODUCTION

The mining industry in South Africa makes a major contribution to the economy of the country, but its very economic strength also contributes to massive pollution effects. Revenue totalling R65 billion was generated in 1997, 79% of which was in the form of foreign exchange (Financial Mail 1998 Nov:46). According to estimates, this industry added 7.8% directly to the gross domestic product (GDP) as well as 15% indirectly by means of multiplier effects. About 10.5% of all people employed in the non-agricultural formal sectors of the economy are still employed by the mining industry despite sharp production decreases during the past decade.

While the mining industry does make an enormous contribution to the economy of the country, it also has quite a number of negative environmental impacts owing to pollution. These impacts range from the contamination of soil, air and water to negative influences on the agricultural, cultural and visual environments. A large portion of the waste generated is in the form of waste water, and high environmental risks are involved when releasing waste into the aquatic systems.

The health and safety of employees and people in communities situated close to mining operations are important concerns for this industry. An example of this is found in the legacy of asbestos mining in the country which caused extensive ill health for decades after the closure of these mines (Koch et al 1990:3).

In this introductory chapter the background to the study is discussed. The problem to be investigated is formulated and the purpose and importance of the study are explained. The parameters of the study are set out in accordance with the defined problem. The methodology followed and the research method are described. The programme of the study is then set out in the form of a review of the chapters. For the sake of clarity concerning the use of relevant terminology, a number of definitions are added in a glossary.
1.2 THE PROBLEM AND PURPOSE OF THE STUDY

1.2.1 Inadequate allocation

Accounting and management accounting procedures traditionally do not take into account the principle of “polluter pays”. This inadequate allocation of environmental costs forms part of a global trend where the present environmental costs of pollution to the atmosphere, hydrosphere and lithosphere are externalised to be paid for by future generations. In this regard Porritt (1989:19) quotes the opinion of the former Secretary of State that

pollution, like fraud, is something you impose on others against their will so that you can gain financial advantage.

Rehabilitation and environmental costs are inadequately allocated because environmental costs are not collected, classified, assessed and disclosed properly, and all interested and affected groups are not taken into account.

1.2.2 Invisible environmental costs

Environmental and rehabilitation costs are hidden in the form of environmental damage, to be paid for in financial and non-financial terms in years to come. In traditional accounting systems environmental costs are not separated from other costs and overheads, which results in a lack of awareness of the extent of these costs. Remediation liabilities exist both for rehabilitation pertaining to current mining activities and for ecological damage inherited from previous generations. The operation of the free market does not, however, immediately provide an automatic solution for this problem.

The lack of regular assessments of environmental and rehabilitation failure and control costs perpetuates the traditional approach of hiding the costs associated with the minimising of negative environmental impacts. Since these costs are kept invisible, adequate provision cannot be made for their prevention in the rehabilitation and environmental budgets.
1.2.3 Traditional values, beliefs and mindsets

Experts differ on the interpretation of rehabilitation and environmental costs. According to more traditional values, beliefs and mindsets, the costs incurred for remediating environmental damage and preserving natural habitats are regarded as unnecessary. This attitude is also found in poor countries in respect of uncontrolled small-scale mining operations where compulsory remediation actions at present would lower the standard of living for millions of people.

When the importance of environmental expenditure is recognised, the motivation is only to comply with environmental legislation in order to avoid and reduce excessive environmental failure costs. The values, beliefs and mindsets of management need to be developed to the following phase, where rehabilitation and environmental costs are managed in an environment with a strategic orientation and with the capitalisation of environmental know-how.

1.2.4 Evaluation in financial terms only

The approach in management accounting has traditionally been that input and results should be measured in financial and monetary terms only, resulting in a culture where preference is given to the short-term financial manipulation of data. The traditional systems do not make adequate provision for the measurement of non-financial input and results. In rehabilitation and environmental management, however, the assessment of pollution levels and comparison with previous levels, as well as with recommended levels, forms the basis for calculations and for decision making.

Society is becoming more informed and aware of environmental matters and increasingly demands information on environmental damage caused by mining activities as well as on the corrective measures taken. Present public relations officers do not have the right type of information available to communicate to the public and stakeholders, as only a small percentage of the population is conversant with complex tables made up of financial figures.
1.2.5 Purpose of the study

The major purpose of the research is to develop a comprehensive management accounting strategy to be implemented for the rehabilitation of damaged areas after excavations by mining enterprises. Secondary purposes are to design bases for quality rehabilitation management accounting and for decision making that would include identifiable rehabilitation and environmental gains and losses, in both financial and non-financial terms. Decision making as a result of these information structures would reflect changed cultural and behavioural patterns which differ from the traditional ecological views.

1.3 IMPORTANCE OF THE STUDY

There is therefore a need to find and develop a comprehensive management accounting strategy for rehabilitation and environmental management in South Africa. Rehabilitation and environmental management should integrate and acknowledge all elements of the environment which are linked and interrelated. It should take into account the effects of all decisions on all aspects of the natural environment and of the people in that environment. The best practicable ecological option should be selected from the available, relevant information.

This study will increase awareness of the importance of implementing adequate management accounting principles in respect of rehabilitation and environmental management in the mining industry. Both the financial and the non-financial implications of the management of costs and input are considered during all the stages from impact assessment to rehabilitation costs during operations, followed by costs during closure and ending with maintenance expenditure after closure. This awareness of the implications of rehabilitation costs, which includes the identification and classification of environmental costs and the application of both financial and non-financial evaluations, should influence the behaviour of the management team in the direction of developing more appropriate methods for the allocation of these costs.

Since each individual mining company has its own particular rehabilitation and environmental difficulties and problems, adjustments should be made for differing and changing circumstances within the broader guidelines of the framework. Each individual mining site needs a tailor-made comprehensive strategy for the management of
rehabilitation expenditure and inputs. The rehabilitation and environmental management team which includes the management accountant, should be able to prepare an adequate management accounting system based on a holistic approach in order to include all relevant information for decision-making purposes.

The development of formal rehabilitation and environmental policies based on adequate information provided by management accountants would enhance the position of mining companies regarding international recognition. Competition in the international arena has the potential to improve the economic position of the mining company as well as that of the country as a whole.

In principle the costs of pollution should be paid by those responsible for ecological damage, and not by the taxpayer where the original mining company has not made provision for remediation expenditure. Interested and affected groups in the extended enterprise that would benefit by improved rehabilitation management accounting systems include the providers of money, workers, future generations, the natural environment, the state, suppliers, debtors, customers and people living in the communities surrounding mines and in the whole of Africa. For each one of these stakeholders an equilibrium position should be determined in terms of gains and losses. The equilibrium position is one where interested and affected groups would gain by not putting others in a worse position. In accordance with the Bill of Rights of the Constitution (Act 108/96), section 24 (quoted in Environmental Affairs and Tourism 1998:17)

> everyone has the right (a) to an environment that is not harmful to their health or well-being,...

The comprehensive contribution of this study is to add quality of life to stakeholders in the form of long-term survival and sustainable living through the protection and rehabilitation of the natural environment. This can be achieved through the utilisation and development of adequate management accounting approaches and strategic management accounting. Strategic management accounting has the dimensions of quality, cost and time and provides information to link daily actions with strategic objectives, involves the extended enterprise, and includes long-term strategies and actions (Ansari, Bell, Klammer & Lawrence 1997c:SMA-6).
This study set out to combine aspects of existing fragmented research on rehabilitation management accounting into a proposed holistic and comprehensive strategy.

1.4 METHODOLOGY AND RESEARCH METHOD

Information for the research in this study was obtained through a comprehensive literature study, as well as by means of empirical investigations.

The literature study examined the economic and financial environment for rehabilitation programmes for worked-out mines or sections of mines. The influence of historical developments on the present situation regarding rehabilitation management and the accompanying management accounting perceptions were investigated. The South African position in comparison with that of the rest of Africa was researched. Possible methods of alleviation the present South African rehabilitation management problems were sought in developed countries through this literature study. Various management accounting approaches and techniques, with total quality environmental management as the basis, were researched in the process to develop a comprehensive rehabilitation and environmental strategy for mining operations.

Empirical information was obtained through visits to mining rehabilitation sites, and by means of questionnaires sent to environmental and rehabilitation managers in the major mining sectors in South Africa. In Chapter 3 the design and methodology of the empirical research are discussed in detail. This acquired information forms the basis for deductions on the present opinions of environmental and rehabilitation managers in the country.

1.5 DELIMITATION OF THE STUDY

The mining industry was selected for this study because of the enormous volume of waste that is generated during mining operations. According to estimates (Institute for International Research (IIR) quoting Engineering News, 1997 Oct. 24-30), 466 million tons of waste are produced in South Africa each year. The mining industry alone is responsible for 377 million tons (81%) of this waste. Of the total of 2 million tons of hazardous waste in the country, the mining industry generates 1,05 million tons (52%).

Although the mining industry creates large-scale employment opportunities and generates
much-needed foreign exchange, it also has to set the example of adequate rehabilitation and environmental management policies to preserve the biophysical environment for future generations.

Within the mining industry the researcher concentrated on the mining of gold, coal, asbestos, chromium, vanadium and iron ore. The excavation and other mining operations associated with these commodities have the potential to cause extensive ecological damage. The mining of other commodities such as diamonds, which also yields large amounts of foreign exchange, directly causes most damage in the form of soil erosion rather than massive pollution to the natural environment. Indirectly, however, the accumulation of people and industries in the vicinities of these diamond mining activities also leads to pollution of the air, soil and water.

Within the broad holistic spectrum, background information is amalgamated with management accounting views and developments to form a comprehensive strategy for rehabilitation management in South Africa. This long-term strategy needs to be adapted according to individual preferences.

1.6 PROGRAMME FOR THE STUDY

Scattered existing research findings on various related issues are combined to form a holistic strategy to be implemented in respect of rehabilitation and environmental management accounting in the mining industry.

This study on management accounting approaches to environmental rehabilitation in the mining sector begins in Chapter 1 with an orientation towards the field of research. The background is supplied and the problem and purpose explained. The methodology, research method and delimitations are outlined. The importance and objectives of the study are emphasised. In addition, a glossary of subject terminology peculiar to this field of study is provided.

Since the local situation in respect of management accounting for rehabilitation management in the mining industry is the most relevant for the purposes of this study, the South African situation is investigated in the next three chapters. In Chapter 2 a historical overview is given because present physical ecological damage, as well as experience,
perceptions (Gouws 1999: 17) and attitudes regarding the repair of damage have been inherited from previous generations. Developments during the past 15 years in particular are explored. Environmental disclosure practices are analysed briefly.

In Chapter 3 the method and approach for the empirical study are developed. A questionnaire is designed. (This questionnaire was subsequently sent to all rehabilitation and environmental managers in the gold, coal, asbestos, chromium, vanadium and iron mining industries in South Africa.)

In Chapter 4 the collected opinions are grouped together and statistically analysed. Limitations and problems as well as benefits arising from the empirical study are identified. A list is compiled of items that should be included in a management accounting strategy for rehabilitation management.

Since South Africa plays such a strategic role in Africa, the situation in the rest of Africa is analysed briefly in Chapter 5. The evolution and development of rehabilitation are investigated because these would form the basis for present inherited approaches towards rehabilitation management accounting procedures. In particular, difficulties encountered with rehabilitation are looked at. The positive influences of successful rehabilitation cost management policies are emphasised.

In Chapter 6 rehabilitation management in Canada, the United Kingdom and the United States of America is investigated. In each of these, the most highly developed countries in the world, substantial management accounting contributions have been made towards environmental and rehabilitation management systems, the measuring and reporting of environmental rehabilitation efforts and the role of authorities.

In Chapters 7 and 8 the information from the previous chapters is utilised to design a comprehensive plan for total quality rehabilitation management accounting. In Chapter 7 major and notable factors that influence a strategy for total quality rehabilitation management accounting are investigated. Included in these substrategies are the role of background knowledge and a holistic approach, cost reduction policies, the role of authorities, total quality environmental management, research and development, and ethics. In Chapter 8 the role of management, performance evaluation, reporting, feedback, the improvement of strategies, and the finding of an equilibrium position are analysed in
terms of a strategy for total quality rehabilitation management accounting.

In the final chapter conclusions and recommendations are summarised on the design of a proposed strategy to include the role of background information, a holistic view, cost reduction policies, the role of authorities, total quality environmental management, research and development, education and training, ethics, the role of management, performance evaluation, reporting, feedback, the improvement of strategies and the finding of an equilibrium position.

1.7 GLOSSARY

The following terms and their definitions are given in alphabetical order in the sense in which they are used in this study.

accreditation: the procedure by which an authoritative body formally recognises that another body is competent to carry out specific tasks

balance (balance matrix): a combination of factors compiled to find a balancing position where all the stakeholders from the community, environment and industry would benefit

benchmarking: “The process of investigating and identifying ‘best practices’ and using them as a standard to improve one’s own processes and activities.” (Ansari et al 1997c:SMA-17.)

continuous improvement: “a program to improve the strategic variables of quality, cost or time in small incremental steps on a continuous basis” (Ansari et al 1997b:MMEC-20.)

cross-functional teams: a group of internal and external experts which includes botanists, chemical and civil engineers, actuaries, geologists, hydrologists, and community leaders

environmental costs: “the costs incurred to control, assess, prevent, and correct failures from actions that potentially have an adverse impact on human, animal, or plant life. It includes pollutants in the air, soil, and water.” (Ansari et al 1997b: MMEC-1.)

environmental impact: an environmental change, or outcome of an action, caused by some human action, whether desirable or undesirable

interested and affected parties: They are individuals or groups concerned with or affected by activities and their consequences. Included are investors, customers, authorities, local communities, the labour force, environmental interest groups, the general public and future generations.

ISO9000: international standards on quality management issued by the International Standards Organisation (ISO)

ISO14000: international standards on environmental management issued by the International Standards Organisation (ISO)

life-cycle cost: "a system that tracks and accumulates the actual costs and revenues attributable to each product from inception to abandonment" (Drury 1996: 845)

non-financial indicators: other than financial indicators which are measured in monetary terms only, these include factors such as time, health, safety, pollution levels, technology employed, customer and community satisfaction, quality, behaviour and attitudes

pollution: “any change in the environment caused by substances; radio-active or other waves; or noise, odours, dust or heat, emitted from any activity, ... where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future” (Act 107/98: 10)

strategy: “a particular long-term plan for success ... in business” (McLeod & Makins 1993: 1163), consisting of both long-term and short-term plans and ways to implement these plans. “The way that an organization positions and differentiates itself from its competitors. Positioning refers to the selection of target customers. Distinctions typically
are made on the dimensions of quality, cost, and time." (Ansari et al 1997c: SMA-18.)

tailings: finely divided residues that remain after the valuable minerals have been extracted from the ore

ture profits: profits are recognised only when none of the stakeholders incur losses from the process of profit generation (refer to Pareto optimum in par 7.9.5)

value-added activity: "an activity that customers perceive as adding usefulness to the product or service" (Drury 1996:517)
non-value-added activity: "an activity where there is an opportunity for cost reduction without reducing the product's service potential to the customer" (Drury 1996:517)
CHAPTER 2

THE HISTORICAL AND EXISTING PRACTICES THAT HAVE LED TO PRESENT REHABILITATION MANAGEMENT SITUATIONS IN SOUTH AFRICA

2.1 INTRODUCTION

According to archaeological sources (Clarke 1989:35), the Southern African subcontinent has the world's oldest mines. Under these circumstances it would be appropriate to investigate the historical background to managerial and rehabilitation activities right from the earliest times, and to determine the influence of such activity - or in some cases inactivity - on the civilisations of the descendants of the early people or other inhabitants making a living out of the same land.

The objectives of the discussions in this chapter are to investigate rehabilitation management of the mining industry in Southern Africa from the earliest years of mining in the country, and to determine the influence of successful actions or of inappropriate actions of the past on the present management situation. Traditional cost and management accounting practices are investigated and attempts are made to compare these with the developments of the eighties and nineties. Management accounting principles identified by Ansari et al (1997c,b: SMA-2, 5; MMEC-2, 14), such as the dimensions of quality, cost and time, are sought for and analysed briefly, together with the technological, behavioural and cultural attributes of a good management accounting system. The object of these principles is to provide relevant information for management decision making, managerial planning, control and performance evaluation (Maher, Stickney, & Weil 1994:5). They form the bases in the long term for the determination of profits or gains as a result of monetary investments, as well as the various non-financial inputs and results, in the process of rehabilitating the environment of worked-out mines.

2.2 BEFORE 1985

2.2.1 Before 1850
2.2.1.1 Stone Age

In Southern Africa the peoples of the Stone Age were skilled miners. In Swaziland in the 1960s a pigment mine was found which was more than 40 000 years old (Cowey 1994:3). Late in 1979 an archaeologist and his helpers found a hole in the Northern Cape near Kathu containing about half a million separate items, most of which were razor-sharp hand-axes and lumps of specularite and red ochre. These Stone Age people whose tools were found lived in the bottom layers of the cave between 300 000 and 1,6 million years ago, and the groups living on top of them mined there about 120 000 years back. The Stone Age peoples of Southern Africa traditionally prized the mined specularite, red ochre or “shining stone” and pigment as cosmetics. Specularite is black iron ore which was rubbed into hair to make it shine. To represent strength and vitality the people of ancient times smeared red ochre, which is haematic, over his body, and they also sprinkled it on their dead in the hope that they would rise (Hocking 1983:6,7).

As the earlier peoples of Southern Africa did not use sophisticated equipment to mine their valuables, they were not really able to cause much damage to their environment. The dugout holes became caves for shelter against the harsh natural elements. Mined-out dumps consisted mostly of topsoil, and vegetation could more easily be established by means of wind and rain.

However, thousands of years after the excavations of the Stone Age people, sinkholes were formed on a farm in the Sishen area during 1974. At the bottom of these sinkholes almond-shaped axes and other tools were found which were most probably used for unearthing valuable substances. Over the course of the centuries about three metres of surface deposits were formed above these mines, but the surface was unstable and finally collapsed (Hocking 1983:6).

2.2.1.2 Transitional period from Stone Age to Iron Age

In the northern part of Botswana mining sites may have been chosen deliberately on account of their relatively inaccessible and protected location. According to Murphy, Murphy, Campbell & Robbins (1994:87), mica schist was mined in this region by Khoisan and African language speaking peoples of the early Iron Age. What appeared at first sight to be caves where people took shelter during long wet periods were actually
the abandoned mines of previous centuries. Outside the mines were large piles of tailings arranged in semicircles which provided even more protection.

A considerable amount of labour must have gone into excavating these mines in the solid rock of the Kalahari. The procedure followed includes the making of charcoal and the heating of rocks until they crack. Murphy et al (1994:89) confirm that these early indigenous miners were exceptionally skilled at organising labour and sustaining this considerable work force and effort. As the labour force of the early miners was their most important input factor or capital investment in exploiting underground mineral wealth, they duly recognised the importance of utilising and developing their labour skills. The exceptionally skillful organisation of labour into teams, the first capital investment, could only be accomplished either by groups working together for a life-supporting collective purpose, or by a dynamic leader organising and inspiring these miners. The existence of a well organised labour group could possibly be attributed to slavery (More 1974:229).

Stone Age peoples mined alongside Iron Age peoples for at least 1 000 years. The Iron Age miners utilised their own knowledge of prospecting, shaft-sinking, smelting, forging and the making of alloys, basically using Stone Age tools and equipment. Western technology overtook both the Stone Age and the Iron Age technologies, and built on the foundation of skills acquired through complex industrial labour aptitudes developed during the Iron Age. The mining industry widely respected the innate aptitudes of the Swazis and Shangaans, as well as the reputation of the Basutos as being probably the fastest shaft-sinkers in the world (Clarke 1989:35,36).

2.2.1.3 Iron Age

Metal working in Africa began in West Africa and from there the knowledge of mining and working metals was brought south by migrant tribes. Clarke (1989:36) is of the opinion that the use of iron was established in Southern Africa as early as 350 ACE (after the common era). Gold was not regarded as a useful metal until the Arab and Portuguese traders from Sofala in the north of Mozambique inspired an interest in the metal among the inhabitants of the southern region. The mining and exportation of iron were encouraged as the Middle Eastern traders regarded the iron from Africa as being of better quality than the iron from India. Since very early times coal was used as fuel in Zululand, and more recently it was also used for smelting operations for weapons and agricultural
tools (Coal & Base Minerals of Southern Africa 1963:46). Other ancient mining activities have been recorded (Cowey 1994:6,7): Copper was mined at Phalaborwa between 770 and 1750 ACE, and tin was mined around 1595 ACE in the Transvaal. These commodities were excavated mostly for the purpose of trading with countries to the north and to the east.

From the early years of mining communities had already realised the importance of the distribution of work to the individual members of the group, in accordance with the ability of each one to accomplish certain tasks. According to archaeological sources (Clarke 1989:36,40,43), the management process at mines and the iron works started with setting women to dig in the ancient mines, and even small children in the narrow tunnels, as it was a cultural taboo for women to be around the smelting and forging processes. It would have taken twelve men eight days at ten hours per day to make one spearhead from the mined ore. Eight men would repair the furnace from the previous smelting, which would take one day; select and collect the iron-bearing ore during one further day; and operate the furnace for another six days. The other four would collect food and water for the eight, which would take four days, and make about 100 kilograms of charcoal from two large trees for the fire in the furnace and for the forging of the metal. The value of the extended enterprise, which involved a process which began with the natural environment and ended with the utilisation of the iron tool, was realised as well as the contribution of each element to the value chain and the resulting benefits to each member of the group and to the group as a whole.

This enormous input, with the minimum of safety measures, illegal child labour, the excessive consumption of local trees, and the smoke pollution effect of the whole process, to produce a relatively small iron part for an arrow or a hoe would not have been a positive holistic economic proposition in today’s terms. It would take at least two hundred years for each of those big trees to be replaced by nature. The cumulative effect of the burning of big trees for the smelting and forging of an iron tool could leave large stretches of country without any big trees or even without trees at all since trees were usually utilised as firewood and to crack rock inside the mines. Not only organised labour, but also the natural environment became production factors that went into the mining process. Whereas labour as a stakeholder could be remunerated by means of an arrowhead for the best hunter to hunt more game to provide food for the community, the natural environment as the other stakeholder provided ore, fresh air and trees without receiving
replacements to the same value in return. No provision was made for the maintenance of environmental and natural assets, which are one of the most important resources for the generation of profits for both present and future generations.

On the one hand the non-financial inputs of labour and the natural environment do not compare favourably with the output of a hunting or an agricultural aid. But on the other hand this was, and in many instances still is, the price to be paid in the process of evolutionary development. Somewhere in between, the pendulum of extremely high input and relatively low output should find an equilibrium position. But the achievement of equilibrium depends on finding a satisfactory evaluative instrument for measuring natural environmental sacrifices and gains.

More than one thousand years ago deep-level miners were active in what was previously known as the Northern Transvaal region. Vertical as well as horizontal tunnels were dug. The ancient mineworkers apparently ceased activities when they could not clear water from the bottom of the mine holes. Other obstacles were the lack of natural light, which they partly overcame by using candles made of leaves; and safety, as the roofs not infrequently collapsed on them, causing accidents (Cowey 1994:6). Backfill was used to keep tunnels open, providing a means of reducing the volume of the dumps on the outside of the mines, and reducing labour hours for working out unwanted soil.

Clarke (1989:43) states that even the most ancient mines in Swaziland were often filled with rubble. The abandoned mines were filled up because the people of those times felt a religious compulsion to fill them in order to appease the spirits of the underworld. Despite relatively crude mining technology they worked neatly and did not remove much waste material from the tunnels.

2.2.1.4 Conclusion

Although the mineworkers and their employers of centuries ago did not use sophisticated means to excavate precious metals, they indeed applied management systems to create order in the working environment, and they used uncomplicated rehabilitation methods. These management systems did not however, make provision for the replacement of natural resources such as trees, and for the settlement of people, since vast stretches of country were left barren after the early stock-farmers and miners had moved on to better
Inputs in the form of effort and time were reduced, especially as regards the building or digging of shelters and the filling up of pits with backfill. In later centuries these effort and time parameters would be calculated in financial and non-financial terms. After mining activities had ceased, the pits or caves were used as shelters, even by generations in following centuries. Rubble and excavated soils were used as filling material for the abandoned mine pits. These waste materials were also utilised as support for roofs during mining activities.

2.2.2 1850 - 1920

2.2.2.1 Introduction

A new era in the mining history of Southern Africa began with the discovery of diamonds during the 1860s, and ended in 1919, at the conclusion of the First World War. The discovery first of diamonds, and later of gold in the 1880s, in the unknown interior turned the poor agricultural country into a young industrial state, and into one of the world’s richest countries.

Soon after the landing of Van Riebeeck in 1652, expeditions sent to search for riches came across Namas decorated with copper (Holz 1994:28). Although Commander Simon van der Stel shipped the first wagon-load of copper ore from near Springbok to Batavia in October 1685, actual copper- mining operations in that region started in 1850. According to Vorster (1987:41,43), two prospectors, Phillips and King, made their first shipment of copper-bearing ore in 1852. But it was not until 1940 that the rehabilitation of one of the copper mines at Nababeep started.

2.2.2.2 Asbestos

After diamonds, blue asbestos had become the main mineral product of the Cape Province by 1917 (Hocking 1983:43). In his record of the history of asbestos mining, Snyman (1988:33-40) tells us that the production of blue asbestos or crocidolite, which is found in the Northern Cape, accounted for almost 100% of world output. The presence of this useful substance was first described in 1805 by the German explorer Lichtenstein,
followed by missionaries and other explorers like Campbell in 1813, Philip in 1820 and Moffat in 1821. But it was not until the early 1880s that exploitation began in this region. The first decades of the mining of blue asbestos were characterised by ignorance about the potential health hazards of uncontrolled exploitation activities. The production of blue asbestos involved the whole family, as in ancient times, in contrast with other Southern African mining sectors where only the individual male worker was engaged. While the men performed the extraction processes, the women and children were cobbing, sorting, grading and bagging, and the babies slept on the asbestos dust nearby.

Meek, speechless, clad in khaki shorts and shirt
She took her place in the asbestos dirt.
(From: Asbestos wife’s poem, Hocking 1983:82.)

Snyman (1988:40) records that it was not until 1941 that a visiting senior government health officer found that the mortality in respect of chest diseases was particularly high among the people on the asbestos fields. Mining operations for asbestos were scattered over a large area, and not subject to any governmental control. As most of the production procedures were performed in a cloud of asbestos dust, pollution of the living and natural environments inevitably occurred. From the very beginning asbestos was produced under extremely unhealthy working conditions, particularly as far as the Griqua and indigenous people were concerned.

According to Snyman (1988:37) mineworkers were, however, attracted to this type of work because of the limited family disruption, relatively high wages, because they were allowed to work independently and because livestock were allowed on mine properties. By 1917 the number of people engaged in the asbestos industry who depended on working with asbestos for a livelihood, was estimated at 10 000 indigenous people, men, women and children (Hocking 1983:42). Unfortunately, all these people, as well as the supervisors and owners of the mines and the authorities, were ignorant of the fact that these short-term benefits should be weighed against the risks and claims arising from ill health in the long term, and the possible closure of mines or decline in their source of income.
2.2.2.3 Diamonds

Long before the inhabitants of the Northern Cape realised that some of the stones and pebbles that their children played with and which had been lying around on the surface for centuries were in fact diamonds, the Reverend John Campbell paid a second visit to Southern Africa in 1820. Herbert (1972:11,12) tells us that Campbell published a missionary journal of his travels in 1852. On the map in this journal he wrote across the whole Orange River valley “Here be diamonds”. Alluvial diamonds as well as diamonds in volcano pipes were later discovered in this region. Although the first diamond was officially discovered in 1866, it was not until March 1869 that the diamond business exploded. Farmers from all over Southern Africa moved to the confluence of the Orange and Vaal Rivers, and to the Modder and Harts Rivers in search of a better life. They were followed by diamond diggers and prospectors from India, Brazil, Australia, North America and Europe who streamed into the previously empty and untouched natural environment of the interior.

2.2.2.4 Coal

The coal industry began to develop in Natal after 1886 (Coal & Base Minerals of SA Southern Africa 1963:57), and then in the Transvaal in the 1890s. While the coal deposits of the Transvaal were better situated in respect of the large and expanding markets of the gold mines and related industries, coal mining in Natal was mainly aimed at the export market. In the Transvaal more labour was available and owing to market forces labour costs were lower than in Natal, or the labour force was underpaid in the Transvaal with relatively more profits going into the pockets of the money providers. This culture of the apparent making of profits at the cost of cheap and low paid labour has been evident since the earliest years of colonialism and mining in Africa.

In Natal, on the other hand, the undulating natural landscape, and the relatively long distances from the industries of the Transvaal, as well as the lack of an extended railway system, resulted in higher transportation expenses for the coal mining industry. These factors contributed to labour and other operating costs being much higher in Natal than in the Transvaal, and made coal from Natal more sensitive to market price fluctuations.

In the early years of the coal industry in Natal, the shipment trade demanded round coal,
and there was no market for small coal. Small coal was dumped or sold at very low prices to whoever would take it (Edgecombe & Guest 1987:50,61).

2.2.2.5 Gold

When the mining of gold started at the end of the previous century on the Highveld of the Transvaal, there was no basis for long-term planning. At first it was only the miners and their families on the open veld who endured the inconvenience of dust from mine dumps. As further developments followed, the gold mining activities expanded and the isolated shacks grew into towns and later cities like Johannesburg. During the early gold extraction processes the residues were discharged as sand on sand dumps. The dry climate and wind caused the dust to become a constant nuisance. Efforts to control the blowing of dust included the dumping of rock on the sides of the dumps, or the tipping of rock in depth. The use of rock proved to be quite expensive and after a while the rock was again covered with dust. Attempts to control dust by spraying various substances like molasses, salt and hygroscopic materials, were also unsuccessful. Grange (1973:67) further states that in 1913 a sludge made from black vlei soil was applied on the surfaces of the dumps.

This method succeeded to some extent in solving the problem and was practised for many years afterwards. But the cost of the destruction of the wetlands in the process of taking this clay for covering the abandoned dumps was never determined. Entire natural habitats associated with wetlands, including their purifying effect on water, were forfeited without considering the consequences or counting the centuries it would take nature to rehabilitate these environments. It seems as if one type of natural environment was utilised in order to cosmetically cover another damaged area without determining the “cost”. According to the thinking of this era, cost was only recognised as such when it was actually incurred or paid. The existing definition of cost therefore needs to be redefined when the natural environment is in question, and should encompass at least a non-financial measurement index of the years required for recovery. Environmental costs should be made more visible and a value should be placed on natural resources. Both financial and non-financial assessment methods should be applied.
2.2.2.6 Rehabilitation management practices

During the early years of this period of formal mining operations in Southern Africa, cost and management aspects of the excavation of riches as well as of environmental management were mainly based on the principles of fortune hunting. Labour and land were handed over to the suppliers of money, or just taken by the holders of financial means, whose merciless exploitation of these production factors was the bottom line (Estes 1996:239). While the risks of the mining operations were carried by all stakeholders involved, profits were taken by money providers only. Profits were made without actually counting the full cost of labour and the natural environment, and without properly remunerating these production factors. People in search of a means to survive or dreaming of becoming rich overnight, invaded the inland. Some of them emigrated from exhausted gold and diamond fields from overseas countries like Australia, or the American south, or from other areas where the pickings seemed to be less rich than in South of Africa. Others were South African peoples who had moved away from the hardships of the harsh agricultural sector, plagued by droughts, the theft of livestock and the exhausting labour required by farming. In many instances the farmers switched from the hardships in farming to the hardships of mining.

Crocidolite. Their temperature will rise
To heights of wealth whose limit is the skies
And fall to chasmed penury, by the hour.
Asbestos fever has them in its power,
(From: Asbestos wife’s poem: Hocking 1983:82.)

As soon as they had made their fortune, or when they realised that there was no fortune to be made, at a particular mining area, or when pollution drove them away, they moved on, leaving dumps, pits and pollution behind.

These mining people gave no thought to the way subsequent generations would have to struggle to make a living on the land that they abandoned. During the early years of formal mining in South Africa a culture of greed developed where the most powerful stakeholders took as much financial gain as possible without considering the well-being of the other stakeholders, including future generations and the natural environment. The long-term financial and non-financial effects of such approaches and mindsets on other
stakeholders were ignored. This cultural attribute of traditional management accounting is still present to some degree and mindshifts should be effected by means of education, training and legal action by authorities.

It seems as if only the very short-term aspects of management, cost and environmental management were taken into account, by striving to gain the maximum fortune in the shortest possible time-span, with the minimum of financial input. Strategic management policies, long-term planning, life cycle or full costing methods, and extended rehabilitation management were totally out of the question. It is also evident that the elements of total quality management and the application of non-financial indicators were not introduced in a formal or informal way (Smith M 1995:181). (Refer to Chapter 7 for total quality management and non-financial indicators.)

Later on during this period, attempts were made and costs incurred to cover up mine dumps in order to enhance the quality of the living environment of the inhabitants in the mining communities. An awareness of environmental management can be detected, probably as a result of the permanent residence of people as well as the development of larger managerial mining infrastructures over the years.

2.2.3 1920 - 1985

2.2.3.1 Introduction

The end of the First World War and the subsequent post-war depression of the early 1920s were responsible for a decrease in mining operations. But after around 1925 mining activities in Southern Africa increased steadily, and only decreased during the Depression of 1932 and the Second World War. During these decades greater efficiency was accompanied by safer working conditions which resulted in a reduction in fatal injuries of 50% from 1901/5 to 1951/5 (Grout & Lechmere 1958:508). It was also during this period that the Orange Free State gold mines started to open up in 1947 and 1948 (SA Mining, Coal, Gold & Base Minerals 1991:15).

2.2.3.2 Diamonds

More diamonds were discovered in the course of 1919 near Postmasburg and to the north
of the town. Later in the 1920s diamond diggers also rushed to the Lichtenburg diamond fields. In his chronicle of the history of the diamond diggings in Southern Africa, Hocking (1983:44-46) describes how the mining of the “carrot-hole” shaped volcanic diamond pipes starts with the removal of the top layer of yellowish oxidised soil. The deeper layer is blue and much harder to work away. Millions of tons of kimberlite were removed during mining operations, leaving behind gaping cavities. These holes are to be found in and around Kimberley as well as near Windsorton and Postmasburg.

2.2.3.3 Asbestos

Asbestos mining provided widespread relief for the agricultural sector as protracted droughts and animal diseases had forced farmers from their farms after 1910. This movement of the poor farming community to the mining industry was especially noticeable during the post-war depression of the 1920s (Snyman 1988:41). The short-term economic benefits under these circumstances seemed to outweigh the long-term negative social impact of asbestos dust pollution. Since the production of blue asbestos meant so much in an economic sense to workers, towns and businesses, the potential health dangers were overlooked or simply ignored.

An alliance appeared to exist between the state and capitalists as far as health and safety matters were concerned. The state supported capitalist production because of its reliance on taxes from the mining sector, although in time capitalists were confronted with irrefutable evidence of the health risks associated with mining operations. Labourers stood defenceless against this alliance of power as they could not organise money for research, nor could they exert any direct influence over the state or the capitalists. Capitalists and the state were the dominant influence in the labour and health issues affecting miners as well as the natural environment, but their only concern was the maximum monetary gain. They did not count the current and future cost of underpaid and potentially physically ill labourers, and the hazardous working environment and residue dumps. The maintenance of resources such as labour and the natural environment was not accounted for.

Local authorities only took measures to move the asbestos workings to the outskirts of towns and to compel mining companies to make their buildings dustproof; the government waited until 1947 to proclaim special regulations to compel asbestos
companies to improve living and working conditions of their workers. Although the authorities started intervening to press for better conditions, these actions seemed useless as there was no enforcement of laws and regulations (Snyman 1988:41).

Ignorance about the financial and non-financial consequences of the applications of asbestos and about the constant presence of asbestos dust in the living environment during the first decades of this century, was appalling (Dempster 1983). Asbestos waste was such a useful material that it was applied as road gravel just before 1938 in Kuruman. Snyman (1988:41) says that it was also used as paving material in towns, and it became a substance in brickmaking and plaster. Even the golf course of Prieska was originally laid out with asbestos waste. Uncovered mine dumps were the unrestricted playground of children, and the wind spread asbestos by blowing fibres from the dumps, mines and plant into the towns. Asbestos had about three thousand applications, but people who were exposed daily to fibres were unaware of the dangers.

Steps to create a safer living environment for asbestos workers were most probably also delayed because of the long time-span from exposure to asbestos to the appearance of signs of asbestos-related diseases. As late as in 1960, the average time for the development of asbestosis was reckoned to be eight years, and it could take between twenty and forty years to contract mesothelioma after exposure to blue asbestos fibre (Snyman 1988:46,47). The number of people who died of asbestos-related diseases was calculated to be about 5 000 (Swart 1998:3). Although it was known by 1950 that asbestos dust caused asbestosis, the government seemed reluctant to implement control measures. A few years later Act 57 of 1956 and the Mines and Works Act of 1956 made provision for safety and health regulations.

Demand for blue asbestos increased during this period, with the result that fifteen separate mines were operating in the Northern Cape by the time the Second World War broke out. Mining reached a peak in 1977 (Hocking 1983:83; Snyman 1988:31). As a result of the increasing demand, new mining techniques and safety measures were introduced and more people were employed. Unfortunately for this mining sector, actions by management and the authorities to implement precautions to limit the dangers of working with asbestos were introduced too late. Production then started to decrease as a result of reduced overseas demand following the negative effects of the health campaign against the applications, mining and use of asbestos.
2.2.3.4 Gold

During 1921 the system of slimes dams for the extraction of gold was introduced to replace the existing system of sand dumps. Residues are discharged onto slimes dams which are built up from the drying residues. As the surfaces of these dams dry out, the wind blows the dust from the flat tops, but very little dust can be blown from the sides as they become hardened. The tipping of rock on the sides reduces the dust pollution, but it is an expensive process.

Grange (1973:67) records that in 1932 Professor Phillips from the University of the Witwatersrand gathered all the existing information on previous attempts to grow vegetation on mine dumps, and continued with experiments to find ways of covering them. Phillips found that the acidity was too high and that only drought-resistant plants could survive. He suggested that soil be moved to the mine dumps, but the authorities argued that the costs were too high, and that material like street refuse and dumped building material could also be applied with success. It would, however, not be possible to establish vegetation on this cheaper form of covering. Street refuse, which consists of empty tins and bottles, waste paper and the odd poisonous cigarette butt, as well as building rubble containing cement, broken bricks, a square metre of wall, stones, timber off-cuts and strips and pieces of iron and steel, does not provide sufficient organic material. For management accounting to function in a cost-effective way in the end, expert advice should be obtained from external sources when necessary.

However, by 1953 the problem of covering dump surfaces had not been solved. Owing to the increasing awareness of environmental damage and changing aesthetic values, the public started to put pressure on mining and other authorities to develop strategies for the improvement of the situation. It was then that the Chamber of Mines, in collaboration with the Council for Scientific and Industrial Research (CSIR), investigated the situation around slimes dams. Consequently the steering committee recommended that the best method would be to cover the surfaces with vegetation if this was possible. Research on vegetation resulted in the establishment of a mechanised unit for planting on dumps in 1961. Grange (1973:68) further records that from January 1964 the Vegetation Unit of the Chamber of Mines became fully operational in an advisory as well as a contracting capacity for the revegetation of mine dumps and slimes dams. James (1966:157) emphasises the importance of creating a self-supporting plant community on the dumps.
where practically no organic materials are present. Initial plantings of grasses died out after three or four years, but they provided a better environment for flora of the surrounding countryside to establish in the meantime.

James (1966:157) stated that the permanent and successful covering of mine dumps with vegetation is a long-term project. Long-term planning and funding should be included in the comprehensive strategic and quality management programmes of mining enterprises in order to achieve this goal. Not only should sufficient funds be set aside for the rehabilitation of current dumps and tailings impoundments, but means should also be found to properly revegetate all disused residue deposits which represent significant environmental liabilities. The high costs of revegetation, which runs into tens of thousands of rands per hectare (SA Mining, Coal, Gold & Base Minerals 1996 March:23), could be reduced by coordinated research and development programmes to determine feasible slopes, angles, chemical composition and drainage.

From 1958 to June 1972 the total amount spent on the suppression of dust from mine dumps by the mining industry amounted to six million Rand. Grange (1973:69) reports that this amount was made up of R3 656 000 for the establishment of vegetation on dumps, more than R1 600 000 for rock tipping on the sides of dumps, and R333 388 for sludge spraying. By 1973 he stated that, owing to these enormous financial investments, more than 2 500 hectares on the Witwatersrand had been planted and much had been gained in terms of experience (1973:71). This experience of the vegetation aspects of rehabilitation management resulted in 1979 in guidelines for the vegetation of residue deposits against water and wind erosion (Chamber of Mines 1979). After thirty years the Vegetation Unit of the Chamber of Mines had vegetated more than four thousand hectares of land of which about 85% were on the Witwatersrand alone (Friend 1990:19). In the process valuable expertise and information were obtained on how to combat pollution of the air and water and improve unsightly dumps and slimes dams under conditions where no two residue disposal sites have the same chemical, physical or microbiological composition.

Investigations were also carried out at dumps on asbestos, coal, diamond, copper and other metal mines, as well as ash heaps. Since coal mine dumps combust spontaneously, treatment of these dumps is more difficult than the treatment of other dumps. The impact of burning dumps on the living environment of people is fortunately low, because very
few new coal mines are near densely populated areas (Grange 1973:69).

2.2.3.5 Coal

The establishment of Escom in 1922 and Iscor in 1928 created a new demand for the small coal mined in Natal, which had previously been dumped. The steel and electricity industries utilised this type of coal since small coal was used for manufacturing coke and power stations were designed to burn small coal (Edgecombe & Guest 1987:61).

Small entrepreneurs who have long since stopped excavating coal from the scattered shallow coal mines of the Witbank and Middelburg areas are not in a position to rehabilitate the environment many years afterwards. These mines still continue to pose a serious threat to the living and natural environments of the region. The individual entrepreneurs may still be alive, but the official companies which owned the mines have been liquidated in most instances, leaving the cost of rehabilitation to the State (SA Mining, Coal, Gold, & Base Minerals 1993:19).

Lang (1995:194) describes the legacy from the mining activities of coal miners in the days before environmental awareness as having left a “devastated land surface”.

Open-cast coal mining especially has the potential to ravage the countryside. Defunct mining companies left behind more than fifty old coal waste dumps, most of which were burning. Because of the spontaneous combustion which has occurred, these dumps are responsible for air pollution and are adding to the resultant acid rain dangers. By 1995 some of these burning dumps had been sealed off, covered by soil and vegetated. Lang is of the opinion that dumped coal could in future be regarded as a resource which could be utilised by means of advanced technology for a changed market demand. In the history of coal mining in South Africa his theory that dumps should be preserved for future generations, was proved true by the utilisation of previously dumped small coal in Natal in the 1920s in the emerging steel and electricity industries (Edgecombe & Guest 1987:61). An environmental liability eventually changed into an environmental asset.

Tremendous progress was made when in October 1981 the Chamber of Mines set out guidelines in a handbook to assist the managements of coal mines with the rehabilitation of disturbed land, especially in open-cast mining. Developments during the second half of the 1970s made it possible to profitably exploit coal which occurred too close to the
surface for underground mining. These technological developments were supported by the increasing international significance of the coal industry during the era of the worldwide oil crises from 1973 onwards. The Chamber realised that surface coal mining would easily become a sensitive and potentially costly environmental issue, even when coal provides about 75% of the energy requirements of the country. The aim of the document was to supply guidance on returning the mined land to its original condition. This guidance included measures to stabilise the ecology, and aesthetic considerations on blending the rehabilitated land in with the natural surroundings. These recommendations on the establishment of a stable ecological condition and surroundings that did not differ from nature, could however, not be fully complied with. No yardsticks for the comparisons were given, probably because there were none. There is therefore a need to devise such evaluation indices.

These Guidelines (Chamber of Mines 1981:v) also stipulate that the costs involved in the attainment of proposed rehabilitation standards will be added to the cost of the coal being mined, and will be borne by the energy consumer. The consumer indirectly pays for rehabilitation expenses, but the reduced profits after the deduction of these rehabilitation expenses also affect the other stakeholders such as the suppliers of the financial means who receive lower dividends, and labourers who have to settle for lower wage increases. Less damage would be passed on to the natural environment and future generations. All interested and affected groups in the value chain are therefore involved in the distribution of rehabilitation expenditure.

This document further recommends an equilibrium between the high standards of rehabilitation and the cost of such actions. These Guidelines also make provision for evolutionary aspects of rehabilitation management as technology develops and as further experience is gained over time. This principle of making provision for changes and improvements is a core ingredient of quality management as defined by Deming and quoted by Riahi-Belkaoui (1993:3).

These Guidelines prescribe all the actions that should be taken, beginning with pre-mining surveys, including a layout plan, a rehabilitation programme, water control, purification and impact plans, soil levelling schemes, erosion minimising plans, selection of vegetation and the establishment of suitable covering materials. There are also guidelines for the maintenance and monitoring of rehabilitation management plans. In
order to obtain certificates of closure, at cessation of mining activities, the mining company must comply with legal requirements in respect of the demolition of structures and other prescribed issues. This Handbook with Guidelines by the Chamber of Mines is a definite first step towards the development of the concept of the "balanced scorecard", where the traditional short-term management accounting systems are linked to long-term strategies (Kaplan & Norton 1996:75). (Refer to Chapter 8 for a discussion of "equilibrium objectives".) This is a cost phenomenon that cannot yet be defined precisely, which existed over the centuries, and which needs to be identified and evaluated.

A list of the various Acts of Parliament that have a bearing on the rehabilitation of surface mining is provided in Section 1 of the Guidelines. The list includes the Mines and Works Act (27 of 1956), the Water Act (54 of 1956), the Atmospheric Pollution Prevention Act (45 of 1965), the Environmental Planning Act (88 of 1967), the Soil Conservation Act (76 of 1969), the Subdivision of Agricultural Land Act (70 of 1970), the Mineral Laws Supplementary Act (10 of 1975), and the Physical Planning and Utilization of Resources Amendment Act (73 of 1975). This list emphasises the complicated task of mining management in rehabilitating worked-out areas.

This Handbook of Guidelines was supplemented in 1983 by the Handbook of guidelines for environmental protection, which revised and extended Volume I of 1979 (Chamber of Mines). The aim of this publication was to design guidelines for environmental protection around the "best practicable means" approach for local circumstances, costs to be incurred and their practical implementation. Guidance is given on the design, operation and closure of residue deposits for metalliferous and coal mines.

As awareness of rehabilitation management increased, another set of guidelines, sponsored by the Chamber of Mines, followed in 1985. They deal with water pollution due to coal mining activities (Hodgson, Wagner & Shipman 1985). Since coal is normally extracted by surface mining (85%-90%), and at depths of up to 200 metres in South Africa, geological, hydrological and ecological disturbances could more easily and visibly develop as a result of coal mining operations.

At the Tshikondeni coal mine in Venda there is evidence that Iscor has already realised the importance of environmental management. Coal mining activities which commenced
in 1983 were preceded by thorough environmental impact assessments (Iscor News 1988:4). The mining of iron ore started in 1930 at Thabazimbi when the Department of Mining seconded an officer to Iscor, and mining operations by Iscor at Sishen began during the 1950s. Iscor News (1988:1-4) reports that at both sites ancient engravings and other objects of cultural-historical value were found and preserved for posterity.

2.2.3.6 Iron ore

At Thabazimbi the millions of tons of mining wastes that have been dumped on the slopes of the mountain outside the town for more than forty years have recently appeared to create a danger for the inhabitants. During heavy rainfall these unstable wastes are inclined to rush down the sides of the mountain and cause extensive damage to the town below. According to Rapport (1997:6) damage during the preceding twelve months was estimated to amount to hundreds of thousands of Rands. This mining rubble was dumped on the mountainside long before there was a possibility that a town could be developed on the lower slopes, and that houses might be built on the slopes of the mountain. It seems as if in the long-term planning in respect of the dumping of mining wastes, and in the town development planning by the town council, the possibility of the latent dangers posed by these wastes if housing were to be established in that area, was not foreseen.

The rehabilitation of worked-out sections of mines, dust control and the re-use of abandoned mining structures have not always been critical issues in the recent past. Hocking (1983:129) describes the mining activities by the end of the 1950s in the manganese belt in the vicinity of Lohatla as red dust clouds marking the iron ore handling plants, and deep canyons where manganese had been stripped from the lower layers. The iron ore mine at Sishen was an ever-expanding hole in the flat countryside, while abandoned workings of one of the manganese mines lay to the north. In an effort to obtain maximum financial profit over a short period from the countryside, extensive damage was caused to the natural environment at the cost of future residential, recreational and nature areas. Non-financial and long-term gains in the form of aesthetic appeal and the conservation of natural habitats were not given high priority in management accounting information and in decision making.
2.2.3.7 Involvement of authorities

The State realised that a definitive policy for the environment should be established and the Council for the environment was formed in 1982 in terms of the Environment Conservation Act (100 of 1982) (Ridl 1990:77). The objective was to coordinate all actions directed at, utilising or having an influence on conservation. Under existing legislation during those years, should the minister wish to prevent mining which might have such serious consequences for the environment that he would deem it preferable not to allow mining to take place, that decision should be reached prior to the granting of a prospecting permit to the applicant, which could not occur in practice (Ridl 1990:78).

According to an agreement between the Chamber of Mines and the State, rehabilitation where mining operations ceased before 1956 is the responsibility of the State. Where operations ceased between 1956 and 1975 the original owners are responsible for rehabilitation, although the state will be responsible if the mining companies no longer exist. After 1975 the responsibility for rehabilitation rests with the owner (SA Mining, Coal, Gold & Base Minerals 1993a: 19). Richter (1993:26) emphasises that the Mines and Works Act of 1956 through Regulations 5.12.1 and 5.12.2 required only opencast mines to submit rehabilitation programmes, sitting out how rehabilitation would be done, for approval. The only penalty for default was R300.

Although the Mines and Works Act of 1956 and the agreement with the Chamber of Mines make provision for the State to intervene and rehabilitate worked-out mining areas when the original owner company or individual has ceased to exist, the taxpayer ultimately has to carry the cost of those operations. The question therefore arises whether quality cost management is really being applied.

The Atmospheric Pollution Prevention Act was signed in April 1965. Whereas the existing Mines and Works Act of 1956 only made provision for the safety and health of people directly involved in mining operations, this new Act also took into consideration the health of the general public. Dust control is being dealt with in Part IV of the Act, which stipulates that any person depositing more than 20 000 cubic yards (15 267 m³) of matter that causes or may cause a dust nuisance should take the appropriate steps to prevent such nuisance. The Act further states that in the event of the depositor being deceased or having ceased to exist, the State will organise for the prevention of pollution,
and will also direct that the cost involved be paid by the State, or by the appropriate local authority, or by the owner in the proportion that the Minister may decide. The requirement regarding the prevention of dust pollution in the air, especially when the mining operations cease at the closure of the mine, means that the mining company has to make provision by putting aside an adequate sum of money to finance the prevention of pollution as and when required (Grange 1973:70-71).

As far as planning is concerned, long-term future developments for an area should be taken into consideration before starting dust-control operations. To avoid fruitless expenditure of cost and effort, development planning for projects such as new townships, railways and roads should be investigated. In addition mining companies must bear in mind that new legislative measures may be introduced to prevent future environmental damage and to enforce the cleaning up of previously dumped waste materials. Another factor is that much higher fines and penalties for ignoring these measures could be applicable in future.

2.2.3.8 Changing attitudes and practices

The enormous extent of the coverage of usable land by worked-out mine dumps and slimes dams was not always realised, as each individual mining group functioned on its own, and probably did follow a holistic approach. Grange (1973:67) estimates that by 1973 more than three thousand million tons of rock had been excavated from the depths of the earth and processed in the extraction of gold, and practically all of this rock ended up in the form of sand dumps or slimes dams on the surface. On the Witwatersrand alone he estimates that there are 6 800 hectares of slimes dams and 1 200 hectares under sand dumps. This land could be advantageously used in an already over-populated region for purposes such as housing, industries, agricultural activities, and recreational, educational and health facilities.

In later years, however, the situation changed as mining companies the world over started to become conscious of environmental concerns, and realise that they had an obligation to guard against pollution of land, water and air, and implement noise control. Iscor, for example, has its own farm at Sishen to provide milk, meat and other products to workers. Iscor also developed one thousand hectares as the Sishen Reserve. This area houses game and has ponds for fishing and picnic areas (Hocking 1983:167-8). Iscor took the lead in
the profitable recovering of usable fine coal from slimes dams at Durnacol (SA Mining World 1990: 47). Coal that could not be consumed during the fifties and sixties is recovered for use as coking coal.

While mine dumps did create dust, health and aesthetic problems, in later years they were able to yield millions in terms of reclaimed gold and other precious commodities. Around a hundred years ago when the available technology for the extraction of gold was limited, it was not possible to extract all gold. On the Witwatersrand, especially, where the mine dumps are much older than those of the Free State, up to one gram per ton has been reclaimed since 1976 from previously worked-out mine dumps. In addition to specialised plants like Ergo, Village, Benoni, Knights and Rand Mines Properties, other gold mines also supplement their incomes by reclaiming old mine dumps. F & T (1993:43) further reports that the extraction of gold from worked-out dumps yielded more than 14 tons of gold during 1992, representing about 2.4% of the country’s total gold production of 600 tons.

Operating costs to reclaim gold from worked-out dumps vary between R8 per ton for Ergo and R33 per ton for Village. But the average operating costs for the underground extraction of gold amount to approximately R132 per ton of ore. Operating costs for reclaiming sand dumps not only compare favourably for mining companies, but the procedure also encompasses other benefits to the community. Valuable land for the development of industries and housing becomes available as wastes from reclamation processes are pumped back into the old mine workings. At the sites of the Benoni company waste materials are disposed of by means of a pipeline which carries them to a site about 18 kilometres away. When Knights and Simmer & Jack amalgamated, the group estimated that industrial land worth at least R120 million could be made available over the following ten years by reclaiming old mine dumps (F&T 1993:43).

Reclamation of gold from worked-out mine dumps provides the mining community with profits, but also creates an opportunity for them to return land to the broader community who originally owned the land and to create employment. Treatment of a sand dump could provide work for up to 110 people over a period of 14 years (SA Mining World 1988:52). Some aspects of quality management are present, such as the furthering of the interests of the people in the living and working environments by rectifying the erroneous treatment of mine dumps inherited from the past. These correction of past errors coincides
with the improvement phase in total quality management as described by Juran (Riahi-Belkaoui 1993:4), which involves the reaching of higher quality levels than those that have already been achieved.

Other positive developments in respect of the prevention and control of mine-related pollution also occurred during the second half of the period under discussion. As a result of the growing consciousness of the environmental damage caused, criticism was expressed in 1973 at a planning conference of the South African Institute of Mining and Metallurgy (SAIMM) on the subject of the disregard of environmental issues by the profession, and the Environmental Planning Professions Interdisciplinary Committee (EPPIC) was consequently formed in 1974. The SAIMM was a founder member of EPPIC and has since been represented on the central committee. Membership of EPPIC is open to professional institutes whose members are involved in activities which could have a significant impact on the environment. In 1990 EPPIC formulated its mission statement, policy and strategy towards the environment. (Journal of the SAIMM 1993:11.)

Owing to their short-term view of worked-out mine dumps, management in the past regarded them as liabilities or negative assets that would need money spent on them if they were to be kept in an acceptable condition. From a strategic point of view these mined-out dumps were future assets that would be utilised after the development of technological expertise that did not exist at the time of their formation. Costs incurred in the preservation of these dumps in the past were actually incorrectly allocated to the final products, or incorrectly deducted from profits. In other words consumers and shareholders were already being penalised for the preservation of a future production resource.

2.2.3.9 Growing awareness of the importance of water quality

Formation of slimes dams and mining activities have an enormous financial and non-financial impact on the quality of inland waters. Rudd (1973:184) gives the causes of pollution as the exposure and removal of unwanted minerals from areas where they have been covered for millions of years and have now been brought into contact with air, water and sunlight. The crushing and grinding of the solid rock as it occurs in nature to a finely ground sand or powder increases the surface considerably and the minerals become
relatively far more reactive. As the Witwatersrand is more densely populated and has a humid climate, the pollutant effect of slimes dams and mining in general on water streams can immediately be felt by many people. Pyrite \((\text{FeS}_2)\) and fluorspar \((\text{CaF}_2)\) are the two main minerals that have probably had the biggest influence on water pollution in South Africa. Where pyrite is usually associated with the mining of gold and coal, fluorspar occurs during the mining and processing of fertiliser, as well as in small quantities in some coal and iron ores. Numerous sources of drinking water contain levels close to the maximum level considered safe. The siting and design of slimes dams can to a large extent reduce or eliminate the pollution of underground water supplies. These techniques include thorough geological investigations before siting slimes dams, the use of special milling and sorting methods to provide correct slimes for the inner lining and for the stability of the outer structural portion, and the design of the correct shape and slopes of the dams so that flora can easily be established. Rudd (1973:186) further states that flood water run-off can rapidly minimise the pollutant effect by diluting and self-purifying the water in a river, as is especially noticeable in the Natal rivers. His investigations found that the pollutant impact of slimes dams and mines is not only restricted to the Witwatersrand, but that large parts of the country are directly affected, as most of the pollutants end up in the Vaal river. This river also provides water for household purposes and industries throughout most of the Free State and parts of the Northern Cape.

Drinking water criteria form an important non-financial indicator for the evaluation of environmental and rehabilitation successes. The limits set by the CSIR (Kempster & Smith 1985) for aesthetic or physical and inorganic chemical determinants in drinking water are categorised as a “recommended” limit, a “maximum permissible” limit and a “crisis” limit, defined as twice the maximum permissible limit. Previously, limits at which drinking water would become poisonous as well as margins for the evaluation of water for human consumption were compiled (Henzen & Stander 1962). These figures also provided an indication of the non-financial results of environmental and rehabilitation policies. Management of water quality coincides with quality environmental management and the bases are pollution prevention, impact minimisation, management of the assimilative capacity and management of the symptoms of pollution (Quibell, Van Vliet & vd Merwe 1997:195).

Rainfall run-off from mine dump surfaces causes erosion, but also dissolves substances like acids that may cause pollution of underground and surface water sources. Both
financial and non-financial effects of water-pollution control measures and dust-control work should be coordinated in the original planning strategies. These would include construction and engineering work before dumping commences as well as for the duration of dumping activities to control run-off water. On older dumps considerable financing of earthwork is required where structural failure and erosion have necessitated the reshaping of dumps. Grange (1973:72) records that the Johannesburg City Engineer’s Town Planning Department has a special division for the coordination and planning of old mining areas, and that their major task is to establish priorities for the work to be done. At all abandoned mines this task falls to the Government Engineer. There is an effective liaison between the government, local authorities and the mining industry as far as water and dust control matters are concerned. During the 1960s the Department of Health began to assist the Department of Mines by financing dust-control measures on the dumps of mines that ceased to operate prior to the Atmospheric Pollution Prevention Act of 1965. In accordance with the Water Act of 1956, the Department of Water Affairs also finances work on the control of water pollution.

2.2.3.10 Conclusion

The situation in respect of the management of mining waste and environmental management in the history of the mining industry, would have been very different if today’s compulsory procedures had been enforced. These procedures compel mining companies to determine the impact of potential development projects on the natural and living environments before the actual launching of mining operations. Steenkamp (Smit 1991:18), former president of the Chamber of Mines, can rightly be quoted in this regard:

... at times, mining in South Africa has been done with a degree of insensitivity to the environment, particularly when one considers all mining, including smaller shoestring operations.

The period from 1920 to 1985 was characterised by the progress from the post-war depression and associated low levels of awareness of the ecological impacts of mining activities to the development under the aegis of the Chamber of Mines of practical guidelines for rehabilitation and environmental policies. Both financial and non-financial issues were included in these guidelines. The exploitation of natural resources for short-term financial gain only was gradually and partly replaced by a long-term vision based
on both financial and non-financial implications for all stakeholders, including the natural environment and future generations. Forethought and planning were recognised as the basis in minimising the effects of disturbances caused by mining operations (Mining Survey 1989:33). During this period a behavioural and cultural basis for rehabilitation management accounting evolved which should be utilised for the expansion of information provision and for improved management decision making. Long-term comprehensive planning and strategies should, however, be encouraged and allowed to develop further in future.

2.3 1985 - 1999

2.3.1 Introduction

The most important event of this period was the movement in support of rehabilitation management in the mining sector. This movement gained momentum and culminated in the Minerals Act (50 of 1991), Chapter VI, and the Minerals Amendment Act (103 of 1993). Underlying this movement was the increasing awareness of the disturbance of the immediate natural environment by all parties involved in mining activities, from management which noticed developments in other countries, to miners who wanted to hike or fish in the outdoors (SA Mining, Coal, Gold & Base Minerals 1993a: 19). This sense of awareness was reinforced by the disaster at Merriespruit in 1994. Sectors of the community appeared to reach the very important realisation that a portion of profits should be put back into the rehabilitation of areas damaged in the course of obtaining such profits.

Mineral rights have been separated from the land to which they belong from the earliest years of formal mining in Southern Africa. The owner of the mineral rights had the implicit right to damage the land surface to exploit its riches. The minimum effect on the environment would be the disturbance of the surface, or the pollution of the atmosphere or water sources, or the occupation of the surface by mining-related structures, or the disturbance of community life, or the destruction of vegetation and wildlife. Wherever mining takes place there are three main parties involved. Because their rights inevitably conflict, protective legislation is needed. As the first party, the holder of the mineral rights utilises his right to extract the minerals, but in the meantime infringes on the rights of the second party, the surface owner, who is entitled to the full use of the surface. The
third party is the community, which has the right to enjoy a natural environment consisting of clean air, clean water, nature’s undisturbed beauty, living space, and tranquillity. Land and water are the most important natural resources in the country, because they are scarce and because they are needed to sustain the human population, who are too numerous and depend on the natural resources for their livelihood and for their continued existence. The Government, which is the guardian of the rights and assets of the people of the country, was compelled by these infringements to take steps to regulate these interactions and to ensure that disturbed land was rehabilitated (Richter 1993:25).

In addition to laws regulating the conflicting financial and non-financial interests of all stakeholders, these differing interests and rights need to be identified, measured, evaluated and balanced. A method of measurement that does not rely on monetary value should be found, especially as the holder of the mineral rights is allowed to cause a certain amount of damage to the property of the surface owner. An example of differing interests is found in the mining of titanium at St Lucia. After R5 million had been spent to inform and convince the public that they would eventually benefit through mining activities in that area, the mining company was able to continue with excavating and rehabilitation activities (vd Westhuizen 1996:2). This provision of information to enable interested and affected groups to make informed decisions forms the basis of the function of the management accountant.

Even when it was possible to rehabilitate the surface so that it was in the same condition as before the mining operations commenced, the volume underneath the surface would have lost some of its metals and minerals and in effect the surface owner would have lost value.

2.3.2 The Minerals Act 50 of 1991, as amended by Act 103 of 1993

In the past money was provided in the budget during the life of a mine to achieve the goals of following the most profitable method of exploiting the minerals and also ensuring the safety and health of employees. Financial capital was provided to develop and utilise the best geological and technical knowledge available to bring the planned mining projects into production, and to ensure that the best procedures were followed for the health and safety of workers. According to Richter (1993:26), little or no attention
was paid to the rehabilitation of the natural environment of mines. When a mining company or operator on a smaller mine went bankrupt or disappeared without rehabilitating the mine, this would give rise to enormous problems for the Department of Minerals and Energy Affairs. An equilibrium should be found, and the importance of rehabilitation, together with maximum profits, and the health and safety of workers, should be realised.

Rehabilitation and environmental managers should be well-informed about a wide selection of regulations and legislation, or at least have experts in that field available for consultation. A major factor which influences environmental expenditure is legislation and regulations. Many categories of environmental costs are related to legal fees, penalties, fines, and repairs owing to a lack of compliance with regulations. Knowledge and information could eventually prevent major disasters such as the one at Merriespruit, where neither the Minerals Act nor the Water Act was adhered to.

The Minerals Act (50 of 1991) is based on the principles of ensuring the safety and health of workers at mines, regulating the orderly utilisation of the surface of the land, and rehabilitating the land disturbed by mining and related activities. These principles are equally important in the administration and application of the Act. The Minerals Act of 1991 became law on 1 January 1992 (Richter 1993:25).

Chapter VI deals specifically with the rehabilitation of the surface of land (section 38), the environmental management programme (EMP) (section 39), the removal of buildings, structures and objects (section 40), limitations as to the utilisation of the surface of the land (section 41), and the obtaining or purchase of land and compensation under certain circumstances (section 42).

Section 38 stipulates that the rehabilitation of the surface of the land shall be carried out by the holder of the prospecting permit or mining authorisation concerned, in accordance with the approved rehabilitation programme, as an integral part of the prospecting or mining operations, simultaneously with these mining activities, and to the satisfaction of the regional director. When there is a possibility that the owner may discontinue operations within the following five years, he may not sell any mining assets without the certificate of approval of the regional director. The certificate of approval will only be issued when appropriate provision has been made for the rehabilitation of the mining site.
According to this section, the holder of the prospecting permit is responsible for the rehabilitation of the surface of the land, and this holder must exercise this important responsibility before any certificates of approval will be issued.

According to section 39 (50 of 1991), an environmental management programme must be submitted by the holder of the prospecting permit or mining authorisation concerned, and approved by the regional director before any mining operations can begin. The environmental management programme should include a layout plan and rehabilitation programme in respect of the surface of the land in prospecting or mining operations or such intended operations. The director may also require that an environmental impact study be conducted by a professional organisation, appointed by the director, in respect of the intended mining activities. Subsection (5)(b) stipulates that all costs incurred in respect of the environmental impact study must be carried by the holder of the prospecting permit or mining authorisation. Here, too, the holder of the prospecting permit is responsible for the submission of the environmental management programme, and the director supervises to ensure that this important responsibility is fulfilled.

Section 40 deals with the removal of buildings, structures or other objects which were constructed in connection with prospecting or mining operations on the surface of the land concerned. When a prospecting permit or mining authorisation is suspended, cancelled, terminated or lapses, and the prospecting or exploitation of any mineral which was authorised under such permit or authorisation finally ceases, the person who was the holder of that permit or authorisation immediately prior to the suspension, cancellation, termination or lapsing, shall demolish all buildings, structures and other objects which were constructed for mining operations. All debris must be removed. As far as possible the surface of the land must be restored to its natural state, within a predetermined period, to the satisfaction of the regional director. Such demolition or removal shall not be applicable to buildings, structures or objects which may not be removed or demolished in terms of other laws, or when exemption has been granted by the director, or when the owner of the land wishes to retain some or all of these and this has been agreed upon in writing with the holder of the mining rights.

Section 40 does not exactly stipulate what is meant by the restoration of land to its “natural state”. It is, however, impossible to achieve such a state, even at the surface. Some evaluation criteria are needed to compare the usefulness of land before and after
mining operations, and determine what purpose land could serve in future. Mined-out coalfields, for example, could never again be utilised for the extraction of coal, but could be transformed into recreational or wildlife areas. A fine not exceeding R5 000 and/or one year of imprisonment may be imposed under sections 38, 39 and 40.

The rights of the surface owner are protected in section 41, in which provision is made for the regional director to regulate the orderly use of the surface. Any damage caused to the surface, vegetation, natural environment or water resources must be kept to the minimum. The position of the owner of the land must not be worse after mining operations than before the commencement of those mining activities.

In section 42 provision is made for the compensation of the surface owner if the mining operations prevent the proper use of his land, or render the farm an uneconomic farming unit. Included in this compensation is provision for rehabilitation that has already been done or must be done ((3)(b)(i),p1064).

In terms of the Minerals Act 50 of 1991 each mine is under an obligation to make financial provision to cover rehabilitation costs from the outset and maintain such provision until the final closure of the mine. These trust funds will be security against sequestration. According to Richter (1993:28), such funds have already been registered by most large mines and mining groups, but this would not be an appropriate solution for small mining operators.

The objectives of Act 50 of 1991, Chapter VI, and the Minerals Amendment Act 103 of 1993 link up with total quality management in the sense that the legislation is aimed at improving management and managerial responsibilities. This Act adds rehabilitation management of the surface of mining land to the existing issues of profit maximisation and the health and safety of workers, and gives equal priority to all three of them. The interests of the community, especially in connection with the natural and living environments, should therefore be included in long-term quality management planning, as the responsibilities of management expand in the direction of ensuring the wellbeing of present and future generations. Point one of Deming’s fourteen points on total quality management, as quoted by Schonberger and Knod (1994:27), emphasises the importance of a continuous drive towards improvement of a product or service to enable a company to become competitive and stay in business, as well as to determine to whom top
management is responsible.

According to this Act equal priority would be given to the seemingly conflicting issues of profit maximisation, the safety and health of workers, and the rehabilitation of the surface of land. The costs involved in the latter two issues should be weighed against the benefits of the higher satisfaction of labour and the consumer or community. An evaluation index should be found to compare monetary input with the non-monetary factor of human contentment.

The empirical study included a further study of the effects of Act 50 of 1991 (Chapter VI), as amended by Act 103 of 1993. The influence on management programmes in respect of the rehabilitation of worked-out sections of mines, mine dumps and disturbed land after the introduction of the Act was researched.

The new 1991 legislation should limit future environmental damage, but cannot, however, rectify the poor decisions taken in the past. A mining journal (SA Mining, Coal, Gold & Base Minerals 1993a:19) quotes M Gouws of the Department of Mining Engineering of the University of the Witwatersrand in this regard. He stated that “mine dumps are an unfortunate but necessary result of mining but a fault that will have to be accepted, for at least the time being.”

2.3.3 Towards improved rehabilitation management

During this period investments in clean-up operations and the rehabilitation and vegetation of slimes dams and waste dumps continued. Since 1986 asbestos dumps near Pietersburg and at Prieska have been successfully reshaped, rehabilitated and vegetated. About two hundred unemployed local people were employed to vegetate these dumps over a period of six years, at an annual expense of R2,5 million. The production of asbestos, however, kept on declining and by 1988 approximately 40% of the peak production of 1977 was reached. Because of its distinctive properties, asbestos cannot be replaced economically in many applications. Neither the European Economic Union, nor the International Labour Organization, nor the United States of America is against the production of asbestos under the present strict safety controls and standards, which comply with international standards. Better rehabilitation methods and more suitable vegetation were also developed to improve the existing situation in respect of the mined-
out dumps of previous decades (Journal of the SAIMM 1988:195,198).

Where coal discard is being generated at a rate of 50 Mt annually, one billion tons of coal discard could be accumulated by 2000. Discard coal amounts to 20% of run of mine coal, and amounts to 35% if unbenefficiated coal used at Sasol and Escom were to be included. In an effort to combat this problem, strategies are being developed to prevent, control and reuse discard (Krige 1996:10). The basis of these strategies is to find solutions that are market-related and free of public funding. Preventive measures include the investment in and implementation of advanced overseas technology to reduce fine discard. Control measures are aimed at strict adherence to laws and regulations, improved dump designs and investigations to reclaim compacted dumps. Regarding the utilisation of discard, databases are compiled on the characteristics of the contents of these dumps and their reuse is encouraged. There will also be opportunities in future for small-scale entrepreneurs to develop fuel products from this discard.

Another major contribution to improved rehabilitation management took the form of investments to build a treatment dam to prevent the sterile inflow of water from the Klipspruit into the Loskop Dam. Acidic mine drainage enters the river, coming from mines that ceased operations more than 40 years ago (SA Mining, Coal, Gold & Base Minerals 1996c:41). Improved water quality in that region would lead to increased economic activity, resulting in a better quality of life for the inhabitants.

Criteria for the discharge of excessive polluted water from coal mines evolved from no set criteria during 1995/1996 to stringent permit conditions during 1998/1999 (Christie 1999:6). The first defined criteria during 1996/1997 stipulated that discharges should be based on the quality of the water in the dam downstream. The mines had to allocate polluted water to subcatchments where samples were taken before discharges into the river system were allowed.

To make them more effective (choice of appropriate objectives) and eventually more efficient (minimising of costs of resources) (Kabat 1983:41), rehabilitation projects are contracted out to external waste management companies. In this regard Fraser Alexander applied the expertise of its team of specialists to rehabilitate burning coal dumps into rolling hills (Bennetts 1992:15). When mining companies have been dissolved and have left behind old discard dumps, third parties such as the state undertake to bear the costs
of cleaning up these abandoned areas. Another example of the utilisation of external organisations is the seeking of advice from a recently formed specialist organisation to combat radiation pollution when operations reach the end of their economic lives and after closure of mines (SA Mining, Coal, Gold & Base Minerals 1996: 43). In this regard Van Blerck (1994:132) propagates the establishment of an environmental body by mining companies to rehabilitate, and demolish and remove structures after closure, as a financially sound and tax-effective way to provide for future environmental rehabilitation.

Background knowledge about the taxation implications of rehabilitation expenditure should also form an integral part of the portfolio of the management accountant in rehabilitation leadership, even though environmental taxation forms a separate study as such. The stakeholders in the extended enterprise have a contribution to make towards rehabilitation management, each one in a different form. They include the capital providers, future generations, labourers, consumers, creditors, suppliers, recyclers, and the authorities who collect tax and promulgate legislation. For taxation purposes a distinction is made between environmental capital expenditure and rehabilitation costs incurred as part of the operating process (Van Blerck 1992:11-30). The latter are deductible from current income, whereas depreciation allowances can be deducted for capital expenditure. A situation might, however, occur where closure expenditure would be more than the taxable income for the same period after termination of excavating operations. Repetitive capital expenditure, however, does not qualify as expenditure incurred as part of ongoing operations (SA Tax Cases & Reports 1996:26). Expenses are deductible from taxable income relating to rehabilitation and protection of the surface of the land, as well as the demolition and removal of structures to restore the surface as far as is practicable to its natural state (KPMG Aiken & Peat 1993:48).

2.3.4 Involvement of authorities

The importance of integrated environmental management evolved and manifested in the form of a series of guidelines prepared by the Department of Environment Affairs (1992). The first document in the series explains the integrated environmental management procedure; while the third document gives guidelines for reporting requirements.

Among the developments around legislation in regard to environmental management is the Green Paper of 1996 on an environmental policy for South Africa, for public
discussion, by the Department of Environmental Affairs and Tourism. On page 71 of this document it is emphasised that integrated environmental management and planning will be prerequisites for government approval of all activities and operations that may possibly have an adverse effect on the environment. Management tools that may be used in securing integrated environmental management and planning include integrated environmental management (IEM), environmental impact assessment (EIA) and risk assessment. The purpose of these requirements is to give decision-makers adequate financial and non-financial information with details of the possible adverse effects of their proposed activities, as well as possible policies, programmes and alternative actions. During this process of decision making the participation and influence of stakeholders must be ensured.

This Green Paper was followed by a White Paper in July 1997. Legislation on an environmental policy for South Africa was promulgated on 27 November 1998 in the form of Act 107 of 1998, the National Environmental Management Act. This Act is based on the Bill of Rights in the Constitution (section 24), which provides that “everyone has the right to an environment that is not harmful to his or her health or well-being”. The responsibilities of the authorities are described as “the State must respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the basic needs of previously disadvantaged communities”. With this broad attitude on the part of the State in mind, the management accountant should promote sustainable development by means of “the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations”. The objectives of this Act are to provide “reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.

In principle the “costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment” (s2.(4)(p)). According to the White Paper of 1998 (22), full cost accounting should be implemented and this includes the recording and analysis of all relevant environmental information. This means that decisions should be based on
financial and non-financial information originating from all social and environmental inputs and benefits of strategies and activities that have an impact on the environment, some of which were not traditionally visible. Environmental implementation plans as well as environmental management plans are required (Chapter 3, Act 107/98). Provision is also made for international obligations and agreements regarding environmental management (Chapter 6, Act 107/98). According to regulations (R1183 of 1997, September 5) adding to the Environmental Conservation Act (No. 73/1989), plans for environmental impact assessments are required. A definitive trend is developing here in that the management accountant is required to contribute towards environmental and rehabilitation management decision making through the provision of adequate information.

An important further development, particularly regarding mining and rehabilitation activities, was the publication of a White Paper on a minerals and mining policy in South Africa in 1998. It discusses various aspects regarding mineral development as well as the people involved in mining activities. One section is devoted to environmental management in particular. On page 19 of the White Paper small-scale mining is encouraged because “small-scale mining has the potential to take over and mine economically where large-scale mining is unable to operate profitably”. In addition the “development of small-scale mining alongside mining in underdeveloped regions would also increase the portfolio of minerals being produced…”.

In view of the enormously devastating effects of small-scale mining on the natural environment and on the quality of life of these miners in the rest of Africa, small-scale mining should not be encouraged. Small-scale mining of coal, for example, in underdeveloped regions could easily result in people excavating just enough coal for heating and cooking purposes for daily needs. When all the easily accessible coal has been dug out, they would be too poor and would lack adequate knowledge to rehabilitate the damaged area.

During 1997 the Department of Environmental Affairs and Tourism committed itself to a programme for the further implementation of Agenda 21. This document was an offshoot of the “Rio Declaration on the Environment and Development” in 1992, which reflects global consensus and political commitment on developmental and environmental cooperation. On page 17 of Agenda 21 various projects are identified for the development
of sustainable development frameworks. This document accepts the challenge to move towards the integration of social and environmental costs with economic activities, so that prices can reflect the relative scarcity and total value of natural resources and contribute towards the prevention of environmental degradation. The objective is given on page 16 which is to change the tendency to treat the environment as a free good as well as the tendency to pass environmental costs on to other parts of society, other countries and future generations. Eventually the existing system of national economic accounting would be expanded to integrate environmental and social dimensions into accounting and similar systems. The contribution of natural resources would be more adequately evaluated and taken into account in decision making.

The authorities increasingly apply the principle of “the polluter pays”. This means that “those responsible for environmental damage must pay the repair costs, both to the environment and to human health, and the costs of preventive measures to reduce or prevent further pollution and environmental damage” (Joubert 1999:21).

2.3.5 International and national standards

As environmental management has become an important element of management decision making, national and international standards are prepared, and certificates issued to meritorious enterprises. In this regard the SABS recently became involved in the development of the ISO14000 series of the International Standards Organisation (Fourie 1997:9). Some of the management tools included in this ISO14000 series are environmental management systems, environmental auditing, environmental labelling, environmental performance evaluation, and life cycle assessment and analysis.

SABS ISO9000 on quality management and continuous quality improvement includes environmental measures relating to quality which stakeholders require to be implemented. Where ISO9000 facilities already exist, ISO14000 could be relatively easily introduced into the system. The many similarities between these two international standards systems form the basis for integration, although provision should be made for differences (Nel 1997:18). The facilitation of both these series of international standards as well as the promotion of continuous quality improvement would enhance the competitive advantage of these companies. In this regard Phoscor was the first South African mining company to obtain ISO14000 accreditation - in 1998 - after the
introduction of the initial stages of this comprehensive environmental management strategy during 1993 (Sake-Beeld 1998:4). ISO9000 accreditation for all the activities of this mine had already been obtained previously. The introduction of ISO14000 and ISO9000 is a giant step in the direction of quality management and rehabilitation management accounting in the mining sector in a globally competitive market.

2.3.6 Summary and conclusion

When the historical and existing practices leading to the present rehabilitation management situation in South Africa are evaluated, it is clear that the technical, cultural and behavioural attributes of a good environmental management accounting system (Ansari et al 1997b: MMEC-14) are still in the process of developing.

Education and training form an integral part of total quality management, and form the basis for rehabilitation and management accounting developments and continuous improvements. This is especially needed in the African context to improve technical, cultural and behavioural influences aimed at changing management accounting approaches. In this regard the Education Services Department of the Chamber of Mines has taken responsibility for training and educating mine employees in mine and surface environmental control (vd Berg 1990:E). Following the Merriespruit disaster in 1994, the Tailings Information Management System has been developed, its task being to upgrade the environmental performance of tailings dams (SA Mining, Coal, Gold & Base Minerals 1997:43). This system combines relative data-based management systems to provide reliable, timely and comprehensive information on the tailings facility. This information includes design, construction, installation, monitoring, maintenance and closure aspects in an attempt to educate, train and enable operators to make adjustments significantly more quickly and in a more cost-efficient manner.

The disposal of large volumes of polluted water remains a problem. Illegal midnight disposals into streams have been halted by the Department of Water Affairs (SA Mining World 1994:7). The disposal options of polluted water are limited to short-term solutions, such as the overloading of existing slimes dams, or to expensive long-term solutions. The siting of slimes dams in high-risk areas such as upstream from settlements, as at Merriespruit, could eventually cost R70 million in claims (Murray 1995:46), leaving aside the non-financial price that may have to be paid in the form of loss of life. In order to
save capital expenditure on water treatment, adequate funds need to be spent on the construction of dams according to stringent requirements, from the design stage to the rehabilitation stage. The unique nature of each individual tailings dam should also be taken into account. Initial planning and long-term strategies would eventually result in financial and non-financial benefits in the form of fewer penalties and a better quality of life for the interested and affected groups.

Techniques based on ancient mining practice, such as the use of backfill, were introduced into gold mining from the mid eighties onwards. The benefits of this method are experienced at many of these mines (SA Mining Coal, Gold & Base Minerals 1996a:23; Ryan 1997:24). Not only is the volume of discard on dumps reduced, but the cavities are also filled to a certain extent, reducing future rehabilitation liabilities in the process.

This period saw the promulgation of several important acts, most prominent of which was the Minerals Act of 1991. Other positive developments relating to quality rehabilitation management took place, such as the introduction of the ISO14000 series of standards, and improved methods for the vegetation of mine dumps and slimes dams. Other positive codes of conduct are reflected in the policy of companies like De Beers, which has stated that the environment forms an integral part of company business planning and operations (Bennetts 1996:42). Local regulatory requirements are fully applied as well as international procedures for environmental management. Special attention is given to the development of an attitude among employees at all levels of fostering ownership and being responsible for the environment.

During this period significant progress was made in the development of long-term strategies. But the culture and behaviour of inflating short-term profit targets (Johnson & Kaplan 1987a:201) by reducing rehabilitation expenditures pertaining to research and development, promotion, quality improvement, engineering technology, human resources and the external community are still found. The need arises to find broader and more comprehensive performance evaluation criteria for integrated long-term strategic goals, such as for rehabilitation input and gains. These models could be developed by management accountants from Kaplan’s “balanced scorecard” approach (Vermaak 1996:244).

In years to come some maintenance will have to be done, especially in respect of water
pollution. Another gap that needs to be filled is the development of measurement and evaluation instruments, by management teams that include accountants, in addition to the existing monetary ones for the comparison of sacrifices and gains in respect of environmental matters. No matter how effectively rehabilitation can be carried out at present, the possibility still exists that after decades the environmental and rehabilitation management of today might still have a negative impact on the environment. This dilemma could be overcome by means such as the development of life cycle costing, value chain costing and full cost accounting practices.

2.4 DISCLOSURE OF REHABILITATION TO STAKEHOLDERS

Public and accurate reporting on environmental performance is becoming an essential component of the business practice of many companies. Having high-quality environmental information readily available, as well as a framework for environmental indicators (SA Mining, Coal, Gold & Base Minerals 1996d:31) are helpful for decision making to integrate policies, environmental impacts and problem areas.

Although the internal and external disclosure and reporting of environmental and rehabilitation activities have been studied in depth by various scholars, this integral aspect of a comprehensive strategy on rehabilitation management for management accounting should be discussed briefly.

The importance of reporting on financial, environmental and social performance is increasingly being realised by companies, especially the bigger companies in South Africa. According to the 1998 survey of the Social Accounting Unit at the Department of Accounting of the University of Pretoria and KPMG (Bennett 1998:12) the top three companies are involved in high environmental impact activities. They are the mining companies Trans-Natal Coal/Ingwe Coal, Western Deep Levels and Samancor. According to this survey South African companies are still five to six years behind their international counterparts in developed countries. Although environmental and rehabilitation disclosure and reporting are not yet compulsory in the country, the following effects of inadequate environmental awareness are gradually being realised by management teams:

- International trade agreements could be restricted.
- Prosecution, cleanup costs and penalties could follow after contamination of the
natural environment.

- International pressure through the media, customers and investors could lead to higher rehabilitation expenditure if precautionary measures were not taken timeously.
- The public has the right to take polluting companies to court for threatening their rights to a clean environment under the Constitution Act.
- Public pressure could cause extensive damage to the image of companies mining in ecologically sensitive areas.

Since the sudden introduction of complete sets of rehabilitation and environmental information could be difficult and overwhelming, De Villiers (1996b:55) suggests that a phased introduction of various aspects of this type of disclosure and reporting be implemented. The target could be the disclosure of a larger body of relevant information annually.

With the objective of improving and harmonising the reporting practices of mining companies, the Accounting Practices Committee of the Chamber of Mines, in conjunction with the South African Institute of Chartered Accountants (SAICA), prepared a document on reporting in annual financial statements. This document provides guidelines on matters such as restoration and rehabilitation practices (SAICA 1995:14). When provision is made internally for environmental rehabilitation costs to be incurred after the cessation of mining operations, the provision should be reflected as an “Environmental rehabilitation reserve fund” that is a separate item in the balance sheet. When the other option, that of a dedicated environmental rehabilitation fund, is chosen, the method of providing for such funding should be disclosed as an accounting policy in the annual financial statements. All amounts incurred both on current environmental rehabilitation as well as amounts provided as internal funding or contributed to a dedicated trust fund for future environmental costs should be charged to the income statement as an expense item when these amounts are set aside, contributed or incurred. The method used to provide for future environmental liabilities should be disclosed in a note to the financial statements. This note should also give an indication of the adequacy of this method for the intended purpose.

In order to provide sufficient funds for future rehabilitation expenditure, SAICA (1995:15) suggests that the management accountant should re-assess the following factors
on an annual basis:

- current cost of future environmental rehabilitation operations
- estimated remaining life of mining operations
- current value of the internal provision, or trust fund

The provision for any particular year, or the trust fund contribution, can be estimated by subtracting the current value of the provision (factor 3) from the current cost of future rehabilitation (factor 1), and then dividing the result by the estimated remaining operational years of the mine (factor 2).

The system of disclosure and reporting of rehabilitation and environmental activities should be supported by a cycle of regular feedback. Information provided in these disclosure statements has to be applied in the process of continuous improvement and modifications. Environmental audits would be required to confirm this information (McCallum 1992:8) and to eventually make a difference to both financial and non-financial indicators in respect of inputs and gains.

It is not only official published annual financial statements that provide information on rehabilitation and environmental activities. Advertisements, especially in special supplements to relevant periodicals and regular financial publications, provide a wide variety of information. This information is usually communicated with accompanying high impact visual representations.

Although South Africa is still behind highly developed countries with regard to the disclosure of rehabilitation and environmental operations, progress towards improved approaches is being made in many respects. However, there is a need to report and disclose information on the use of natural assets, and the accumulation of natural liabilities. This information is necessary to make projections on future sources of income and prosperity.

2.5 SUMMARY AND CONCLUSION

To enable management accountants to obtain a holistic view of rehabilitation management in the mining industry, a knowledge of historical and existing rehabilitation
attitudes and practices in mining in South Africa is needed. Inherited ecological damage from mining operations of the past, as well as inadequate cleanup results, are reminders of mistakes in both financial and non-financial terms. This inherited damage could be ascribed to technical, cultural and behavioural perspectives (Ansari et al 1997b: MMEC-15). Some of these perspectives originated from virtually unchangeable beliefs and mindsets, while others developed out of a combination of factors. Such factors are fortune hunting on foreign soil, lack of advanced technologies, inability to make relevant decisions and to understand long-term environmental processes, and ignorance of the restrictions imposed on future generations by damaged land.

When measured against the cost, quality and time dimensions of strategic management accounting (Ansari et al 1997b:MMEC-2), traditional approaches towards total quality environmental management were absent in many respects. Adequate cost assessments in respect of the natural environment and natural resources were not made, resulting in the burdening of the wrong stakeholders, including future generations. These financial and non-financial evaluation concepts were not visible to management and were therefore not included in management accounting systems. The needs in terms of cost and time for the prevention of ecological damage and the maintenance of the natural environment were not calculated. Traditionally, the miner was not able to recognise the ethical principle of enriching oneself without placing other stakeholders (future generations and nature) in a worse position than before. These mistakes should be avoided by adequate management accounting strategies.

A knowledge of history also equips the management accountant with information on the influence of development trends on financial and non-financial rehabilitation and environmental policies. In South Africa in particular, the role of the central government in recent years has been rapidly expanding in the area of legislation to combat pollution resulting from inadequate rehabilitation practices. This tendency will continue in future. The informed and prepared management accountant should be able to timeously provide information to management to prevent future environmental costs in the form of penalties and extensive cleanup expenditure.

This tendency of legislation to increasingly prevent and combat pollution, particularly in the mining industry, follows in the footsteps of guidelines on pollution control issued by the Chamber of Mines in South Africa. In order for management accountants to make
projections regarding long-term strategies, it is recommended that they be informed about the actions of the leader in this sector, the Chamber of Mines.

Efforts to conform to international conventions and standards are increasingly noticeable in South Africa. Examples of these are accreditations for ISO14000 on environmental management and ISO9000 on total quality management. Companies not conforming to these standards might in future have to face international isolation.

The importance of using teams of experts as well as employing consultants was realised by some managers in the early days of mining in this century. These experts were mainly consulted about the covering of mine dumps. Another development is the cost-efficient contracting out to external companies specialising in rehabilitation projects. Apart from the principle of using experts in team context and on contracts, the benefits of benchmarking were applied in an informal way. Both the utilisation of experts and consultants, and networking by means of benchmarking, form an integral part of total quality management and of continuous improvement.

Seemingly conflicting situations still exist, however, in rehabilitation and environmental policies. Short-term financial profitability is often preferred to long-term gains in both financial and non-financial terms. The amount spent on the restoration of damaged land after the cessation of mining activities is still sometimes below the acceptable long-term minimum. Interested and affected parties such as the providers of money, labour and the natural environment do not share proportionally in yields from mining operations. The management team should be aware of these conflicting situations and should actively work towards finding eventual solutions. These efforts to find solutions should aim (Ansari et al 1997b: MMEC-2) at the achievement of ecological quality at the cost of affordable expenditure as part of long-term strategies. An example is the possibility that discard, such as small coal, that cannot be utilised at present could be safely preserved for future use.

Even though extensive environmental disclosure and public reporting of rehabilitation and environmental expenditure and gains are not yet required by legislation in South Africa, a tendency is evolving for major companies to set standards for disclosure policies. These disclosures through financial and published statements, advertisements and other media, cannot be introduced overnight, however. Management accountants should be aware of
the need to gradually introduce and reflect the various elements of rehabilitation and environmental information in the form of financial and non-financial input and gains in published statements. The goal should be to eventually have a full range of relevant information available to interested and affected groups.

The situation in South Africa regarding rehabilitation and environmental management is further investigated in the following two chapters. Information on the opinions of rehabilitation and environmental managers in the mining industry was collected by means of a survey in order to obtain a better view of attitudes and possible trends.
CHAPTER 3

DESIGN AND METHODOLOGY OF THE EMPIRICAL RESEARCH

3.1 INTRODUCTION

Chapter 2 contains a discussion of the need to improve the management accounting systems pertaining to the rehabilitation of the natural environment after mining excavation activities in South Africa. The historical and existing mining rehabilitation practices that have led to the present managerial attitudes and performances were investigated.

In order to obtain a better insight into the views and attitudes of mining environmental managers in respect of their opinions on rehabilitation management issues, an empirical investigation was also conducted. These opinions contribute towards a better understanding of the present situation in South Africa. This would include the awareness levels of individual rehabilitation managers regarding sound environmental practice and their willingness to support improved evaluation strategies. Knowledge of these opinions would form a basis for future positive developments in managerial rehabilitation accounting strategies in the mining industry.

The major objectives of this chapter are to describe the approach, methodology and design of the empirical research that was undertaken to obtain the opinions of environmental managers on their experience of rehabilitation management. These objectives include an analysis of the reasons behind the empirical study, as well as an account of the choice of the method of data collection. These analyses and choices culminated in the development of a questionnaire. This development included the testing, refining and modifying of the contents of the questionnaire. Both the population for the survey and the method of distributing the questionnaire were determined.

Further analyses and interpretations of the opinions obtained from the survey follow in the next chapter.
3.2 REASONS FOR AND APPROACH TO THE EMPIRICAL RESEARCH

In addition to the literature study and observations, it was necessary to determine the opinions of environmental managers regarding the application of management accounting procedures to the rehabilitation of mining sites. Their views form an integral part of the future implementation and success of changed management accounting systems. In order to gather information on these attitudes, empirical research was conducted.

“Opinion”, for the purposes of this research, is described as the “evaluation, impression, or estimation of the value or worth of a person or thing” (McLeod & Makins 1993:796). The “attitude” of rehabilitation management which was to be determined empirically, is described as “the way a person views something or tends to behave towards it, often in an evaluative way” (McLeod & Makins 1993:67).

This empirical research forms part of the total research exercise, the object of which was to obtain knowledge and answers to questions. The Collins Shorter English Dictionary (McLeod & Makins 1993:986) describes research as a “systematic investigation to establish facts or collect information on a subject”.

Opinions on the attitudes of environmental managers are therefore required as an integral part of the research exercise in order to find solutions to past and future problems, as

Today’s problems should have been solved in the 1950s, but in the 50s we were solving the problems of the 20s, in the 20s we were solving the problems of the 1880s...
(S. Harris quoted by Chadwick et al 1984:32.)

Because there may be a certain element of subjectivity when a researcher is conducting a literature investigation, the empirical research component was added to provide objective information and an objective interpretation of the information. The empirical research would supply additional information on the attitudes of managers which is not readily available in the literature. Elements of the empirically collected information could then be compared with the views of other researchers in the field as reflected in the literature, and with those of the researcher.

The approach adopted in the empirical research is in accordance with the ethical code of
the HSRC (Kamper 1997:109). Its objective was to conduct research with scientific integrity and excellence, with social sensitivity and responsibility, and with regard to the dignity of the individual and basic human rights.

The basis of the empirical research was a desire to ultimately contribute towards better understanding, and to increase knowledge that could be utilised in the development of a strategy for solving the problem.

3.3 OBJECTIVES OF THE RESEARCH

Research for this study involved gaining an understanding of the problem of finding suitable management and management accounting systems for rehabilitation managers, and recommending proposals for improving existing systems. The objectives of the research were to describe and explain the problem in the first instance, and to compile a normative model (Abdel-Khalik & Ajinka 1979:22) for a solution to the problem. This research obtained confirmation of the existence of the problems regarding rehabilitation management accounting, and deduced what the reasons behind these problems were. A comprehensive strategy for the improvement of existing management accounting systems was then formulated. The acquisition and application of knowledge about the attitudes towards rehabilitation activities of mines, could be expected to lead to their improved functioning, and perhaps add to the improvement of the quality of life for humankind in general.

A literature study of the South African situation provides a background picture of the management environment for the development of a management accounting system for rehabilitation management in the mining industry. Empirical research was also conducted in South Africa to provide a broader spectrum of management opinions and attitudes on these issues. In addition, a brief literature study was undertaken to investigate the management and management accounting procedures in developed countries with regard to rehabilitation management. This literature study was expanded to include the African milieu of which South Africa forms an important part. These documented literature studies and the empirical research contributed to the development of a comprehensive strategy for management accounting for rehabilitation purposes. The availability of applicable, timely and quality management information for decisions on rehabilitation management is the fundamental aim in the development of this management accounting
strategy.

The major objectives of this empirical research were to obtain

- general background information for classification purposes
- opinions from mine managers on the relative importance of the environmental management accounting dimensions of quality, cost and time
- their opinions on the relative importance of the technical, behavioural and cultural attributes of a good rehabilitation management accounting system
- their opinions on the above-mentioned management accounting dimensions and attributes in relation to their own rehabilitation management approaches
- voluntary comments on any of the given statements in the questionnaire

The questionnaire was therefore compiled in an effort to ascertain these opinions. The ultimate objectives were that the conclusions reached from this empirical data collection project should have validity, an acceptable degree of precision and wide coverage (John & Quenouille 1977:12).

3.4 METHOD OF DATA COLLECTION

3.4.1 Introduction

In order to collect relevant data to form a more complete opinion of the views of mine managers, to support and add to the existing views on rehabilitation management, and to broaden the basis for the development of a management accounting strategy, various steps were followed. These steps included the following procedures:

- deciding on the method of data collection
- determining the type of data needed and the target population involved
- determining the number of potential respondents
- compiling and distributing the questionnaire
- deciding on the methods of processing the data obtained, and on the statistical services needed
- assessing the results, and drawing conclusions and making recommendations
The structured interview method was chosen for this research project. Various forms such as the formal interview, the mail questionnaire, the electronic mail (e-mail) questionnaire and the facsimile questionnaire were considered as a means of data collection. These methods for the collection of data were compared with the characteristics of the ideal method for the collection of data (Malan, Coetzee & v Breda 1992:41), which include reliability, validity, sensitivity (especially in this survey), suitability, objectivity, practicability and acceptability on ethical grounds. Cost and time implications were added to these qualitative characteristics.

3.4.2 Formal interview

The data-gathering research type of interview was considered, using a questionnaire as the interview schedule. The flexibility of an interview is probably its greatest advantage. Other advantages of the formal interview are that nonverbal behaviour can be included in the response and that the “uncertain” option can more easily be avoided. If a response is expected, answers to the questions will be obtained and therefore the chances of reliability are increased (Oppenheim 1979:30-33).

Disadvantages of the formal interview in general include the high cost that is incurred, the time spent on travelling and keeping appointments with busy people all over the country, the possibility of subjective reaction on the part of the interviewer, and the lack of standardisation for purposes of comparison (Eiselen, Greenacre, Grupel, Markan, Shultz, Steffens & Venter 1989:109-110). Inaccessibility as a result of security systems at mines makes it more difficult to find practicable and suitable methods of collecting data.

Apart from the general disadvantages associated with the personal interview, specific disadvantages for this kind of empirical research arise from the sensitive atmosphere in which the questions would be asked. Some of the respondents would prefer to be anonymous as visits to their offices on the sites would allow the researcher to observe malpractices such as a mine discard dump in a wetland, or water erosion scars indicating poor rehabilitation management practices. Under these circumstances the respondents would be unwilling to allow interviews, even if the interviews were aimed at ascertaining their opinions and preferences, as in this study, and not at determining what they actually did or do in respect of rehabilitation management.
The formal personal interview as a method of data collection is therefore unacceptable for this empirical research.

3.4.3 Mail questionnaire

A mail questionnaire, to be mailed to individual respondents together with a franchised envelope for the return of answers, was considered next. The mail questionnaire is generally cheaper than the personal interview and could be widely spread (Moser & Kalton 1977:257). There would be a better chance of an honest response in the case of potentially sensitive reactions to the questions, standardisation of answers, and objectivity. Questionnaires can be sent simultaneously to all respondents and respondents can complete them at a convenient time.

General disadvantages of the mail questionnaire include the relatively low response rate, which may lead to poor representation of the target population. Further disadvantages are that misunderstandings could occur if the questions are not kept straightforward and that there is no opportunity to check answers to questions. Mail questions might inhibit spontaneous answers, limit the independence of individual answers, fail to ensure that the intended person completes the questionnaire, and limit the comparison of observations with the answers (Moser & Kalton 1977:260). The omission of answers to important questions could lead to a 20% response to some questions, while the overall response rate could be 50%, or with an overall response rate of 50% only 10% might have answered all the questions (Eiselen et al 1989:115). These disadvantages have a strong negative effect on the practicability of this method of collecting data. The most important disadvantage of mail questionnaires in South Africa at the moment is the time that has to be allowed for the delivery of mail. After about three months follow-up letters and questionnaires can be mailed to the respondents as reminders in the case of non-responses. After a further three months these can be added to the first set of responses, giving a six months’ period for the sending and receiving of questionnaires. Although the mail questionnaire is cheaper than the personal interview, it still costs a lot of money to process. The costs incurred in respect of this type of survey include postage, franchised envelopes for use by respondents, address labels and stationery and equipment for printing and duplication purposes.
This method of collecting of data has many disadvantages and better alternatives for the sending of questionnaires were considered.

3.4.4 Electronic mail (e-mail)

As most large and medium sized enterprises use computer technology quite extensively for their daily administrative tasks, this method for the distribution and return of questionnaires was also considered.

One of the major advantages of electronic mail is that it is time saving, which is certainly not the case when questionnaires are sent by ordinary mail. Apart from the time factor, there are cost savings on paper and postage, and the responses received are already keyed into the computer system. It would be possible for the respondents to complete the questionnaires on their computers and for the researcher to receive the answers to the questions within an hour. Messages sent by electronic mail are stored and forwarded quickly and easily by the recipient. It would not be necessary to re-key, as with a facsimile machine or to spend endless hours on the telephone trying to get through to a busy telephone user. It is possible to send a single entry to the whole target population simultaneously. A researcher would, however, need a few hours to send about 150 questionnaires during off-peak hours to the target respondents if they are not grouped together (Gallagher 1997:23).

In general the same advantages and disadvantages as for the printed questionnaire would be expected. Costs and expenses would be less than those of the mail questionnaire, as no duplication or postage would be required. The only cost for which provision should be made would be the cost of after-hours telephone time, which is less than the time needed to send similar messages by means of facsimile equipment.

One major drawback of electronic mail is the variety of incompatible electronic mail packages such as the GroupWise and Pegasus Mail that are in use, as well as the number of word processing packages available. Incompatibility does complicate matters. To expect that a hundred or more of the recipients of the questionnaire would be using the same electronic mail program and not only the same Wordprocessor, but also the same version, is somewhat unrealistic. The wordprocessors WordPerfect versions 5.1 to 8 are currently being used, as well as MSWORD versions 6 to 8.
These problems could be overcome to a large extent by both the researcher and the respondent by converting the electronic mail into a language such as ASCII before mailing. This computer “language” is then automatically converted into the current programme of the particular recipient, respondent as well as researcher, in most cases. As this is not a commonly applied computer procedure in most administrative sections, the application possibilities are limited to a few exclusive users. It is not possible to determine which enterprises are conversant with these conversion procedures. At least two of the largest mining companies in South Africa operating in Mpumalanga do not know why they sometimes receive “hieroglyphs”, and put the blame on the senders of the e-mail messages.

A further factor which limits the application possibilities of electronic mail is that the electronic mail addresses are not readily available. Even the Minerals Bureau, which is the general provider of information on the mining industry in South Africa, does not have these addresses.

At this stage all the developments concerning electronic mail have not yet reached the administrative sections of the target population for this empirical study. Electronic mail therefore has a very limited application value and other methods for the collection of the empirical data have had to be considered.

3.4.5 Facsimile

Facsimile facilities are more widely used in business than electronic mail, and are mostly linked to the same cable as telephones. The application of this piece of equipment for communication purposes has been possible for many years and is acknowledged as a reliable method of sending information to interested parties. The facsimile was therefore the next option to consider for the sending of questionnaires to respondents and for the receiving of completed questionnaires.

In general this method of data collection has the same advantages and disadvantages as a printed questionnaire. The advantages are the same as those for electronic mail, especially in respect of the reduction of the period of time between sending the questions and receiving of the answers. Cost calculations would be similar to those for electronic mail as telephone time and the facsimile equipment and stationery would be the prime
cost items. Additional advantages of the facsimile facility are the easy availability of facsimile numbers, and the fact that the respondent would receive a printed questionnaire to complete which could be returned immediately.

The advantages of the facsimile facility as a method for the collection of data, together with practical considerations such as the exact type of questions, determined the choice of this method for the empirical study.

3.4.6 Conclusion

The personal interview, the mail questionnaire, the electronic mail questionnaire and the facsimile machine as a means of distributing and returning the questionnaire were considered for the survey of opinions. After comparing these methods for the collection of data with the characteristics of a suitable method, the researcher chose the facsimile facility.

3.5 DEVELOPMENT OF THE QUESTIONNAIRE

3.5.1 Introduction

The questionnaire was developed from the literature study and from on-site observations. An approach was followed in the preparation of the questionnaire in which various experts were consulted in order to gain optimum and quality response, as "no survey can be better than its questionnaire" (Moser & Kalton 1977:308). The ways in which the questionnaire was developed are described, as well as the reasons for the particular choices made. This development includes the choice of language and wording, the type and grouping of questions, the compilation of the covering letter, the geographical area investigated, the target population and sample, the preliminary investigation and the improvement and finalising of the questionnaire.

3.5.2 Wording

Although the people in the target group who were to answer the questions are well-educated and have tertiary qualifications, the wording chosen for the questionnaire was selected such that it would be easily understood. Provision had been made for the subject
terminology peculiar to management accounting.

An effort was made to compile the questions and statements in such a way that their meanings could be fairly easily understood in order to enable the respondents to respond fully (Oppenheim 1979:51; Hague 1993:64). Terminology typical of rehabilitation management issues, such as ISO9000, is explained briefly in brackets. The questionnaire and covering letter are in English, but it is mentioned that they are also available in Afrikaans on request. An attempt was made to find a compromise between the minimum number of pages for the questionnaire and a letter type large enough to be easily read.

The statements in the questionnaire are short, but not so cryptic that they are difficult to understand (Steenekamp 1984:36). Language usage is checked by a qualified English editor to improve the readability of the questions. In addition consultants from a statistical service (Statistical Consultation Service, Unisa) read through the questions to determine whether they were formulated in such a way that they would be easily understood by all respondents, and whether they were not too one-sided (Oppenheim 1979:51), and also whether they were user-friendly. Before finalising the questionnaire, preliminary test runs were conducted on experts who were not from the target group to ensure that the statements would be interpreted in the manner intended.

3.5.3 Type and grouping of questions

3.5.3.1 Introduction

The facsimile mail items that were sent to the respondents consist of a covering letter and a questionnaire. In the questionnaire, questions were asked and statements made to which the respondents were asked to express an opinion on the extent to which they agreed.

3.5.3.2 The covering letter

A short covering letter was used as a means of introducing the facsimile interview in the questionnaire that followed, to state the purpose and objectives of the survey (Berdie, Anderson & Niebuhr 1986:51), and to provide a brief background to the empirical research.
In the covering letter mine managers or their appointed environmental managers were encouraged to complete the questionnaire. The following strategies were followed to increase the number of responses:

- The covering letter and questionnaire were addressed to the most senior person at the mine, the mine manager. This left the mine manager with the choice of either answering the questions himself or of delegating the task to the environmental manager. It is more likely that the environmental manager would in fact complete the questionnaire if asked to do so by his senior.
- In the questionnaire the opinions of the managers were obtained. They were not asked what they actually did in the past, or presently do, in respect of rehabilitation management.
- The managers were assured that the information would be applied for research and statistical purposes only.
- The managers were offered a brief summary of the results of the survey of their opinions after the processing of the statistics if they were interested to compare their own opinions with those of the majority of rehabilitation managers, and knowing what use had been made of their responses (Berdie et al 1986:51; Hague 1993:106).
- In view of the possibility that environmental managers might experience some of the questions as sensitive, the request providing their addresses for a brief summary of the information obtained from the survey, could be returned separately by facsimile or by mail.
- It was stated that the completion of the questionnaire would not take more than fifteen minutes of their time.
- The covering letter was printed on the letterhead of the Department of Accounting of the University of Pretoria. The head of the department as well as the supervisor signed this letter to indicate their approval of this research project.

The covering letter is to be found in Annexure 3.1.
3.5.3.3 The questionnaire

Introduction

Because of the sensitivity surrounding direct questions and the importance of obtaining an adequate response of a high quality, direct questions as to the actual rehabilitation activities on mining sites were avoided. The majority of the questionnaire therefore consists of statements to which the respondents had to give their opinions.

The questions and statements were grouped into the following sections:

- general background information as to the type of commodity mined and the size of the mine
- opinions on strategic management accounting individually in respect of the dimensions of quality, cost and time
- opinions on the attributes of a good rehabilitation management accounting system, separately in respect of technical, behavioural and cultural aspects
- general opinions on awards, Act 50/1991/Chapter VI (as amended), and on the application of a combination of the major groups of cost management issues of the questionnaire in general and in their own rehabilitation environment
- open-ended comments on the previously completed questions and statements

Provision was made for five categories of responses by the mine or environmental managers. They had to decide to what degree they personally agreed or disagreed with the statements. When the opinions of respondents are required, five or even seven categories are usually used (Steenekamp 1984:31; Oppenheim 1979:125,135). The five categories applied in this research were strongly agree (SA), agree (A), uncertain (U), disagree (D) and strongly disagree (SD). The “uncertain” option was added to diminish guessing and to provide for a lack of knowledge on the particular subject (Steenekamp 1984:26). The questionnaire had to be completed by marking the chosen option in the relevant space.

In order to reduce the effect of the “good guy” indicating “Strongly Agree” as the most popular option, four filter statements were included in the questionnaire in a random way. These statements were formulated in the negative mode as another means of control to
ensure that the respondents read through all the statements. Since questions and statements are more difficult to understand when they have a negative in them, short statements were selected for conversion into filter statements.

Instructions were given at the beginning of the questionnaire on how the boxes should be marked, when to comment and how to return the completed questionnaire. A column was added to provide for the capturing of data for purposes of statistical processing.

Section 1: Background information

The objectives of the first section are to obtain background information on the commodity mined at the particular mine or group of mines and the size of the mine, which is indicated in terms of the number of employees. This section forms the framework for the statistical matrices to be analysed and interpreted, and for the deductions made in respect of the questions that follow.

Section 2: Opinions on the strategic management accounting dimensions of quality, cost and time

The objectives of this second section are to determine the opinions of mine and environmental managers in respect of the strategy and purpose of management accounting. Successful enterprises should function simultaneously in the three dimensions of quality, cost and time (Ansari et al 1997c,b: SMA-5 & MMEC-2). Quality is a combination of the total experience of the stakeholders, whereas cost is a combination of all the elements in the value chain. The dimension of time entails a complete cycle from the beginning to the end of an activity. Smaller time cycles join up to form a life cycle which extends from the commencement of activities to the disposal stage at the end. These three dimensions of management accounting strategy are illustrated in the form of a triangle in Figure 3.1.
The objective of the first subsection in the quality dimension is to determine the opinions of the rehabilitation managers in respect of quality cost management strategies. They should be familiar with most of these concepts from the perspectives of their varied experience, as some of these managers are chemical engineers, geologists, mining engineers and civil engineers.

Some of the management accounting applications, such as those in Statements 2.2.11 to 2.2.14 in the subsection on cost, are quite new. These categories of environmental costs in which prevention, assessment, control and failure costs are identified, were recently formulated by Ansari et al (1997b: MMEC-9). Designing costs out (Statement 2.2.2) is another management cost concept identified by Ansari et al (1997d: TC-13) for the reduction of cost at the design stage for all activities. Since rehabilitation costs should form an integral part of long-term management accounting procedures, unnecessary costs should be designed out at the design stage. The costs of the extended enterprise (Statement 2.2.7) were formulated by Ansari et al (1997c: SMA-8) to identify management costs beyond the local operating boundaries, so that aspects such as environmental costs are included.

In Statement 2.2.8 the opinion asked concerns the separation of rehabilitation expenditure as part of the ongoing process, and rehabilitation expenditure to rehabilitate damage from previous generations. The aim of this opinion is to determine whether managers realise that value is added during the rehabilitation of past damage, whereas rehabilitation as an
ongoing process - now required by law - does not add value to the property.

In the subsection on time, opinions are required on unplanned activities resulting from inherited environmental damage from past operations, and on planned time allowed for education and training.

These opinions should make a positive contribution towards a better understanding of attitudes on the fundamentals of quality, cost and time. This multi-dimensional approach to management accounting strategy is in the process of replacing the historical one-dimensional view of only operating to reduce cost with a view of differentiating through quality and to concentrate on the time factor pertaining to stakeholders (Ansari et al 1997c: SMA-4).

Section 3: Opinions on attributes of a good rehabilitation management accounting system: technical, behavioural and cultural

The aim of this section is to obtain opinions from mining and rehabilitation managers on the attributes of a good rehabilitation management accounting system. These interdependent attributes include technical, behavioural and cultural aspects (Ansari et al 1997c,b: SMA-9 & MMEC-14). This interdependency is illustrated in Figure 3.2 by means of a triangle.

Figure 3.2 Attributes of a good management accounting system

![Triangle with labels Technical, Behavioural, Cultural](Ansari et al 1997c: SMA-9, adapted.)
Technical attributes are utilised for the measurement of qualities to be included in the information provided for decision-making purposes. The major function is to provide information that would improve and positively change existing decisions, such as information on the application of ISO9000 for rehabilitation purposes. Other functions include the understanding of processes, such as the organisation of work schedules.

Management accounting procedures have a behavioural influence on the people in the enterprise. These behavioural attributes include power and leadership (CIMA Paper 16 1996:43), as well as the ability to change perceptions, for example by assessing environmental costs to emphasise their importance in decision making (Ansari et al 1997b:MMEC-16).

Cultural attributes are to be found in the beliefs and values which form an integral part of management accounting. Knowledge of integrity, ethical values, group thinking, sensitivity to the environment and the political views of the various components of society, as well as a knowledge of the internal values of the enterprise, could improve management decision making (CIMA Paper 16 1996:25).

The opinions on the technical, behavioural and cultural attributes of management accounting provide new insights into the awareness levels of rehabilitation managers.

Section 4: General opinion

The last section requires general opinions in respect of rehabilitation management applications, as indicated in the previous questions. In the last question the importance of these applications in their particular mine or group of mines is requested. At the end provision is made for open-ended statements on any additional comments the respondent might wish to make on any of the previous questions. The open-ended questions are placed at the end because they do not usually elicit a good response. Since the target population does not exceed 150 answering points, and as this is an optional question, the
response could be processed relatively easily. The aim of these statements is to investigate some attitudes and opinions that could not be discovered by means of the foregoing responses.

**Summary and conclusion**

The questionnaire commences with general, impersonal questions in an attempt to engender confidence in the respondents. Statements that are likely to be more difficult to respond to, as well as the open-ended questions, are placed at the end of the questionnaire. The statements that could possibly be experienced as sensitive, such as those on the actual applicability of the management accounting strategies mentioned in respect of environmental rehabilitation in their own situation are placed at the end (Brownell 1995:37).

After the sections where graded responses and general comments are required, provision is made for interested mine and rehabilitation managers to request a brief summary of the information obtained in the survey. Owing to the sensitivity some respondents might experience, the sections on mining rehabilitation are separated from this request.

One questionnaire was prepared and sent to all mine managers in the predetermined industry groups. Two weeks after the issue of the questionnaire, follow-up questionnaires and reminders were sent to all units in the target group in an effort to increase the response rate. The follow-up letter to accompany the questionnaire is found in Annexure 3.5. The first questionnaire was sent out during the first week in May 1998, and the follow-up questionnaire at the end of May 1998. The questionnaire is to be found in Annexure 3.2.
3.5.4 Investigation area, target population and sample

3.5.4.1 Investigation area

The investigation area could be regarded as homogeneous because information was obtained from mines operating in South Africa only. A distinction was made, however, because factors such as the type of commodity mined as well as the number of employees were considered.

It was deduced from the literature study and from observations that not all types of mining activities cause major pollution of the air, water and soil. Diamond mines for instance produce muddy water as the main effluent, but then it should be remembered that major erosion of river banks does occur and the surrounding mining population could cause severe pollution. There are only a few large diamond mines in the country. Most diamond mining operations are still performed by short-term individual fortune-seekers who cannot be traced in the records. The same arguments could for example be advanced for the mining of aggregate and sand, salt, phosphates and various types of stone such as limestone. Mines which are self-employed and those with only a small number of employees are more likely to be unable to answer the questions as a result of a lack of adequate knowledge on and interest in rehabilitation and management accounting issues. They would not be able to contribute significantly towards this empirical research programme.

The investigating area was therefore reduced to include only the major mining sectors in South Africa, mining a limited number of commodities. These mines and groups of mines have the potential to become leaders in rehabilitation management in their own industrial environment as well as countrywide.
3.5.4.2 Target population

Observations were made that some of the mines which are geographically situated on adjoining farms are grouped together with only one mine manager and one rehabilitation manager. The number of units in the target population are therefore less than the number of operating mines. The survey would have produced duplicate answers and opinions if questionnaires had been sent to all the mines in the identified sectors. The correction in respect of the number of units was made by identifying mines with the same telephone and facsimile numbers, and by grouping them together. All mines in the identified sectors are therefore either directly or indirectly included in the survey.

The individual selected mining sectors, as well as the number of units identified in each, are the following:

- Gold, platinum, silver: 58
- Coal: 55
- Asbestos: 3
- Chromium: 13
- Vanadium: 6
- Iron: 7
- Total: 142

This grouping was deduced from the directory of the Minerals Bureau of South Africa (Department of Minerals & Energy 1997).

3.5.4.3 Sample

Sampling procedures are recommended when conducting surveys of large populations. But as the total target population consists of a relatively small group of 142 units, no sampling was considered. Questionnaires were therefore sent to all potential respondents.
in this population study.

3.5.5 Preliminary investigation and finalisation

As the quality of the information and data is primarily determined by the quality of the questionnaire (Pietersen & Lubbe 1986:88), care should be taken to prepare and design a suitable questionnaire. In order to obtain a high standard of response, preliminary testing was conducted. Commentaries received from the test run were applied to improve the design and to finalise the questionnaire.

Preliminary testing helped to eliminate unforeseen problems regarding the administration of the questionnaire. Aspects of user-friendliness, such as wording, order of questions, structure, instructions, contents and format were evaluated to determine whether the design was feasible (Pietersen & Lubbe 1986: 90). The value of the results depends to a large extent on preliminary trials and improvements to prepare questions that are clear and will have the same meaning for all respondents (Berdie et al 1986:29).

A draft of the complete questionnaire and of the covering letter was circulated among experts who were not from the target group, in an effort to determine technical shortcomings (Brownell 1995:38). About six people are required to see if and how a questionnaire is working (Hague 1993:95), but as some of them were colleagues, it was decided to include ten people in the preliminary survey. This group consisted of a variety of individuals who were asked to consider the content and layout of the draft questionnaire from their different perspectives. The questionnaire was sent by facsimile to these people and they were asked to complete the questionnaire and return it by facsimile. The list of names of people who were asked to evaluate the preliminary questionnaire, together with particulars on their field of expertise, is provided in Annexure 3.3. The covering letter to the specialist group requesting their inputs in testing the questionnaire, is enclosed in Annexure 3.4.
After the preliminary testing procedure had been conducted, the questionnaire was finalised. The final questionnaire was then sent to the target population with a request to participate in the investigation.

3.5.6 Summary

The questionnaire was developed by paying careful attention to the wording, contents of the covering letter, type and grouping of the questions and statements, as well as by determining the area to be investigated, the target population and the sample. A preliminary investigation was conducted in order to make final improvements and adjustments to the questionnaire.

3.6. SUMMARY AND CONCLUSION

The reasons for and approach to the empirical research have been determined. After considering the formal interview and the mail and electronic mail questionnaire as a means of collecting information on the opinions of environmental managers, the researcher rejected these methods in favour of facsimile correspondence. Time, cost and a higher possible response rate were the major factors in the decision to utilise the latter approach.

The questionnaire was developed from the literature study and from conversations and observations. Aspects of wording, type and grouping of questions and statements, the area investigated and the target population were considered when preparing the questionnaire. Preliminary investigations by a variety of experts were conducted before the questionnaire was finalised.

The questionnaire was sent by facsimile to all units in the target population. In the following chapter the opinions collected are evaluated and assessed.
ANNEXURE 3.1
COVERING LETTER TO ACCOMPANY THE QUESTIONNAIRE- ENGLISH
ATTENTION THE MINE MANAGER
(or Environmental manager)

Number of pages (this one included): 7

Date: 5 May 1998

Dear Sir

Rehabilitation management in the mining sector is increasingly gaining importance, especially after the promulgation of Act 50/1991/Chapter VI (amended by Act 103/1993).

As part of my doctoral studies at the University of Pretoria, I need a more complete overview of the opinions of mine managers or their environmental managers on rehabilitation management. The focus of my doctoral research project is to devise a strategy that the management accountant can use to include all relevant costs when comparing inputs and outputs concerning rehabilitation management issues.

Accompanying this letter you will find a questionnaire that is calculated to take approximately 15 minutes of your time to complete. You will notice that a brief summary of the results of the opinion survey will be available to all interested persons. If you want to keep your answers separate from the request for the results, please detach the last section of the questionnaire and return it separately by facsimile or by mail.

All answers will be treated as strictly confidential and will be used for statistical and research purposes only.

Should you require information for the completion of the questionnaire, do not hesitate to contact me at 012-664-0825 during office hours, or at PO Box 14919, LYTTELTON, 0140.

Kindly return the completed questionnaire by fax to 012-664-0825 (a private temporary number).

Indien u die begeleidende brief en die vraelys in Afrikaans verkies, skakel of stuur asseblief 'n boodskap per faks na 012-664-0825.

Your kind cooperation is appreciated.

Yours sincerely

Cecilia Beukes

Approved by

PROFESSOR DAAN GOUWS (supervisor)

PROFESSOR QUINTUS VORSTER
(Head of the Department of Accounting)
AANDAG: DIE MYNBESTUURDER (of Omgewingsbestuurder)

Aantal bladsye (hierdie een ingesluit): 7

Datum: 5 Mei 1998

Geagte Meneer

Rehabilitasiebestuur in die mynbousektor is besig om steeds belangriker te word, veral na die uitvaardiging van Wet 50/1991/Hoofstuk VI (soos gewysig deur Wet 103/1993).

Aangesien rehabilitasiebestuur 'n onderdeel van my doktorale studies aan die Universiteit van Pretoria uitmaak, het ek 'n vollediger oorsig nodig van die menings van mynbestuurders of van hulle omgewingsbestuurders. Die fokus van my doktorale navorsingsprojek is om 'n strategie te ontwikkel wat die bestuursrekenmeester kan gebruik om al die relevante koste in te sluit wanneer insette en uitsette ten opsigte van rehabilitasiebestuurursaspekte vergelyk word.

Tesseame met hierdie brief kry u 'n vraelys wat na raming ongeveer 15 minute sal neem om te voltoo. U sal ook merk dat 'n kort opsomming van die resultate van die opname beskikbaar sal wees aan alle persone wat belangstel. Indien u die antwoorde afsonderlik wil hou van die versoek vir die resultate, verwyder dan asseblief die laaste gedeelte van die vraelys en stuur dit afsonderlik terug per faks of met die pos.

Alle antwoorde word streng vertroulik behandel en sal slegs vir statistiese en navorsingsdoeleindes gebruik word.

Indien u enige inligting benodig met die voltooiing van die vraelys, moet u nie huiver om met my in aanraking te kom nie by (012)664-0825 gedurende kantoorure, of by Posbus 14919, LYTTELTON, 0140.

Stuur asseblief die voltooiide vraelys so gou as moontlik per faks terug na (012)664-0825 ('n privaat tydelike nommer).

U vriendelike samewerking word waardeer.

Vriendelike groete

Cecilia Beukes

Vriendelike groete

Goedgekeur deur

PROFESSOR DAAN GOUWS (studieleier)

PROFESSOR QUINTUS VORSTER
(Hoof Departement Rekeningkunde)
ANNEXURE 3.2

QUESTIONNAIRE USED IN THE SURVEY OF OPINIONS - ENGLISH

QUESTIONNAIRE TO MINE MANAGERS (for environmental managers)

All answers will be treated as strictly confidential and will be used for statistical purposes only.

QUESTIONNAIRE ON REHABILITATION MANAGEMENT ACCOUNTING

☐ Please indicate the most appropriate option by marking it with a cross in black ink.

☐ Please ignore, for processing purposes only.

... Please indicate your own personal view.

☎ Please return as soon as possible to fax number 012-664-0825.

1. Background information

1.1 Please specify the mining commodity of your mine/s.

☐ Platinum, gold, silver or uranium  ☐ Coal  ☐ Asbestos
☐ Chromium  ☐ Vanadium  ☐ Iron  ☐ Other (please specify) ........

1.2 The number of employees at the mine/s specified above is

☐ 1-100  ☐ 101-500  ☐ 501-1 000  ☐ more than 1 000

Opinions:

To what extent do you personally agree or disagree with the following statements?

SA - Strongly agree  A - Agree
U - Uncertain  D - Disagree
SD - Strongly disagree

2. Opinions on strategic management accounting dimensions of quality, cost and time focussing on environmental and rehabilitation issues

2.1 Quality

2.1.1 A total approach ranging from impact assessment to

SA  A  U  D  SD
aftercare should be adopted.

2.1.2 A category for prevention costs should be introduced to reduce future rehabilitation costs such as failure costs.

2.1.3 A balance matrix should be developed to determine the degree of environmental management equilibrium.

2.1.4 Strategic management planning for long term rehabilitation management and aftercare should exist.

2.1.5 The management accountant should function with the support of cross-functional teams and experts (a botanist, chemical engineer, actuary, geologist, civil engineer, hydrologist, community leaders, etc.) through all the phases from design to disposition during rehabilitation activities.

2.1.6 Benchmarking (investigating, identifying and using best practices) should be used by management in the same mining sector and/or region.

2.1.7 Benchmarking should not be utilised over the whole spectrum of rehabilitation from design to aftercare.

2.1.8 An awareness should exist of the continuous search for best practices in order to improve processes and activities.

2.1.9 Feedback to management on successful rehabilitation operations is important for management decision-making purposes.

2.1.10 Feedback on failures in rehabilitation management is necessary for management decision-making purposes.

2.1.11 Financial results of rehabilitation inputs are disclosed to stakeholders.

2.1.12 Non-financial rehabilitation results are measured.

2.1.13 Non-financial rehabilitation inputs and gains (eg. future savings in work hours and machine hours, as well as pollution levels of water) are disclosed to stakeholders.

2.1.14 Financial issues form an integral part of the procedure to find a balancing position in respect of environmental cost management.

2.1.15 Issues on the natural environment form an integral part of the procedure to find a balancing position regarding environmental cost management.

2.1.16 Leadership factors form an integral part of the procedure
to find a balancing position regarding environmental cost management.

2.1.17 Issues pertaining to the implementation of environmental rehabilitation form an integral part of the procedure to find a balancing position in respect of environmental cost management.

2.1.18 Measurable is tantamount to manageable in rehabilitation management.

2.2 Cost

2.2.1 Environmental costs and expenses should be integrated routinely into management decision making.

2.2.2 Designing costs out (reducing future costs at the design stage) in respect of rehabilitation management should form an integral part of strategic management.

2.2.3 Monetary investments in education and training of the whole workforce in environmental preservation would improve strategic management policies.

2.2.4 Monetary provision should be made for long-term rehabilitation management and aftercare.

2.2.5 Monetary provision should be made for contingencies (eg. flooding).

2.2.6 Life cycle costs of the commodity mined should not be determined in terms of the value chain.

2.2.7 The costs of the extended enterprise (on aftercare, consultants, R&D, contractors, suppliers, security, natural environment) should be determined.

2.2.8 Expenditure to rehabilitate on an ongoing basis as part of the operating process should be separated from expenditure to rehabilitate damage from the past.

2.2.9 Differentiate between internal rehabilitation value-added and non-value-added environmental cost categories (eg. process design, acquisition or modification of equipment, location).

2.2.10 Differentiate between internal and external value-added and non-value-added expenditure.

2.2.11 Prevention costs (eg. R & D) are separated from other environmental cost categories.

2.2.12 Assessment costs (eg. monitoring, reporting) are
separated from other environmental cost categories.

2.2.13 Control costs (e.g. handling of harmful materials) are separated from other environmental cost categories.

2.2.14 Failure costs (e.g. fines) are separated from other environmental cost categories.

2.2.15 All major groups of rehabilitation costs (2.2.9 - 2.2.14) incurred, are disclosed to stakeholders.

2.3 Time

2.3.1 Heritage (of badly rehabilitated land) is an important factor for strategic management.

2.3.2 Investments of time in education and training of the whole workforce in environmental preservation contribute towards better management results.

3. Opinions on attributes of a good rehabilitation management accounting system: technical, behavioural and cultural

3.1 Technical

3.1.1 Application of ISO9000 (international standards on quality management) should be encouraged.

3.1.2 Application of ISO14000 (international standards on environmental management) should be encouraged.

3.1.3 Contingency planning should exist for unforeseen disasters (e.g. flooding).

3.1.4 Experience of other countries does not have a positive influence locally.

3.1.5 Thorough knowledge of the present local and national regulations, laws and fines on rehabilitation issues is an attribute of good management policy.

3.1.6 Sound knowledge of present taxation policies supports decisions on rehabilitation costs and expenses.

3.2 Behavioural

3.2.1 Local and internal attitudes towards rehabilitation management should be considered for decision-making purposes.

3.2.2 The enterprise’s mission statement and objective statement have a positive influence on rehabilitation policies to the
extent that they deal with environmental issues.

3.2.3 Impact assessments are not important at the commencement of mining operations.

3.2.4 Monetary rehabilitation inputs are disclosed to stakeholders.

3.2.5 If there were no laws, regulations and inspections, mine managers would still operate according to an ethic of responsibility to preserve the natural environment.

3.2.6 Positive changes in behaviour towards rehabilitation and environmental management are attained by means of education and training.

3.2.7 True profits are recognised only when none of the stakeholders incur losses from the process of profit generation.

3.3 Cultural

3.3.1 Cultural differences influence the process of rehabilitation management decision-making.

3.3.2 People in the communities surrounding mines are dependant on the natural environment.

3.3.3 More expensive processes are preferable when the surrounding community is better informed and educated about the natural environment.

General opinion

4.1 Awards to encourage improved and successful rehabilitation management policies are important (similar to awards for safety hours).

4.2 Awards for green reporting enhance the awareness of cost management for rehabilitation purposes.


4.4 The strategic management accounting dimensions of quality, cost and time (Section 2) should be combined for general rehabilitation management purposes.

4.5 The attributes of a successful management accounting system of technology, behaviour and culture (Section 3) should be combined to the benefit of rehabilitation management in general.

4.6 To obtain maximum results the relationship between these
strategic dimensions (Section 2) and attributes of good management accounting (Section 3) should be flexible.

4.7 The strategic management accounting dimensions of quality, cost and time (Section 2) are combined in the interest of rehabilitation management in your mine/s.

4.8 The technological, behavioural and cultural attributes of a successful management accounting system (Section 3) are combined to serve the best interest of rehabilitation management in your mine/s.

Comments: (especially on SA and SD responses)

Statement no. .........................
Statement no. .........................

In general .............................

Please return this questionnaire to facsimile number 012-664-0825.

Address (or Fax no.) if you are interested in a brief summary of the results of the survey (Return separately if you wish.)

.................................................................................................................................
QUESTIONNAIRE USED IN SURVEY OF OPINIONS - AFRIKAANS

VRAEYLYS AAN MYNBESTUURDERS (vir omgewingsbestuurders)  ○ 1  ○ 2  ○ 3

Alle antwoorde word streng vertroulik behandeld en word slegs vir statistiese doeleindes gebruik.

VRAEYLYS OOR REHABILITASIEBESTUURSREKENINGKUNDE

☐ Dui asseblief die gepaste keuse aan deur dit met 'n kruisie in swart ink te merk.
☐ Ignoreer asseblief, slegs vir verwerkingsdoeleindes.
… Dui asseblief u eie persoonlike mening aan.
☒ Stuur asseblief so gou as moontlik terug na faksnummer 012-664-0825.

1. Agtergrondinligting

1.1 Spesifiseer asseblief die ontginde kommoditeit van u myn/e.

☐ Platinum, goud, silwer of uraan  ☐ Steenkool  ☐ Asbes
☐ Chroom  ☐ Vanadium  ☐ Yster  ○ 4
☐ Ander (Spesifiseer asseblief)...........

1.2 Die aantal werknemers op die myn/e wat hierbo gespesifiseer word, is

☐ 1-100  ☐ 101-500  ☐ 501-1 000  ☐ meer as 1 000  ○ 5

Menings:

In watter mate sou u persoonlik saamstem of verskil van die volgende stellings?

<table>
<thead>
<tr>
<th>SS - Sterk saamstem</th>
<th>S - Saamstem</th>
<th>O - Onseker</th>
<th>V - Verskil</th>
<th>SV - Sterk verskil</th>
</tr>
</thead>
</table>

2. Menings oor die dimensies van strategiese bestuursrekeningkunde van gehalte, koste en tyd gefokus op omgewings- en rehabilitasie-aspekte

2.1 Gehalte

2.1.1 'n Totale benadering wat strek van impakberaming tot nasorg behoort gevolg te word.  SS  S  O  V  SV  ○ 6
2.1.2 'n Kategorie vir voorkomende koste behoort ingestel te word om toekomstige rehabilitasiekoste soos mislukkings-koste te verminder.

2.1.3 'n Balansmatriks moet ontwikkel word om die mate van ewewig van omgewingsbestuur te bepaal.

2.1.4 Strategiese bestuursbeplanning vir langtermynrehabilitasie-bestuur en -nasorg moet bestaan.

2.1.5 Die bestuursrekenmeester moet funksioneer met die ondersteuning van multidissiplinêre spanne en deskundiges ('n botanis, chemiese ingenieur, aktuaris, geoloog, siviele ingenieur, hidroloog, gemeenskapsleiers, ens.) deur al die fases van ontwerp tot wegioening tydens rehabilitasie-aktiwiteite.

2.1.6 Benchmarking (ondersoek, identifisering en aanwending van die beste praktyke) moet deur die bestuur in dieselfde mynbousektor en/of -streek toegepas word.

2.1.7 Benchmarking moet nie benut word oor die hele spektrum van rehabilitasie van ontwerp tot nasorg nie.

2.1.8 'n Bewustheid van die voortdurende soeke na die beste praktyk om prosesse en aktiwiteite te verbeter, moet bestaan.

2.1.9 Terugvoering aan die bestuur van geslaagde rehabilitasie-bedrywighede is belangrik vir bestuursbesluitnemingsdoeleindes.

2.1.10 Terugvoering oor mislukte rehabilitasiebestuur is noodsaaklik vir bestuursbesluitnemingsdoeleindes.

2.1.11 Finansiële resultate van rehabilitasie-insette word aan die belanghebbendes openbaar.

2.1.12 Nie-finansiële rehabilitasieresultate word gemeet.

2.1.13 Nie-finansiële rehabilitasie-insette en -voordele (bv. toekomstige besparings van werk- en masjienure, asook besoedelingsvlakke van water) word aan die belanghebbendes openbaar.

2.1.14 Finansiële sake maak 'n integrerende deel uit van die proses om 'n balanserende posisie te kry ten opsigte van omgewingsbestuursrekeningkunde.

2.1.15 Sake rakende die natuurlike omgewing maak 'n integre rende deel uit van die prosedure vir die verkryging van 'n balanserende posisie betreffende omgewingskostebestuur.
2.1.16 Leierskapfaktore maak 'n integrerende deel uit van die prosedure vir die verkryging van 'n balanserende posisie betreffende omgewingskostebestuur.

2.1.17 Sake rakende die implementering van omgewingsrehabilitasie maak 'n integrerende deel uit van die prosedure vir die verkryging van 'n balanserende posisie betreffende omgewingskostebestuur.

2.1.18 Meetbaar kom neer op bestuurbaar met rehabilitasiebestuur.

2.2 Koste

2.2.1 Omgewingskoste en -uitgawes moet gereeld opgeneem word in bestuursbesluitneming.

2.2.2 Koste-uit-ontwerp (vermindering van toekomstige koste in die ontwerpstadium) by rehabilitasiebestuur moet 'n integrerende deel uitmaak van strategiese bestuur.

2.2.3 Monetêre investerings in opvoeding en opleiding van die hele werkerskorps vir omgewingsbehoud sal die strategiese bestuursbeleid verbeter.

2.2.4 Monetêre voorsiening moet gemaak word vir langtermynrehabilitasiebestuur en -nasorg.

2.2.5 Monetêre voorsiening moet gemaak word vir onvoorsiene gebeurlikhede (bv. oorstromings).

2.2.6 Lewensikluskoste van die kommoditeit wat ontgin word, moet nie in termie van die waardeketting vasgestel word nie.

2.2.7 Die koste van die uitgebreide onderneming (aan nasorg, konsultante, navorsing & ontwikkeling, kontrakteurs, verskaffers, sekuriteit, natuurlike omgewing) moet bepaal word.

2.2.8 Uitgawes om op 'n deurlopende basis as deel van die bedryfsproses te rehabiliteer, moet geskei word van uitgawes om skade van die verlede te rehabiliteer.

2.2.9 Onderskei tussen interne kategorieë vir omgewingsrehabilitasiekoste wat waarde toevoeg en nie waarde toevoeg nie (bv. prosesontwerp, verkrygings of vernuwing van toerusting, ligging).

2.2.10 Onderskei tussen interne en eksterne uitgawes wat waarde toevoeg en nie waarde toevoeg nie.

2.2.11 Voorkomingskoste (bv. navorsing en ontwikkeling) word onderskei van ander omgewingskostekategorieë.
2.2.12 Beramingskoste (bv. monitering, verslaglewering) word onderskei van ander omgewingskostekategoriee.

2.2.13 Kontrolekoste (bv. hantering van skadelike materiaal) word onderskei van ander omgewingskostekategoriee.

2.2.14 Mislukkingskoste (bv. boetes) word onderskei van ander omgewingskostekategoriee.

2.2.15 Al die vernaamste groeperings vir rehabilitasiekoste (2.2.9-2.2.14) wat aangegaan word, word aan die belanghebbendes openbaar.

2.3 Tyd

2.3.1 Erfenis (van onbevredigende gerehabiliteerde grond) is 'n belangrike faktor in strategiese bestuur.

2.3.2 Investerings van tyd vir opvoeding en opleiding van die hele werkerskorps in omgewingsbehoud, dra by tot beter bestuursresultate.

3. Menings oor die hoedanighede van 'n goeie rehabilitasiebestuursrekening-kundige stelsel: tegnies, gedrag en kultuur

3.1 Tegnies

3.1.1 Die toepassing van ISO9000 (internasionale standaarde oor gehaltebestuur) moet aangemoedig word.

3.1.2 Die toepassing van ISO14000 (internasionale standaarde oor omgewingsbestuur) moet aangemoedig word.

3.1.3 Gebeurlikheidsbeplanning moet bestaan vir onvoorsiene rampes (bv. oorstromings).

3.1.4 Ervaring van ander lande het nie plaaslik 'n positiewe uitwerking nie.

3.1.5 'n Deeglike kennis van die huidige plaaslike en nasionale regulasies, wette en boetes oor rehabilitasie-aangeleenthede is 'n hoedanigheid van goeie bestuursbeleid.

3.1.6 'n Goeie kennis van die huidige belastingbeleid ondersteun besluite oor rehabilitasiekoste en -uitgawes.

3.2 Gedrag

3.2.1 Plaaslike en interne houdings jeens rehabilitasiebestuur moet oorweeg word vir besluitnemingsdoeleindes.
3.2.2 Die onderneming se missie- en die doelwitstelling het 'n positiewe invloed op rehabilitasiebeleid in die mate waarin hulle omgewingsaspekte aanspreek.

3.2.3 Impakberamings is nie belangrik tydens die aanvang van mynbedrywighede nie.

3.2.4 Monetêre rehabilitasie-insette word aan die belanghebbendes openbaar.

3.2.5 Indien daar geen wette, regulasies en inspeksies was nie, sou mynbestuursders steeds bedryf het volgens die etiek van hulle verantwoordelikheid om die natuurlike omgewing te behou.

3.2.6 Positiewe veranderings in die gedrag en rehabilitasie en omgewingsbestuur word verkry deur middel van opvoeding en opleiding.

3.2.7 Ware winste word verky alleenlik wanneer geeneen van die belanghebbendes verlies in die proses van winsnajaging nie.

3.3 Kultuur

3.3.1 Kulturele verskille beïnvloed die proses van rehabilitasiebestuursbesluitneming.

3.3.2 Mense in die gemeenskappe aanliggend tot myn is afhanklik van die natuurlike omgewing.

3.3.3 Voorkeur word verleen aan duurder prosesse indien die omliggende gemeenskap beter ingelig en opgevoed is oor die natuurlike omgewing.

Algemene mening

4.1 Toekennings om verbeterde en geslaagde rehabilitasiebestuursbeleid aan te moedig, is belangrik (soortgelyk aan toekennings vir veiligheidsure).

4.2 Toekennings vir groen verslaglewering verhoog die bewustheid van kostebestuur vir rehabilitasiedoeleindes.

4.3 Wet 50/1992/Hoofstuk VI (gewysig deur Wet 103/1993) het rehabilitasiebestuur van grond wat beskadig is deur myn bou, beduidend beïnvloed.

4.4 Die dimensies van strategiese bestuursrekeningkunde van gehalte, koste en tyd (Afd 2) moet gekombineer word vir doeleindes van algemene rehabilitasiebestuur.

4.5 Die hoedanighede van 'n geslaagde bestuursrekening-kundige stelsel van tegnologie, gedrag en kultuur (Afd 3)
moet gekombineer word tot die voordeel van algemene rehabilitasiebestuur.

4.6 Ten einde die maksimum resultate te verkry, moet die verhouding tussen die strategiese dimensies (Afd 2) en goeie hoedanighede van bestuursrekeningkunde (Afd 3) buigsaam wees.

4.7 Die dimensies van strategiese bestuursrekeningkunde van gehalte, koste en tyd (Afd 2) word gekombineer in die belang van rehabilitasiebestuur in ū myn/e.

4.8 Die tegnologiese, gedrags- en kulturele hoedanighede van ūn geslaagde bestuursrekeningkundige stelsel (Afd 3) word gekombineer om tot voordeel van rehabilitasiebestuur ūn myn/e te dien.

Kommentaar: (Veral van SS- en SV-responses)

Stelling nr. .........................
Stelling nr. .........................

Algemeen .............................

Stuur asseblief hierdie vraelys terug na faksnummer (012)664-0825.

Adres (of Faksnummer) indien u belangstel in ūn kort samevatting van die resultate van die opname (Stuur afsonderlik terug indien u dit verkies.)
ANNEXURE 3.3

LIST OF PEOPLE APPROACHED TO EVALUATE THE QUESTIONNAIRE

1. Professor Daan Gouws, University of Pretoria, supervisor

2. Blanche Postma, Department of Water Affairs, Pretoria, geologist, inspector

3. Gabriel Hough, Department of Water Affairs, Bloemfontein, civil engineer

4. Daniel Hough, Receiver of Revenue, Sandton, chartered accountant

5. Mattie Kruger, Honeydew, private consultant on management

6. Joyce Jordaan (and Ben, auditor husband), Department of Statistics, University of South Africa

7. Prof. Frans Vermaak, Management Accounting, Department of Accounting, University of Pretoria

8. Prof. Charl de Villiers, CA, Department of Accounting, University of Pretoria, environmental reporting

9. Christo Cronje, CA, Department of Accounting, University of Pretoria, green accounting

10. Dr André Niemand, Head Department of Management Accounting, Pretoria Technicon
ANNEXURE 3.4

COVERING LETTER TO THE PEOPLE APPROACHED TO EVALUATE THE QUESTIONNAIRE

Vir die aandag van:

Aantal bladsye (hierdie een ingesluit):

Datum:

Boodskap:

Beste

Met verwysing na ons onlangse telefoongesprek, stuur ek die voorlopige vraelys en die begeleidende brief sodat jy dit kan evalueer en per faks aan my terugstuur.

Die gehalte van die resultate van die empiriese navorsing word grootliks bepaal deur voorlopige toetsing en verbeterings ten einde ‘n vraelys saam te stel uit vrag en stellings wat duidelik is en dieselfde betekenis het vir alle respondente.

Ek sal dit op prys stel as jy krities sal let op die aspekte van die ontwerp van die vraelys soos gebruiksvriendelikheid, bewoording, volgorde en struktuur, instruksies, inhoud en formaat. Indien jy verdere kommentaar wil lewer, sal ek dit beslis oorweeg in die proses om die vraelys moontlik te verbeter.

Stuur asseblief die ingevulde vraelys en jou kommentaar so gou as moontlik na my toe terug (faks 012-664-0825). Hierdie nommer is ook my telefoonnommer indien jy navrae het oor die hantering van die vraelys of ‘n gesprek wil voer oor die onderwerp.

Jou samewerking in verband met hierdie empiriese navorsing word oopreg waardeer.

Vriendelike groete

Cecilia Beukes
ANNEXURE 3.5
FOLLOW-UP LETTER TO ACCOMPANY THE QUESTIONNAIRE- ENGLISH

ATTENTION: THE MINE MANAGER
(or: Environmental manager)

30 April 1998

Dear Sir

If you have already responded and returned the following questionnaire, please ignore this correspondence.

Rehabilitation management in the mining sector is gaining increasingly importance, especially after the promulgation of Act 50/1991/Chapter VI (amended by Act 103/1993).

As part of my doctoral studies at the University of Pretoria, I need a more complete overview of the opinions of mine managers or their environmental managers on rehabilitation management. The focus of my doctoral research project is to devise a strategy that the management accountant can use to include all relevant costs when comparing inputs and outputs concerning rehabilitation management issues.

Accompanying this letter you will find a questionnaire that is calculated to take approximately 15 minutes of your time to complete. You will notice that a brief summary of the results of the opinion survey will be available to all interested persons. If you want to keep your answers separate from the request for the results, please detach the last section of the questionnaire and return it separately by facsimile or by mail.

All answers will be treated as strictly confidential and will be used for statistical and research purposes only.

Should you require information for the completion of the questionnaire, do not hesitate to contact me at 012-664-0825 during office hours, or at PO Box 14919, LYTTELTON, 0140.

Kindly return the completed questionnaire by fax to 012-664-0825 (a private temporary number).

Indien u die begeleidende brief en die vraelys in Afrikaans verkies, skakel of stuur asseblief 'n boodskap per faks na 012-664-0825.

Your kind cooperation is appreciated.

Yours sincerely

........................................
Cecilia Beukes

Approved by
........................................
PROFESSOR DAAN GOUWS (supervisor)

........................................
PROFESSOR QUINTUS VORSTER
(Head of the Department of Accounting)
FOLLOW-UP LETTER TO ACCOMPANY THE QUESTIONNAIRE - AFRIKAANS

VIR DIE AANDAG VAN: DIE MYNBESTUURDER

(Omgewingsbestuurder)

30 April 1998

Geagte Meneer

Indien u reeds reageer het op die volgende vraelys en dit teruggestuur het, ignoreer asseblief die volgende korrespondensie.

Rehabilitasiebestuur in die mynbousektor is besig om steeds belangriker te word, veral na die uitvaardiging van Wet 50/1991/Hoofstuk VI (soos gewysig deur Wet 103/1993).

Aangesien rehabilitasiebestuur ‘n onderdeel van my doktorale studies aan die Universiteit van Pretoria uitmaak, het ek ‘n vollediger oorsig nodig van die menings van mynbestuurders of van hulle omgewingsbestuurders. Die fokus van my doktorale navorsingsprojek is om ‘n strategie te ontwikkel wat die bestuursrekenmeester kan gebruik om al die relevante koste in te sluit wanneer insette en uitsette ten opsigte van rehabilitasiebestuursaspekte vergelyk word.

Tesame met hierdie brief kry u ‘n vraelys wat na raming ongeveer 15 minute sal neem om te voltoo. U sal ook merk dat ‘n kort opsomming van die resultate van die opname beskikbaar sal wees aan alle persone wat belangstel. Indien u die antwoorde afsonderlik wil hou van die versoek vir die resultate, verwyder dan asseblief die laaste gedeelte van die vraelys en stuur dit afsonderlik terug per faks of met die pos.

Alle antwoorde word streng vertroulik behandel en sal slegs vir statistiese en navorsingsdoeleindes gebruik word.

Indien u enige inligting benodig met die voltooiing van die vraelys, moet u nie huiwer om met my in aanraking te kom nie by (012)664-0825 gedurende kantoorure, of by Posbus 14919, LYTTELTON, 0140.

Stuur asseblief die voltooide vraelys per faks terug na (012)664-0825 (‘n privaat tydelike nommer).

U vriendelike samewerking word waardeer.

Vriendelike groete

Cecilia Beukes

Goedgekeur deur

PROFESSOR QUINTUS VORSTER
(Studieleier) (Hoof Departement Rekeningkunde)
CHAPTER 4

RESULTS OF AND CONCLUSIONS DRAWN FROM THE QUESTIONNAIRE

4.1 INTRODUCTION

This chapter contains an analysis of the reactions and results which were obtained from the empirical investigation into the opinions of environmental and rehabilitation managers in the mining industry in South Africa. Their views were obtained on rehabilitation management issues which have an influence on management accounting procedures. These opinions were used to formulate a comprehensive strategy for rehabilitation management accounting developments (in Chapters 7 and 8).

The response is firstly discussed in terms of the handling of the returned questionnaires, and the response figures are analysed. This is followed by a discussion of the choice of the analysis methodology for this particular investigation.

The collected opinions are then analysed by means of tables, discussions and, where applicable, histogram representations. Direct conclusions are drawn from percentages in most of the deductions.

Since a one hundred percent response in a population survey like this one, could not be expected, an attempt has been made to identify the limitations which might have caused non-response. The major restrictions encountered in the survey are analysed.

This chapter is concluded with an account of the perceived status quo based on the particular responses in the returned questionnaires concerning the rehabilitation management accounting opinions of environmental managers in the mining industry. Deductions and conclusions on the opinions obtained from the survey are provided. Subjects that form part of the holistic approach to the development of the proposed strategy, but which are not included in the major objectives of this study, are provided for further investigation and research.
4.2 HANDLING THE RESPONSE

A fortnight after the first questionnaires were sent out, follow-up questionnaires were sent to the target group. At that stage it was found that the response rate was 22.6%.

The returned responses were examined for obvious discrepancies and, where necessary, these were corrected. One of the instances where corrections were needed was where respondents indicated that they were uncertain, but did not mark the “U” option. All respondents marked one option only throughout the questionnaire. All returned questionnaires were used in the analyses.

Then the applicable codes were added in preparation for further statistical processing. In order to study the distribution and other characteristics of the data obtained, the researcher subjected the data to statistical processing. It was possible to detect relationships between data groups and similar statements, as well as differences in the influence of the negative formulations on the filter statements.

4.3 RESPONSE

The response figures are analysed in terms of the commodities mined, and reasons for non-response are investigated.

The number and rate of returned questionnaires compared with the number of targets, as well as with the number of targets reached, are illustrated in Table 4.1(a).
Table 4.1(a) Figures for response to questionnaire

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Target</th>
<th>Could not be reached or duplicates</th>
<th>Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Listed</td>
<td>Faxed no. %</td>
<td>Number %</td>
</tr>
<tr>
<td>Gold,* platinum, silver</td>
<td>58</td>
<td>49 84,5</td>
<td>9</td>
</tr>
<tr>
<td>Coal</td>
<td>55</td>
<td>47 85,5</td>
<td>8</td>
</tr>
<tr>
<td>Asbestos</td>
<td>3</td>
<td>3 100</td>
<td>0</td>
</tr>
<tr>
<td>Chromium</td>
<td>13</td>
<td>13 100</td>
<td>0</td>
</tr>
<tr>
<td>Vanadium</td>
<td>6</td>
<td>4 66,7</td>
<td>2</td>
</tr>
<tr>
<td>Iron</td>
<td>7</td>
<td>7 100</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>142</td>
<td>123</td>
<td>18</td>
</tr>
</tbody>
</table>

Average 86,6% 33,8% 39,02%

* For purposes of further analysis, the category “gold, platinum and silver” is indicated as “gold”.

Comments:

Since a usable response of 39,02% (48 out of 123) was received, the response was not generalised over the whole population of environmental and rehabilitation managers in the gold-mining and coal-mining industries and other smaller categories. A response of 39,02% in a population survey like this one could be regarded as satisfactory. The deductions are only applicable to the mines or groups of mines that responded to the questionnaire.

Table 4.1 (b) compares the response in the different commodity categories with the number of employees.
Table 4.1(b) Response according to number of employees

<table>
<thead>
<tr>
<th>Employees</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
<td>No.</td>
</tr>
<tr>
<td>1-100</td>
<td>1</td>
<td>4,5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>101-500</td>
<td>3</td>
<td>13,6</td>
<td>4</td>
<td>23,5</td>
</tr>
<tr>
<td>501-1 000</td>
<td>1</td>
<td>4,5</td>
<td>6</td>
<td>35,3</td>
</tr>
<tr>
<td>1 001-2 000</td>
<td>1</td>
<td>4,5</td>
<td>5</td>
<td>29,4</td>
</tr>
<tr>
<td>2 000+</td>
<td>16</td>
<td>72,7</td>
<td>2</td>
<td>11,8</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>17</td>
<td>8</td>
<td>47</td>
</tr>
</tbody>
</table>

Comments:

One respondent out of 48 did not answer this question.

It could be deduced from these responses that most of the responding gold mines employ more than 2 000 people, whereas coal mines and other categories mainly employ between 100 and 2 000 people. This means that 40,4% of the responding environmental managers are from the biggest mines in the country.

Efforts were made to limit non-response to the minimum. According to Nel, Rädel & Loubser (1990:323), the responses and non-responses received could be classified into the following categories:

- could be reached and willing to respond
- could not be reached but willing to respond
- could not be reached and unwilling to respond
- could be reached but unwilling to respond

In this study 48 members of the target population could be reached and were willing to respond. Thirteen people out of the initial target population of 142 could not be reached. The main reason why they could not be reached was the closure of mines. Non-respondents, that is people who could be reached, but were unwilling to respond, numbered 75.
A satisfactory response to this questionnaire was received. Adequate data were obtained for the analysis of the opinions of environmental and rehabilitation managers in the mining industry for the purposes of this empirical study.

4.4 ANALYSIS METHODOLOGY

In theory a 100% response rate would be the only way to obtain 100% certainty. In practice this is not always possible. Therefore assumptions are made and statistical methods applied in order to determine trends and come to conclusions.

Since the number of responses in this empirical study was relatively low (less than 100), even with a satisfactory response rate, care should be taken to ensure that meaningful conclusions are reached when performing statistical analysis techniques. The combination of low response figures and a large number of statements (60) further complicates meaningful statistical comparisons. In order to determine the influence of all statements on one another, multivariate analysis methods should be applied, such as Hotelling's $T^2$, Principal Component Analysis (PCA), and Factor Analysis (FA). For $n > 3p$, $3 \times 60 = 180$ responses are necessary, where $n = \text{sample size}$, $p = \text{dimensions}$ (Chatfield & Collins 1989). The number of 48 responses is therefore not adequate for this type (PCA, FA) of analysis. The target population (123) in this study is not large enough to justify these comparing analysis procedures with the large number of statements.

When any one of the categories of opinions, that is strongly agree (SA), agree (A), uncertain (U), disagree (D), and strongly disagree (SD), is indicated by 50% or more of the total number, that particular opinion would be regarded as the majority opinion of the respondents of the returned questionnaires. In addition, the categories for agreement, strongly agree (SA) and agree (A), are grouped together, as are the categories for disagreement, strongly disagree (SD) and disagree (D). Whenever it was possible to place 50% or more of the total number of respondents in either of these groups, that particular opinion regarding the statement would be identified as the general opinion of the respondents of the returned questionnaires.

These five categories are illustrated by means of simple tabulation, also known as one-way or univariate tabulation. The number and percentage in each category are indicated in tabular form. The statements are analysed in the order in which the statements
appeared in the questionnaire. Comparisons between similar statements are made after the comments on the first of these statements. Groups of statements which are analysed together in order to arrive at conclusions on a certain aspect, such as on quality management accounting, are discussed after the comments on the last statement in the group.

Responses to similar statements are compared in the course of the discussion on the first of these statements. When there is a difference of less than ten percentage points between the general responses to statements, the results are considered not to differ significantly. Since the response received exceeds 30, groups of statements can be compared, but care should be taken regarding the overall significance (alpha) levels (Freund 1992:297). This alternative alpha method is more suitable for tests on commodities like medicines. On the basis of significance one can be confident that the findings in the survey could be applicable to the population (Chadwick, Bahr & Albrecht 1984:370).

When the statements compared in this study yield a response of general agreement of more than 50%, the responses are regarded as comparing favourably, but the percentages of responses indicating both uncertainty and general disagreement should not be completely ignored.

The opinions of the respondents on rehabilitation management accounting issues on the five point scale are analysed as a separate set. Only the informed respondents, or those who are familiar with the concepts, are regarded as "respondents" when analysing this set of data on the five point scale. The response on the question of how familiar the respondents are with the management accounting terminology and concepts is regarded as a different set of information and analysed separately. Direct deductions are made on the numbers and percentages of respondents who are not familiar with some of the concepts used in the questionnaire.

4.5 ANALYSIS OF THE COLLECTED OPINIONS

4.5.1 Introduction

The biographical information obtained on the respondents is firstly discussed. This is followed by a discussion of the background information on the type of commodity mined
and the size of the mine in terms of the number of employees.

The focal point of the empirical research is the analysis of the views of the mine managers and their environmental coordinators. The collected opinions from the returned questionnaires are presented and analysed in the tables that follow. The opinions of the environmental managers pertaining to rehabilitation management accounting procedures are analysed in terms of the following five categories: “strongly agree (SA)”, “agree (A)”, “uncertain (U)”, “disagree (D)” and “strongly disagree (SD)”. Because of the rounding off of the figures (to the first decimal), the percentages do not necessarily add up to 100%. Since the respondents can choose the option “not familiar with the concept”, and only one response is required to each statement, the number of responses do not always add up to the total of responses in the five categories ranging from “strongly agree” to “strongly disagree”.

Various statements on the questionnaire are grouped together and then analysed. These analyses follow immediately after the analysis of the last statement in a particular group. This analysis of the five categories is followed by a separate set of data on the familiarity of the respondents with the rehabilitation management accounting concepts used in the questionnaire, as indicated in 48 responses.

4.5.2 Section 1: Background information

1.1 on questionnaire: Occupations of the respondents

The occupations of the respondents who are in charge of environmental and rehabilitation management in the mines covered by the survey, are shown in Table 4.2(a).
Table 4.2(a) Occupations of respondents

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer</td>
<td>22</td>
<td>46,8</td>
</tr>
<tr>
<td>Geologist</td>
<td>6</td>
<td>12,8</td>
</tr>
<tr>
<td>Botanist</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>19</td>
<td>40,4</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100</td>
</tr>
</tbody>
</table>

One respondent did not give his or her occupation. Other occupations which the respondents specified in the returns are listed in Table 4.2(b).

Table 4.2(b) Other occupations

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine manager</td>
<td>2</td>
</tr>
<tr>
<td>Geochemist (environmental coordinator)</td>
<td>1</td>
</tr>
<tr>
<td>Financial manager</td>
<td>1</td>
</tr>
<tr>
<td>Collier manager</td>
<td>1</td>
</tr>
<tr>
<td>Environmental safety and health manager</td>
<td>1</td>
</tr>
<tr>
<td>Historian</td>
<td>1</td>
</tr>
<tr>
<td>Geohydrologist</td>
<td>2</td>
</tr>
<tr>
<td>Geomorphologist</td>
<td>1</td>
</tr>
<tr>
<td>Environmental superintendent</td>
<td>1</td>
</tr>
<tr>
<td>Projects manager</td>
<td>1</td>
</tr>
<tr>
<td>Environmental geochemist</td>
<td>1</td>
</tr>
<tr>
<td>Environmental engineer</td>
<td>1</td>
</tr>
<tr>
<td>Ecologist</td>
<td>1</td>
</tr>
<tr>
<td>Environmental coordinator</td>
<td>1</td>
</tr>
<tr>
<td>Horticulturist</td>
<td>1</td>
</tr>
<tr>
<td>“Other” - unspecified</td>
<td>2</td>
</tr>
</tbody>
</table>

Comments:

From the information acquired it is clear that the people responsible for environmental
and rehabilitation management in the selected mining industries are mostly engineers (46,8%), followed by geologists (12,8%). A relatively high proportion (40,4%) of the respondents have a variety of other occupations and are representative of various background academic disciplines.

This confirms the point of view that a multidisciplinary team approach contribute towards better rehabilitation management policies. Representatives of each of the occupations mentioned above could make a contribution from the perspective of their own particular field of expertise.

1.2 on the questionnaire: Highest qualifications of the respondents

Not all the respondents completed this question, but those who did give their highest qualifications as indicated in Table 4.3.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctorate</td>
<td>1</td>
<td>2,2</td>
</tr>
<tr>
<td>Master’s</td>
<td>8</td>
<td>17,4</td>
</tr>
<tr>
<td>Honours</td>
<td>7</td>
<td>15,2</td>
</tr>
<tr>
<td>MBA</td>
<td>3</td>
<td>6,5</td>
</tr>
<tr>
<td>Other post-graduate</td>
<td>2</td>
<td>4,3</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>8</td>
<td>17,4</td>
</tr>
<tr>
<td>Other tertiary qualifications</td>
<td>9</td>
<td>19,6</td>
</tr>
<tr>
<td>Other qualifications</td>
<td>8</td>
<td>17,4</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100</td>
</tr>
</tbody>
</table>

Two respondents did not complete this section of the questionnaire.

Other postgraduate qualifications that were given included the following: (Some respondents gave more than one qualification.)

- Mine Manager’s Certificate: 1
- CA (SA): 1
No-one provided detailed information on other tertiary qualifications on the returns.

Other qualifications indicated by the respondents include the following: (Some respondents gave more than one qualification.)

- COM. Certificate in Mining Environmental Control 2
- NMD Mining 1
- Radiation Protection Diploma 1
- Diploma 1
- Certificate in Mine Management 2
- National Diploma for Technicians 1
- M/O Certificate 1
- Business Management Diploma 1

Comments:

This confirms the general impression that the respondents, and therefore environmental and rehabilitation managers in South Africa, have a high average level of academic proficiency. Each of the respondents has at least one additional post-school qualification. The tertiary qualifications are at a relatively high level, with 21 (45.7%) of the respondents having at least post-graduate qualifications, including one doctorate in engineering, as well as 8 (17.4%) master's and 7 (15.2%) honours degrees. It is clear that these respondents have the ability to acquire high levels of expertise in rehabilitation management and the accompanying management accounting procedures.

1.3 on questionnaire: Age groups of the respondents

The age groups of the environmental managers who responded to this question are shown in Table 4.4.
Table 4.4  Age groups

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 30</td>
<td>3</td>
<td>6,52</td>
</tr>
<tr>
<td>31 - 40</td>
<td>17</td>
<td>36,96</td>
</tr>
<tr>
<td>41 - 50</td>
<td>17</td>
<td>36,96</td>
</tr>
<tr>
<td>51 - 60</td>
<td>9</td>
<td>19,56</td>
</tr>
<tr>
<td>60+</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Response</td>
<td>46</td>
<td>100</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Comments:

Most (73,92%) of the environmental managers who responded to this question are in the age group between 31 and 50. In this age group environmental managers have sufficient interest and energy - together with maturity - to develop strategies for improving rehabilitation management practices.

1.4 on questionnaire: Commodities mined

Table 4.5 shows the number of responding mines that produced commodities in each of the categories indicated.

Table 4.5  Commodities mined

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum, gold, silver, uranium</td>
<td>22</td>
<td>45,8</td>
</tr>
<tr>
<td>Coal</td>
<td>17</td>
<td>35,4</td>
</tr>
<tr>
<td>Asbestos</td>
<td>1</td>
<td>2,1</td>
</tr>
<tr>
<td>Chromium</td>
<td>5</td>
<td>10,4</td>
</tr>
<tr>
<td>Vanadium</td>
<td>1</td>
<td>2,1</td>
</tr>
<tr>
<td>Iron</td>
<td>2</td>
<td>4,2</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100</td>
</tr>
</tbody>
</table>
Comments:

Since the first and second categories, that is the gold (45.8%) and coal (35.4%) groups, are large enough, they were taken as the basis for further analyses. Asbestos, chromium, vanadium and iron ore were included in the group for other commodities (18.8%).

1.5 on questionnaire: *Number of employees at the mine/s*

In order to determine the scope of environmental and rehabilitation activities in the various categories, the number of employees is used as basis for deductions. Table 4.6 is an analysis of the number of employees at mines or groups of mines that fall under a single environmental manager.

**Table 4.6   Number of employees**

<table>
<thead>
<tr>
<th>Group</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 100</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.1</td>
</tr>
<tr>
<td>101 - 500</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>10</td>
<td>21.3</td>
</tr>
<tr>
<td>501 - 1 000</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>9</td>
<td>19.1</td>
</tr>
<tr>
<td>1 001 - 1999</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>2 000+</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td>19</td>
<td>40.4</td>
</tr>
</tbody>
</table>

Comments:

One respondent did not answer this question. One respondents employed at a coal mine, mentioned that their employees decreased in number from more than 2 000 in 1997 to between 500 and 1 000 in 1998. No reason was given.
4.5.3 Section 2.1 Opinions on the strategic management accounting dimension of quality (Tables 4.7 - 4.24)

Statement 2.1.1 A total approach ranging from impact assessment to aftercare should be adopted. (Compare with Statements 2.2.4 and 2.1.4.)

Table 4.7 Statement 2.1.1

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>10 20,8</td>
<td>12 25</td>
<td>2 4,2</td>
<td>24 50</td>
</tr>
<tr>
<td>Agree</td>
<td>11 22,9</td>
<td>5 10,4</td>
<td>6 12,5</td>
<td>22 45,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>46 95,8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1 2,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion is one of strong agreement (50%) with the statement, while the general opinion is agreement (95,8%) with the statement. Most of the respondents are of the opinion that a comprehensive approach ranging from impact assessment to aftercare should be adopted for rehabilitation management.

The general agreement with this statement (95,8%) does not differ significantly from opinions expressed on similar statements on long-term rehabilitation management, namely Statements 2.1.4 (97,9%) and 2.2.4 (95,8%).
Statement 2.1.2 A category for prevention costs should be introduced to reduce future rehabilitation costs such as failure costs. (Compare with Statement 2.2.2.)

Table 4.8 Statement 2.1.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>7 14,6</td>
<td>4  8,3</td>
<td>2  4,2</td>
<td>13 27,1</td>
</tr>
<tr>
<td>Agree</td>
<td>11 22,9</td>
<td>12 25</td>
<td>5 10,4</td>
<td>28 58,3</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2  4,2</td>
<td>1  2,1</td>
<td>2  4,2</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Disagree</td>
<td>2  4,2</td>
<td>0  0</td>
<td>0  0</td>
<td>2  4,2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0  0</td>
<td>0  0</td>
<td>0  0</td>
<td>0  0</td>
</tr>
<tr>
<td>General agreement</td>
<td>41</td>
<td>85,4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2</td>
<td>4,2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (58,3%) is agreement with the statement, and the general opinion (85,4%) is also agreement. Most of the respondents are of the opinion that prevention costs should be introduced to obviate the need for the future expenditure on rehabilitation.

The general agreement with this statement (85,4%) on prevention costs compares favourably with the opinion expressed on a similar statement on the designing out of costs, namely Statement 2.2.2 (97,9%).
Statement 2.1.3 A balance matrix should be developed to determine the degree of environmental equilibrium.

Table 4.9 Statement 2.1.3

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>6 16,2</td>
<td>0 0</td>
<td>0 0</td>
<td>6 16,2</td>
</tr>
<tr>
<td>Agree</td>
<td>12 32,4</td>
<td>10 27,0</td>
<td>4 10,8</td>
<td>26 70,3</td>
</tr>
<tr>
<td>Uncertain</td>
<td>1 2,7</td>
<td>3 8,1</td>
<td>1 2,7</td>
<td>5 13,5</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 32 86,5%
General disagreement 0 0

Comments:
The majority opinion (70,3%) is agreement with the statement, and the general opinion is agreement (86,5%). Most of the responding environmental managers are of the opinion that a balance matrix between environmental inputs and gains should be developed.

Statement 2.1.4 Strategic management planning for long-term rehabilitation management and aftercare should exist. (Compare with Statements 2.1.1 and 2.2.4.)

Table 4.10 Statement 2.1.4

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>8 16,7</td>
<td>10 20,8</td>
<td>0 0</td>
<td>18 37,5</td>
</tr>
<tr>
<td>Agree</td>
<td>14 29,2</td>
<td>6 12,5</td>
<td>9 18,8</td>
<td>29 60,4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>1 2,1</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 47 97,9%
General disagreement 0 0
Comments:

The majority opinion (60.4%) is agreement with the statement, and the general opinion (97.9%) is also agreement. None of the respondents expressed a dissenting opinion. This means that the respondents are in favour of long-term strategic management planning for rehabilitation management and aftercare.

Statement 2.1.5 The management accountant should function with the support of cross-functional teams and experts through all the phases from design to disposition during rehabilitation activities. (Treat Statements 2.1.5 to 2.1.8 on benchmarking as a group.)

Table 4.11 Statement 2.1.5

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>4 8,5</td>
<td>5 10,6</td>
<td>2 4,3</td>
<td>11 23,4</td>
</tr>
<tr>
<td>Agree</td>
<td>12 25,5</td>
<td>8 17,0</td>
<td>6 12,8</td>
<td>26 55,3</td>
</tr>
<tr>
<td>Uncertain</td>
<td>5 10,6</td>
<td>1 2,1</td>
<td>1 2,1</td>
<td>7 14,9</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>2 4,3</td>
<td>0 0</td>
<td>3 6,4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 37 78,7%

General disagreement 3 6,4%

Comments:

The majority opinion (55.3%) is agreement with the statement, and the general opinion (78.7%) is also agreement. Most respondents recognise the role of the management accountant in a multi-functional team during rehabilitation activities.
Statement 2.1.6 Benchmarking should be used by management in the same mining sector and/or region.

Table 4.12 Statement 2.1.6

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>5 10,4</td>
<td>3 6,3</td>
<td>2 4,2</td>
<td>10 20,8</td>
</tr>
<tr>
<td>Agree</td>
<td>16 33,3</td>
<td>12 25</td>
<td>6 12,5</td>
<td>34 70,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>3 6,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>44</td>
<td></td>
<td></td>
<td>91,7%</td>
</tr>
<tr>
<td>General disagreement</td>
<td>1</td>
<td></td>
<td></td>
<td>2,1%</td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (70,8%) is agreement with the statement, and the general opinion (91,7%) is agreement.

The general opinion of agreement (91,7%) with this statement about benchmarking in the same mining sector or region does not differ significantly from opinions expressed on a similar statement on benchmarking for purposes of continuous improvement, namely Statement 2.1.8 (100%). Since Statement 2.1.7 is a filter statement and the respondents seem to be confused, these two statements (2.1.6 and 2.1.8) are not compared with the filter statement.
Statement 2.1.7 Benchmarking should not be utilised over the whole spectrum of rehabilitation from design to aftercare. (Filter Statement)

Table 4.13 Statement 2.1.7

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>1</td>
<td>2,1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>16,7</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4</td>
<td>8,3</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
<td>16,7</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>2,1</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

General agreement 18 37,5%
General disagreement 20 41,7%

Comments:

Although most of the respondents disagree that benchmarking should not be utilised for rehabilitation management purposes, neither a majority nor a general opinion could be obtained from this response.

This filter statement seems to have confused the respondents. The general disagreement (41,7%) with this statement does not correspond to the general agreement with similar statements, namely Statements 2.1.6 (91,7%) and 2.1.8 (100%). This response to Statement 2.1.7 is not regarded as a valid means of arriving at conclusions on the opinion of environmental managers on benchmarking. This conclusion is borne out by the relatively high percentage (20,8%) of respondents who were uncertain.
Statement 2.1.8. An awareness should exist of the continuous search for best practices in order to improve processes and activities. (Compare with 2.1.6 and 2.1.7.)

Table 4.14 Statement 2.1.8

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>10 20,8</td>
<td>7 14,6</td>
<td>2 4,2</td>
<td>19 39,6</td>
</tr>
<tr>
<td>Agree</td>
<td>12 25</td>
<td>10 20,8</td>
<td>7 14,6</td>
<td>29 60,4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 48 100%
General disagreement 0 0%

Comments:

The majority opinion (60,4%) is agreement with the statement, and the general opinion is agreement (100%). This is one of only two statements that produced a response of full (100%) agreement. The other statement was 2.1.9.

Comments on Statements 2.1.5 to 2.1.8: (Opinions on benchmarking.)

The results of Statement 2.1.7 were ignored for the analysis of this group of statements, because this filter statement confused the respondents.

General agreement for these three statements were expressed by 78,7% (2.1.5), 91,7% (2.1.6) and 100% (2.1.8) of the respondents. The general opinion of environmental managers who responded to the questionnaire is that benchmarking should be practised in order to improve rehabilitation processes and activities. The attitude towards benchmarking is illustrated in Diagram 4.1. This positive attitude towards improved quality management through benchmarking, with the management accountant playing a primary role, should be taken into account when developing strategies for improved management accounting approaches.
Diagram 4.1 Opinions on benchmarking (Statements and %)

Comments on Statements 2.1.1 to 2.1.8:
(These statements are opinions on how the strategic management accounting dimension of quality should be utilised for rehabilitation management purposes.) Filter Statement 2.1.7 is omitted because of the evident confusion among the respondents.

General agreement exists that the quality management accounting issues mentioned previously should be included in environmental and rehabilitation management policies. These responses by the environmental managers at the mines who responded to the questionnaire, were 95.8% (2.1.1), 85.4% (2.1.2), 86.5% (2.1.3), 97.9% (2.1.4), 78.7% (2.1.5), 91.7% (2.1.6), and 100% (2.1.8) in favour of this view. Relatively high percentages were obtained in respect of general agreement with this set of statements. Views on the extent to which quality management should be included in rehabilitation management, are reflected in Diagram 4.2. This means that most environmental managers are positively disposed towards quality management approaches in rehabilitation policies at mining enterprises.
Diagram 4.2 How quality management should be utilised

Statement 2.1.9 Feedback to management on successful rehabilitation operations is important for management decision-making purposes. (Actually) (Compare with 2.1.10.)

Table 4.15 Statement 2.1.9

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>10</td>
<td>8</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Agree</td>
<td>12</td>
<td>9</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>48</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>0</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (54,6%) is agreement with the statement, and the general opinion (100%) is agreement. The only other statement which elicited a response of 100%
agreement was Statement 2.1.8. When simple weighted average calculations are applied, this statement (2.1.9) produced the highest general agreement response of the entire questionnaire. This underlines the fact that feedback on successful rehabilitation operations is regarded as of the utmost importance for management decision making.

The general opinion of agreement for this statement (100%) does not differ significantly from the opinions expressed on a similar statement, namely Statement 2.1.10 (93,8%).

Statement 2.1.10 Feedback on failures in rehabilitation management is necessary for management decision-making purposes. (Actually) (Compare with Statement 2.1.9.)

Table 4.16 Statement 2.1.10

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>10 20,8</td>
<td>10 20,8</td>
<td>5 10,4</td>
<td>25 52,1</td>
</tr>
<tr>
<td>Agree</td>
<td>9 18,8</td>
<td>7 14,6</td>
<td>4 8,3</td>
<td>20 41,7</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4,2</td>
<td>0 0</td>
<td>0 0</td>
<td>2 4,2</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>2 2,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>45 93,8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1 2,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (52,1%) is strong agreement with the statement, while the general opinion is agreement (93,8%). Feedback on failures in the actual situation is regarded as very important for decision making.
Statement 2.1.11 Financial results of rehabilitation inputs are disclosed to stakeholders.

(Actually) (Compare with Statements 2.1.13 and 3.2.4.)

Table 4.17 Statement 2.1.11

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>8</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

General agreement 38 79.2%

General disagreement 6 12.5%

Comments:

The majority opinion (58.3%) is agreement with the statement, while the general opinion (79.2%) is agreement. Financial results of rehabilitation inputs are disclosed to stakeholders according to 79.2% of the respondents.

The general agreement with this statement (79.2%) compares favourably with other statements on disclosure, namely Statements 2.1.13 (67.4%) and 3.2.4 (64.6%). The latter statements, namely Statements 2.1.13 (67.4%) and 3.2.4 (64.6%) also do not differ significantly from each other either.

It is encouraging to observe that such a high percentage of the responding environmental managers mentioned that both financial and non-financial inputs, results and gains concerning rehabilitation procedures are disclosed to interested and affected parties.
Statement 2.1.12 Non-financial rehabilitation results are measured. (Actually) (Compare with Statement 2.1.13.)

Table 4.18 Statement 2.1.12

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold No. %</th>
<th>Coal No. %</th>
<th>Other No. %</th>
<th>Total No. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>3 6,4</td>
<td>4 8,5</td>
<td>1 2,1</td>
<td>8 17,0</td>
</tr>
<tr>
<td>Agree</td>
<td>11 23,4</td>
<td>10 21,3</td>
<td>6 12,8</td>
<td>27 57,4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>5 10,6</td>
<td>1 2,1</td>
<td>1 2,1</td>
<td>7 14,9</td>
</tr>
<tr>
<td>Disagree</td>
<td>3 6,4</td>
<td>2 4,3</td>
<td>0 0</td>
<td>5 10,6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>35</td>
<td></td>
<td></td>
<td>74,5%</td>
</tr>
<tr>
<td>General disagreement</td>
<td>5</td>
<td></td>
<td></td>
<td>10,6%</td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (57,4%) is agreement with the statement, while the general opinion (74,5%) is agreement. This means that according to 74,5% of the respondents non-financial rehabilitation results are actually measured.

The general opinion (74,5%) of agreement with this statement on the assessment of non-financial results does not differ significantly from the opinions expressed on a similar statement on the disclosure of non-financial inputs and gains, namely Statement 2.1.13 (67,4%).
Statement 2.1.13 Non-financial rehabilitation inputs and gains are disclosed to stakeholders. (Actually) (Compare with Statements 2.1.11 and 2.1.12.)

Table 4.19 Statement 2.1.13

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4,3</td>
<td>0 0</td>
<td>0 0</td>
<td>2 4,3</td>
</tr>
<tr>
<td>Agree</td>
<td>12 26,1</td>
<td>10 21,7</td>
<td>7 15,2</td>
<td>29 63</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4,3</td>
<td>2 4,3</td>
<td>0 0</td>
<td>4 8,7</td>
</tr>
<tr>
<td>Disagree</td>
<td>6 13</td>
<td>4 8,7</td>
<td>1 2,2</td>
<td>11 23,9</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 31 67,4%
General disagreement 11 23,9%

Comments:

The majority opinion (63%) is agreement with the statement, while the general opinion (67,4%) is agreement. Non-financial rehabilitation inputs and gains are disclosed to stakeholders according to 67,4% of the respondents.
Statement 2.1.14 Financial issues form an integral part of the procedure to find a balancing position in respect of environmental cost management. (Actually) (Treat 2.1.14 to 2.1.17 as a group.)

Table 4.20 Statement 2.1.14

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>8 16,7</td>
<td>8 16,7</td>
<td>4 8,3</td>
<td>20 41,7</td>
</tr>
<tr>
<td>Agree</td>
<td>10 20,8</td>
<td>8 16,7</td>
<td>5 10,4</td>
<td>23 47,9</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>0 0</td>
<td>3 6,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2 4,2</td>
<td>0 0</td>
<td>0 0</td>
<td>2 4,2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 43 89,6%
General disagreement 2 4,2%

Comments:

No majority opinion on the statement can be deduced, while the general opinion is agreement (89,6%) that financial issues actually form an integral part of the procedure for finding a balancing position in respect of environmental cost management.
Statement 2.1.15 Issues on the natural environment form an integral part of the procedure to find a balancing position regarding environmental cost management.

(Actually)

Table 4.21 Statement 2.1.15

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Agree</td>
<td>13</td>
<td>10</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

General agreement: 38 (82,6%)

General disagreement: 3 (6,5%)

Comments:
The majority opinion (63%) is agreement with the statement, and the general opinion (82,6%) is agreement. Issues relating to the natural environment actually form an integral part of the procedure for finding a balancing position regarding environmental cost management, according to the environmental managers who responded.

Statement 2.1.16 Leadership factors form an integral part of the procedure to find a balancing position regarding environmental cost management.

(Actually)

Table 4.22 Statement 2.1.16

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>11</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

General agreement: 39 (83%)

General disagreement: 3 (6,4%)
Comments:

The majority opinion (68,1%) is agreement with the statement, while the general opinion (83%) is agreement. According to these respondents, leadership factors actually form an integral part of the procedure for finding a balancing position regarding environmental cost management.

Statement 2.1.17 Issues pertaining to the implementation of environmental rehabilitation form an integral part of the procedure to find a balancing position in respect of environmental cost management. (Actually) (Compare with Statement 2.1.3.)

Table 4.23 Statement 2.1.17

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>4,2</td>
<td>3</td>
<td>6,1</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>31,3</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>6,3</td>
<td>2</td>
<td>4,2</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
<td>4,2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>39</td>
<td>81,3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2</td>
<td>4,2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (68,8%) is agreement with the statement, and the general opinion (81,3%) is agreement. Environmental rehabilitation issues form an integral part of the actual procedure for finding a balancing position in respect of environmental cost management, according to these respondents.

Comments on Statements 2.1.14 to 2.1.17:

The general opinion of respondents is agreement that financial issues (89,6%), issues on the natural environment (79,2%), leadership factors (81,3%) and issues pertaining to the implementation of rehabilitation (81,3%) form an integral part of the procedure for finding a balancing position in respect of environmental cost management. This general
opinion is reflected in Diagram 4.3. Environmental managers who responded to the questionnaire agree that financial as well as non-financial issues, such as the natural environment, leadership factors and implementation procedures, are actually included in long-term strategies for finding a balancing position in respect of environmental cost management.

**Diagram 4.3 Factors involved in finding a balancing position (Statements and %)**

![Diagram 4.3 Factors involved in finding a balancing position](image)

**Statement 2.1.18 Measurable is tantamount to manageable in rehabilitation management.**

**Table 4.24 Statement 2.1.18**

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>6 13</td>
<td>5 10,9</td>
<td>1 2,2</td>
<td>12 26,1</td>
</tr>
<tr>
<td>Agree</td>
<td>10 21,7</td>
<td>8 17,4</td>
<td>5 10,9</td>
<td>23 50</td>
</tr>
<tr>
<td>Uncertain</td>
<td>6 13</td>
<td>1 2,2</td>
<td>2 4,3</td>
<td>9 19,6</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>2 4,3</td>
<td>0 0</td>
<td>2 4,3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

General agreement 35 76,1%

General disagreement 2 4,3%
Comments:

A majority opinion (50%) can be deduced for the statement, and the general opinion is agreement (76,1%). This opinion emphasises the fact that measurable is tantamount to manageable in rehabilitation management.

Comments on Statements 2.1.9 to 2.1.18:
(Opinions on how the strategic management accounting dimension of quality is actually experienced.)

The general agreement response by the environmental managers to statements on the actual position regarding positive quality management approaches within the framework of management accounting varies from 100% (2.1.9) to 64,6% (2.1.13). The response to the latter statement includes a figure of 22,9% reflecting disagreement on the disclosure of non-financial rehabilitation inputs and gains.

The percentages for general agreement are 100% (2.1.9), 93,8% (2.1.10), 79,2% (2.1.11), 74,5% (2.1.12), 67,4% (2.1.13), 89,6% (2.1.14), 82,6% (2.1.15), 83% (2.1.16), 81,3% (2.1.17) and 76,1% (2.1.18). These responses generally reflect a favourable opinion of the actual application of quality management accounting procedures for rehabilitation management purposes. These opinions are illustrated in Diagram 4.4.

**Diagram 4.4 Experience of quality management (Statements and %)**
4.5.4 Section 2.2: Opinions on the strategic management accounting dimension of cost (Tables 4.25-4.39)

Statement 2.2.1 Environmental costs and expenses should be integrated routinely into management decision making.

Table 4.25 Statement 2.2.1

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>10 20,8</td>
<td>7 14,6</td>
<td>4 8,3</td>
<td>21 43,8</td>
</tr>
<tr>
<td>Agree</td>
<td>11 22,9</td>
<td>9 18,8</td>
<td>5 10,4</td>
<td>25 52,1</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>1 2,1</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>46 95,8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1 2,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (52,1%) is agreement with the statement, and the general opinion (95,8%) is agreement. Most of the environmental managers who responded are of the opinion that environmental costs and expenses should be routinely integrated into management decision making.

Statement 2.2.2 Designing costs out in respect of rehabilitation management should form an integral part of strategic management. (Compare with Statement 2.1.2.)

Table 4.26 Statement 2.2.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>9 18,8</td>
<td>7 14,6</td>
<td>6 12,5</td>
<td>22 45,8</td>
</tr>
<tr>
<td>Agree</td>
<td>12 25</td>
<td>10 20,8</td>
<td>3 6,3</td>
<td>25 52,1</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>47 97,9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1 2,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

The majority opinion (52,1%) is agreement with the statement, and the general opinion (97,9%) is agreement. Only one respondent did not agree that rehabilitation expenditure should be designed out at the design stage.

Statement 2.2.3 Monetary investments in education and training of the whole workforce in environmental preservation would improve strategic management policies. (Compare with Statements 2.3.2 and 3.2.6.)

Table 4.27 Statement 2.2.3

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>6  12,5</td>
<td>1  2,1</td>
<td>3  6,3</td>
<td>10  20,8</td>
</tr>
<tr>
<td>Agree</td>
<td>8  16,7</td>
<td>9  18,8</td>
<td>4  8,3</td>
<td>21  43,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4   8,3</td>
<td>3   6,3</td>
<td>1  2,1</td>
<td>8   16,7</td>
</tr>
<tr>
<td>Disagree</td>
<td>4   8,3</td>
<td>4   8,3</td>
<td>1  2,1</td>
<td>9   18,8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0   0</td>
<td>0   0</td>
<td>0   0</td>
<td>0   0</td>
</tr>
<tr>
<td>General agreement</td>
<td>31</td>
<td>64,6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>9</td>
<td>18,8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

No majority opinion on this statement could be derived from the responses; the general opinion is agreement (64,6%).

The general opinion (64,6%) of agreement on this statement does not differ significantly from the opinions expressed on a similar statement on education and training, namely Statement 2.3.2 (70,2%). The general opinion is that both monetary and time investments in education and training would improve strategic management policies.

The general opinion of agreement with these statements (64,6% and 76,6%) compares favourably with the opinions expressed on Statement 3.2.6 (83,3%) on whether education
and training could be utilised in order to bring about positive changes in behaviour towards rehabilitation practices.

The combined responses indicating uncertainty and disagreement (35.5%, 29.7%, 16.7%) to statements on the positive influence of environmental training and education supports the view of a study by the HSRC on environmental awareness of South African companies. The companies interviewed do not allocate time for environmental training, or else they deal with training only as and when the need arises, or have been unable to add environmental training to the already heavy load of training, or do not allocate any time at all to training (Daily Dispatch 1997). Companies do not yet realise the financial and non-financial benefits that could be derived from employing environmentally trained people who would reduce waste and maximise production. More research should be done on the financial and non-financial management accounting aspects of environmental training and education.

Statement 2.2.4 Monetary provision should be made for long-term rehabilitation management and aftercare. (Compare with Statements 2.1.4 and 2.1.1.)

Table 4.28 Statement 2.2.4

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Agree</td>
<td>11</td>
<td>10</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>46</td>
<td>98</td>
<td>100</td>
<td>95.8%</td>
</tr>
<tr>
<td>General disagreement</td>
<td>1</td>
<td>2.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (54.2%) is agreement with the statement, and the general opinion (95.8%) is agreement. Most of the respondents are of the opinion that financial provision
should be made for long-term rehabilitation management and aftercare.

Statement 2.2.5 Monetary provision should be made for contingencies (eg. flooding).
(Compare with Statement 3.1.3.)

Table 4.29 Statement 2.2.5

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Agree</td>
<td>12</td>
<td>11</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>32</td>
<td>66,7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>6</td>
<td>12,5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (52,1%) is agreement with the statement; the general opinion (66,7%) is agreement. The general agreement (66,7%) with this statement on financial provision for contingencies compares favourably with opinions on a similar statement relating to technical contingency planning, namely Statement 3.1.3 (81,3%).

Statement 2.2.6 Life cycle costs of the commodity mined should not be determined in terms of the value chain. (Filter Statement)

Table 4.30 Statement 2.2.6

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Agree</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>General agreement</td>
<td>8</td>
<td>21,1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>15</td>
<td>39,5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

Neither a majority opinion nor a general opinion could be derived from this information. This filter statement produced the highest percentage for uncertainty, namely 39.5%.

Statement 2.2.7 *The costs of the extended enterprise (on aftercare, consultants, research and development, contractors, suppliers, security, natural environment) should be determined.*

Table 4.31 Statement 2.2.7

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4.3</td>
<td>3 6.4</td>
<td>2 4.3</td>
<td>7 14.9</td>
</tr>
<tr>
<td>Agree</td>
<td>16 34</td>
<td>13 27.7</td>
<td>5 10.6</td>
<td>34 72.3</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4.3</td>
<td>1 2.1</td>
<td>2 4.3</td>
<td>5 10.6</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2.1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2.1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>41</td>
<td>87.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1</td>
<td>2.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (72.3%) is agreement with the statement, and the general opinion (87.2%) is agreement. Most of the respondents are of the opinion that the costs of the extended enterprise should be determined.
Statement 2.2.8 Expenditure to rehabilitate on an ongoing basis as part of the operating process should be separated from expenditure to rehabilitate damage from the past. (Taxation) (Compare with Statement 2.3.1.)

Table 4.32 Statement 2.2.8

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>4,2</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>31,3</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2</td>
<td>4,2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>2,1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2</td>
<td>4,2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

General agreement 37 77,1%
General disagreement 7 14,6%

Comments:
The majority opinion (58,3%) is agreement with the statement, and the general opinion (77,1%) is agreement. Most of the respondents agreed that rehabilitation costs should be divided into two distinct groups: costs in respect of damage inherited from the past and ongoing rehabilitation expenses. In the first instance the value of the land would increase, but in the second case it would remain the same. The general agreement (77,1%) with this statement does not differ significantly from opinions on another statement on the remediation of inherited environmental damage, namely Statement 2.3.1 (83,3%).

Comments on Statements 2.2.1 to 2.2.8:
(Opinions on how the strategic management accounting dimension of cost should be utilised for rehabilitation management purposes.)

Filter statement 2.2.6 is omitted because of the possibility that respondents may have been confused. Among this group of opinions, general agreement varied from 97,9% (2.2.2) to 64,6% (2.2.3). The general opinions expressing agreement with positive statements on cost management procedures for rehabilitation purposes, were 95,8% (2.2.1), 97,9% (2.2.2), 64,6% (2.2.3), 95,8% (2.2.4), 66,7% (2.2.5), 87,2% (2.2.7) and 77,1% (2.2.8). These opinions are analysed in Diagram 4.5. This relatively high
percentage of general agreement that the consideration of various cost factors should be an important element of strategic management accounting for rehabilitation purposes, reflects a positive attitude. When management accounting strategies for rehabilitation management purposes are developed, the attitude of the rehabilitation manager is an important contributing factor to the successful implementation of policies.

Diagram 4.5 How cost should be utilised (Statements and %)

Statement 2.2.9 Differentiate between internal rehabilitation value-added and non-value added environmental cost categories. (Actually) (Compare with Statement 2.2.10.)

Table 4.33 Statement 2.2.9

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>2 5,0</td>
<td>1 2,5</td>
<td>0 0</td>
<td>3 7,5</td>
</tr>
<tr>
<td>Agree</td>
<td>9 22,5</td>
<td>7 17,5</td>
<td>5 12,5</td>
<td>21 52,5</td>
</tr>
<tr>
<td>Uncertain</td>
<td>6 15,0</td>
<td>2 5,0</td>
<td>0 0</td>
<td>8 20,0</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,5</td>
<td>4 10,0</td>
<td>1 2,5</td>
<td>6 15,0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1 2,5</td>
<td>1 2,5</td>
<td>0 0</td>
<td>2 5,0</td>
</tr>
<tr>
<td>General agreement</td>
<td>24</td>
<td>60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>8</td>
<td>20%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

A majority opinion (52.5%) of support for the statement can be deduced, and the general opinion is agreement (60%).

The general opinion (60%) of agreement with this statement does not differ significantly from opinions on a similar statement on value-added cost categories, namely Statement 2.2.10 (57.5%). Relatively high responses, 20% and 22.5% respectively, indicating uncertainty were also recorded.

Statement 2.2.10 Differentiate between internal and external value-added and non-value-added environmental expenditure. (Actually) (Compare with Statement 2.2.9.)

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 5.0</td>
<td>1 2.5</td>
<td>0 0</td>
<td>3 7.5</td>
</tr>
<tr>
<td>Agree</td>
<td>9 22.5</td>
<td>6 15.0</td>
<td>5 12.5</td>
<td>20 50.0</td>
</tr>
<tr>
<td>Uncertain</td>
<td>6 15.0</td>
<td>1 2.5</td>
<td>2 5.0</td>
<td>9 22.5</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2.5</td>
<td>6 15.0</td>
<td>0 0</td>
<td>7 17.5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1 2.5</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2.5</td>
</tr>
<tr>
<td>General agreement</td>
<td></td>
<td></td>
<td></td>
<td>23 57.5%</td>
</tr>
<tr>
<td>General disagreement</td>
<td></td>
<td></td>
<td></td>
<td>8 20%</td>
</tr>
</tbody>
</table>

Comments:

It was possible to derive a majority opinion (50%) of agreement as well as a general opinion of agreement with the statement. A relatively high number of respondents (22.5%) chose the option “uncertain”.
Statement 2.2.11 Prevention costs are separated from other environmental cost categories. (Actually) (Treat Statements 2.2.11 - 2.2.15 as a group.) (Compare with Statement 2.1.2.)

Table 4.35 Statement 2.2.11

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Disagree</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

General agreement | 22 | 45,8% |
General disagreement | 18 | 37,5% |

Comments:
Although most (39,6%) of the respondents agree with the actual separation of prevention costs from the other environmental cost categories, neither a majority opinion nor a general opinion on the statement could be deduced.

Statement 2.2.12 Assessment costs are separated from other environmental cost categories. (Actually)

Table 4.36 Statement 2.2.12

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Uncertain</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Disagree</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

General agreement | 24 | 50% |
General disagreement | 20 | 41,7% |
Comments:

Although most (45.8%) of the respondents agree with the actual separation of assessments cost, a majority opinion could not be derived, and a general opinion of agreement (50%) with the statement was found.

Statement 2.2.13 Control costs are separated from other environmental cost categories. (Actually)

Table 4.37 Statement 2.2.13

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>1 2.1</td>
<td>1 2.1</td>
<td>0 0</td>
<td>2 4.2</td>
</tr>
<tr>
<td>Agree</td>
<td>11 22.9</td>
<td>10 20.8</td>
<td>5 10.4</td>
<td>26 54.2</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4.2</td>
<td>1 2.1</td>
<td>0 0</td>
<td>3 6.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>7 14.6</td>
<td>5 10.4</td>
<td>4 8.3</td>
<td>16 33.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1 2.1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2.1</td>
</tr>
<tr>
<td>General agreement</td>
<td>28</td>
<td></td>
<td>58.3%</td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>17</td>
<td></td>
<td>35.4%</td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (54.2%) was agreement with the statement, and the general opinion (58.3%) was agreement that control costs are separated from other environmental costs.
Statement 2.2.14 Failure costs are separated from other environmental cost categories.

(Actually)

Table 4.38 Statement 2.2.14

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>1 2,1</td>
<td>1 2,1</td>
<td>0 0</td>
<td>2 4,2</td>
</tr>
<tr>
<td>Agree</td>
<td>10 20,8</td>
<td>9 18,8</td>
<td>6 12,5</td>
<td>25 52,1</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4 8,3</td>
<td>2 4,2</td>
<td>2 4,2</td>
<td>8 16,7</td>
</tr>
<tr>
<td>Disagree</td>
<td>6 12,5</td>
<td>5 10,4</td>
<td>1 2,1</td>
<td>12 25</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
<tr>
<td>General agreement</td>
<td>27 56,3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>13 27,1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (52,1%) is agreement with the statement, and the general opinion (56,3%) is agreement that failure costs are separated from other environmental costs.

Statement 2.2.15 All major groups of rehabilitation costs (2.2.9 - 2.2.14) incurred are disclosed to stakeholders. (Actually)

Table 4.39 Statement 2.2.15

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4,2</td>
<td>3 6,3</td>
<td>0 0</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Agree</td>
<td>12 25</td>
<td>12 25</td>
<td>8 16,7</td>
<td>32 66,7</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3 6,3</td>
<td>0 0</td>
<td>0 0</td>
<td>3 6,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>5 10,4</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>8 16,7</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>37 77,1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>8 16,7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (66,7%) is agreement with the statement, and the general opinion (77,1%) is agreement that major environmental costs are actually disclosed to
stakeholders.

Comments on the group of statements from 2.2.11 to 2.2.15 (environmental cost categories):

Statement 2.2.15 is omitted for the purposes of this comparison. Although Statement 2.2.15 combines the various environmental cost categories as formulated by Ansari, et al (1997b: MMEC-5), it is not formulated in terms of the separation of the cost categories. The focus of this statement is on the actual disclosure of environmental costs to stakeholders.

Agreement with the statements was expressed by the following percentages of respondents: 45,8% (with 37,5% disagreement with Statement 2.2.11 on prevention costs), 50% (41,7% disagreement with Statement 2.2.12 on assessment costs), 58,3% (with 35,4% disagreement with Statement 2.2.13 on control costs), 56,3% (with 27,1% disagreement with Statement 2.2.14 on failure costs).

Although most of the respondents indicated agreement with the actual separation of the various cost categories of environmental costs, it seems that respondents do not really care whether costs are separated or kept together. This attitude is borne out by the relatively high “uncertain” responses to some of the statements, namely 16,7%, 8,3%, 6,3% and 16,7%.

The difficulty of drawing definite lines between cost categories that tend to overlap might be another reason for this response. Control costs, for example, could be regarded as prevention costs if they could prevent failure costs.

Comments on Statements 2.2.9 to 2.2.15:
(Opinions on how the strategic management accounting dimension of cost is actually utilised for rehabilitation management purposes.)

In this comparison the comparative comments on Statements 2.2.9 and 2.2.10 (value-added cost) were combined with the above comparative comments on Statements 2.2.11 to 2.2.15 (environmental costs). These two sets of comparative comments are not repeated, but some additional remarks are made in respect of the section on overall actual
costs. Statement 2.2.15 is omitted for purposes of comparing the responses in this section. Except for Statement 2.2.15, in which the emphasis falls on disclosure, each of the statements in this section concentrates on a single cost element in a cost category pertaining to environmental costs.

The opinions of the respondents vary between 45.8% and 58.3% in agreement with the actual separation and application of these cost elements. These opinions are illustrated in Diagram 4.6. Since no definite tendencies can be observed, it is necessary to exercise caution about making deductions and arriving at conclusions on the actual implementation of these elements of value-added and environmental cost categories.

Diagram 4.6 Opinions on utilisation of cost dimensions (Statements, %)
4.5.5 Section 2.3: Opinions on the strategic management accounting dimension of time (Tables 4.40 - 4.41)

Statement 2.3.1 Heritage (of badly rehabilitated land) is an important factor for strategic management. (Actually) (Compare with Statement 2.2.8.)

Table 4.40 Statement 2.3.1

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6,3</td>
<td>4 8,3</td>
<td>2 4,2</td>
<td>9 18,8</td>
</tr>
<tr>
<td>Agree</td>
<td>14 29,2</td>
<td>12 25</td>
<td>5 10,4</td>
<td>31 64,6</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4 8,3</td>
<td>0 0</td>
<td>2 4,2</td>
<td>6 12,5</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>1 2,1</td>
<td>0 0</td>
<td>2 4,2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>40 83,3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2 4,2%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (64,6%) is agreement with the statement, and the general opinion (83,3%) is also agreement. These respondents agree that the heritage of badly rehabilitated land is actually an important factor for strategic management purposes.

Statement 2.3.2 Investments of time in education and training of the whole workforce in environmental preservation contribute towards better management results. (Actually) (Compare with Statements 2.2.3 and 3.2.6.)

Table 4.41 Statement 2.3.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>5 10,6</td>
<td>2 4,3</td>
<td>2 4,3</td>
<td>9 19,1</td>
</tr>
<tr>
<td>Agree</td>
<td>8 17,0</td>
<td>11 23,4</td>
<td>5 10,6</td>
<td>24 51,1</td>
</tr>
<tr>
<td>Uncertain</td>
<td>6 12,8</td>
<td>1 2,1</td>
<td>2 4,3</td>
<td>9 19,1</td>
</tr>
<tr>
<td>Disagree</td>
<td>3 6,4</td>
<td>2 4,3</td>
<td>0 0</td>
<td>5 10,6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>33 70,2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>5 10,6%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

The majority opinion (51.1%) is agreement with the statement, and the general opinion (70.2%) is agreement. Most of the environmental managers who responded to this statement are of the opinion that actual investments of time in the education and training of the whole workforce in environmental preservation contribute towards better management results.

This is an encouraging tendency and should be emphasised when developing a strategy for management accounting in the field of rehabilitation management.

Comments on Statements 2.3.1 and 2.3.2:
(Opinions on how the strategic management accounting dimension of time is actually utilised for rehabilitation management purposes.)

Responses to both statements indicated general agreement (83.3% and 70.2%) that time is actually a factor in management accounting policies towards rehabilitation management. These opinions are illustrated in Diagram 4.7. Time is indeed recognised as a non-financial indicator by rehabilitation managers, especially in futuristic approaches such as those reflected in these two statements.

Diagram 4.7 Opinions on utilisation of time (Statements and %)
4.5.6 Section 3.1: Opinions on the technical attributes of a good rehabilitation management accounting system (Tables 4.42 - 4.47)

Statement 3.1.1 Application of ISO9000 (international standards on quality management) should be encouraged. (Compare with Statement 3.1.2.)

Table 4.42 Statement 3.1.1

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Agree</td>
<td>10</td>
<td>12</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>No. %</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>General agreement</td>
<td>36</td>
<td>76,6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>5</td>
<td>10,6%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (63,8%) is agreement with the statement, and the general opinion (76,6%) is agreement. Most of the respondents agree that the implementation of ISO9000 standards should be encouraged.

Comments on Statements 3.1.1 and 3.1.2:

The general agreement (76,6%) with this statement on ISO9000 standards for quality management compares favourably with a similar statement on ISO14000 standards on environmental standards, namely Statement 3.1.2 (89,1%). The latter statement is more directly related to rehabilitation management and it produced a lower percentage of responses (8,7% compared to 12,8% for the first statement) in the uncertain category. Responses to both statements indicate that environmental managers realise the positive effect that ISO9000 and ISO14000 should have once they have been implemented.
Statement 3.1.2 Application of ISO 14000 (international standards on environmental management) should be encouraged. (Compare with Statement 3.1.1.)

Table 4.43 Statement 3.1.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>6 13,0</td>
<td>2 4,3</td>
<td>1 2,2</td>
<td>9 19,6</td>
</tr>
<tr>
<td>Agree</td>
<td>13 28,3</td>
<td>11 23,9</td>
<td>8 17,4</td>
<td>32 69,6</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4,3</td>
<td>1 2,2</td>
<td>0 0</td>
<td>4 8,7</td>
</tr>
<tr>
<td>Disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2,2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>41 89,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1 2,2%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (69,6%) is agreement with the statement, and the general opinion (89,1%) is agreement. Most of the respondents agree that ISO 14000 should be considered for implementation in rehabilitation strategies.

Statement 3.1.3 Contingency planning should exist for unforeseen disasters. (Compare with Statement 2.2.5.)

Table 4.44 Statement 3.1.3

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6,3</td>
<td>3 6,3</td>
<td>1 2,1</td>
<td>7 14,6</td>
</tr>
<tr>
<td>Agree</td>
<td>16 33,3</td>
<td>12 25</td>
<td>4 8,3</td>
<td>32 66,7</td>
</tr>
<tr>
<td>Uncertain</td>
<td>1 2,1</td>
<td>0 0</td>
<td>3 6,3</td>
<td>4 8,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2 4,2</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>39 81,3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>5 10,4%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (66,7%) is agreement with the statement, and the general opinion (81,3%) is agreement. Most of the respondents agree that technical provision should be made for contingencies when preparing rehabilitation management strategies.
Comments on the group of statements from 3.1.1 to 3.1.3:
(Opinions on how the technical efficiency of a good rehabilitation management accounting system should be utilised for rehabilitation management purposes.)

The following percentages of respondents expressed general agreement with these positive statements: 76.6% (3.3.1), 89.1% (3.1.2), 81.3% (3.1.3). These percentages do not vary very much. The opinions expressed are analysed in Diagram 4.8.

It is encouraging to discover that the environmental managers who responded to the questionnaire, are in favour of the application of ISO9000 and ISO14000, and that they support technical preparations for contingencies.

Diagram 4.8 Opinions on how technical attributes should be utilised
Statement 3.1.4 Experience of other countries does not have a positive influence locally.
(Filter Statement) (Actually)

Table 4.45 Statement 3.1.4

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Agree</td>
<td>2 4,2</td>
<td>3 6,3</td>
<td>0 0</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>6 12,5</td>
<td>0 0</td>
<td>3 6,3</td>
<td>9 18,8</td>
</tr>
<tr>
<td>Disagree</td>
<td>11 22,9</td>
<td>9 18,8</td>
<td>5 10,4</td>
<td>25 52,1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>3 6,3</td>
<td>5 10,4</td>
<td>1 2,1</td>
<td>9 18,8</td>
</tr>
<tr>
<td>General agreement</td>
<td>5</td>
<td>10,4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>34</td>
<td>70,8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

This filter statement produced a majority opinion (52,1%) of disagreement with the statement, and the general opinion (70,8%) was disagreement. This means that most of the respondents are of the opinion that experience from other countries on rehabilitation management issues does indeed have a positive influence on local rehabilitation strategies.

The respondents were not confused by this filter statement, since one of the respondents replied as follows:

Experience from no matter where is important.
Statement 3.1.5 A thorough knowledge of the present local and national regulations, laws and fines on rehabilitation issues is an attribute of good management policy. (Actually)
(Compare with Statement 3.1.6.)

Table 4.46 Statement 3.1.5

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>6 12,8</td>
<td>4 8,5</td>
<td>3 6,4</td>
<td>13 27,7</td>
</tr>
<tr>
<td>Agree</td>
<td>14 29,8</td>
<td>13 27,7</td>
<td>5 10,6</td>
<td>32 68,0</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2,1</td>
<td>0 0</td>
<td>1 2,1</td>
<td>2 4,3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>45 95,7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2 4,3%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (68%) is agreement with the statement, and the general opinion (95,7%) is agreement. Most of the respondents are of the opinion that a thorough knowledge of local and national laws, fines and regulations actually is an attribute of a good management accounting policy.

The general agreement (95,7%) with this statement compares favourably with opinions on a similar statement on regulations, laws, fines and taxation, namely Statement 3.1.6 (80,4%).
Statement 3.1.6 A sound knowledge of present taxation policies supports decisions on rehabilitation costs and expenses. (Actually) (Compare with Statement 3.1.5.)

Table 4.47 Statement 3.1.6

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Agree</td>
<td>14</td>
<td>7</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Disagree</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>37</td>
<td>80,4%</td>
<td>80,4%</td>
<td>80,4%</td>
</tr>
<tr>
<td>General disagreement</td>
<td>2</td>
<td>4,3%</td>
<td>4,3%</td>
<td>4,3%</td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (58,7%) is agreement with the statement, and the general opinion (80,4%) is agreement. Most of the environmental managers who responded agree that a sound knowledge of present taxation policies actually supports decision making pertaining to rehabilitation costs and expenses.

Comments on the of group statements from 3.1.4 to 3.1.6:
(Opinions on how the technical efficiency of a good rehabilitation management accounting system is actually utilised for rehabilitation management purposes.)

Filter statement 3.1.4 is included in this comparison. It is assumed that if the statement had been formulated in a positive way the same percentages would have been obtained in favour of agreement as were obtained in favour of disagreement when the statement was negatively formulated.

The number of respondents who expressed general agreement with the positive formulation of these statements amounted to 70,8% (3.1.4), 95,7% (3.1.5) and 80,4% (3.1.6). These favourable percentages indicate that the technical efficiency of a good rehabilitation management accounting system is undoubtedly a factor. These tendencies are illustrated in Diagram 4.9.
Diagram 4.9 Utilisation of technical attributes (Statements and %)

4.5.7 Section 3.2: Opinions on the **behavioural** attributes of a good rehabilitation management accounting system (Tables 4.48 - 4.54)

Statement 3.2.1 Local and internal attitudes towards rehabilitation management should be considered for decision-making purposes. (Compare with Statement 3.3.1.)

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6,3</td>
<td>2 4,2</td>
<td>0 0</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Agree</td>
<td>12 25</td>
<td>13 27,1</td>
<td>9 18,8</td>
<td>34 70,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>5 10,5</td>
<td>2 4,2</td>
<td>0 0</td>
<td>7 14,6</td>
</tr>
<tr>
<td>Disagree</td>
<td>2 4,2</td>
<td>0 0</td>
<td>0 0</td>
<td>2 4,2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>39 81,3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2 4,2%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

The majority opinion (70.8%) is agreement with the statement, and the general opinion (81.3%) is agreement. This means that 81.3% of the environmental managers who responded to the questionnaire are of the opinion that both local and internal attitudes towards rehabilitation management should be considered for decision-making purposes.

This attitude of environmental managers is conducive to continuous improvement regarding rehabilitation management and for the accompanying management accounting processes. The general opinion of agreement (81.3%) with this statement on the influence of internal and local attitudes compares favourably with opinions on a similar statement on the influence of cultural differences, namely Statement 3.3.1 (56.3%).

Both statements, however, elicited a relatively high response in the “uncertain” category, namely 14.6% for Statement 3.2.1 and 20.8% for Statement 3.3.1. The latter statement also had 22.9% of the respondents disagreeing as to the influence of cultural differences on management decision making. Although a general opinion of agreement was recorded, no definitive conclusions can be drawn from the comparison.

Statement 3.2.2 The enterprise’s mission statement and objective statement have a positive influence on rehabilitation policies to the extent that they deal with environmental issues. (Actually)

Table 4.49 Statement 3.2.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
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<tbody>
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<td></td>
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<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4,2</td>
<td>3  6,3</td>
<td>2 4,2</td>
<td>7 14,6</td>
</tr>
<tr>
<td>Agree</td>
<td>14 29,2</td>
<td>12 25</td>
<td>7 14,6</td>
<td>33   68,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3  6,3</td>
<td>0</td>
<td>0 0</td>
<td>3  6,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>3  6,3</td>
<td>2  4,2</td>
<td>0 0</td>
<td>5   10,4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>40</td>
<td>83,3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>5</td>
<td>10,4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

The majority opinion (68.8%) is agreement with the statement, and the general opinion (83.3%) is agreement.

One respondent mentioned that the mission statement and the statement of objectives could only have a positive influence on rehabilitation policies if they were reinforced by management decisions. This emphasises the view that a distinction should be made between "greenwash" and true efforts to accomplish acceptable standards of rehabilitation and environmental management.

Statement 3.2.3 Impact assessments are not important at the commencement of mining operations. (Filter Statement; Actually)

Table 4.50 Statement 3.2.3

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Agree</td>
<td>2 4.3</td>
<td>2 4.3</td>
<td>0 0</td>
<td>4 8.5</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Disagree</td>
<td>7 14.9</td>
<td>6 12.8</td>
<td>1 2.1</td>
<td>14 29.8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>13 27.7</td>
<td>9 19.1</td>
<td>7 14.9</td>
<td>29 61.7</td>
</tr>
</tbody>
</table>

General agreement | 4 8.5%
General disagreement | 43 91.5%

Comments:

The majority opinion (61.7%) is strong disagreement with this filter statement, and the general opinion (91.5%) is disagreement.

This statement elicited the highest response of strong disagreement (61.7%) in the questionnaire. In comparison with the strong agreement percentages for all statements, this filter statement also produced the highest percentage in the extreme response.
category.

Other than the general disagreement response being in line with other agreement responses, the respondents were not confused by this filter statement since one respondent reacted by writing that

IA (impact assessments) are vital at commencement.

The strong reaction to this statement emphasises the importance of impact assessments at the commencement of mining operations. This fact should be included in the development of strategies for rehabilitation management accounting.

Statement 3.2.4 Monetary rehabilitation inputs are disclosed to stakeholders. (Actually) (Compare with Statement 2.1.11.)

Table 4.51 Statement 3.2.4

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4,2</td>
<td>0 0</td>
<td>1 2,1</td>
<td>3 6,3</td>
</tr>
<tr>
<td>Agree</td>
<td>11 22,9</td>
<td>11 22,9</td>
<td>6 12,5</td>
<td>28 58,3</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3 6,3</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>6 12,5</td>
</tr>
<tr>
<td>Disagree</td>
<td>6 12,5</td>
<td>3 6,3</td>
<td>1 2,1</td>
<td>10 20,8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>1 2,1</td>
<td>0 0</td>
<td>1 2,1</td>
</tr>
</tbody>
</table>

General agreement 31 64,6%
General disagreement 11 22,9%

Comments:

The majority opinion (58,3%) is agreement with the statement, and the general opinion (64,6%) is agreement. Most of the respondents are of the opinion that monetary rehabilitation inputs are actually disclosed to interested and affected parties.
Statement 3.2.5 If there were no laws, regulations and inspections, mine managers would still operate according to an ethic of responsibility to preserve the natural environment. (Ethics)

Table 4.52 Statement 3.2.5

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>1 2,1</td>
<td>3 6,3</td>
<td>0 0</td>
<td>4 8,3</td>
</tr>
<tr>
<td>Agree</td>
<td>4 8,3</td>
<td>4 8,3</td>
<td>6 12,5</td>
<td>14 29,2</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4 8,3</td>
<td>5 10,4</td>
<td>0 0</td>
<td>9 18,8</td>
</tr>
<tr>
<td>Disagree</td>
<td>9 18,8</td>
<td>5 10,4</td>
<td>2 4,2</td>
<td>16 33,3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>4 8,3</td>
<td>0 0</td>
<td>1 2,1</td>
<td>5 10,4</td>
</tr>
</tbody>
</table>

General agreement 18 37,5%
General disagreement 21 43,8%

Comments:

Although most of the respondents are doubtful as to whether all environmental managers can be relied on to uphold a high standard of ethics, neither a majority nor a general opinion can be deducted for this statement.

One of the respondents mentioned that if the environmental and rehabilitation managers were empowered, they would operate according to an ethic of responsibility to preserve the natural environment. This view emphasises the fact that rehabilitation management does not function on its own, and that individuals and groups in higher positions of power dictate the policies to be followed. It is clear from this respondent’s comment that top management does not always have a conscience about the preservation of land that has been damaged or land waste during and after mining operations.

The lack of accountability to stakeholders, including the natural environment, might originate from a culture that permits or even expects top management to perform actions within the organisation that would be unacceptable outside the work culture, such as in the homes and communities of top managers. This lack of internal accountability would
in any case be known outside the organisation. A switch to an attitude of accountability would encourage a moral and ethical culture both within and outside the work environment (Estes 1996:239).

A combination of second and third generations of management is evident in this situation. Under the second generation of management environmental managers are told exactly what to do and how to do it. In the more advanced third generation of management, environmental managers are told to rehabilitate damaged land, but under certain limiting conditions. This management approach could be improved by introducing elements of the fourth generation of management. The fundamental improvement that would be accomplished by regarding employees, such as environmental managers, as partners in developing better methods, would produce better results in the fourth generation of management (Joiner & Reynard 1994:11).

Statement 3.2.6 Positive changes in behaviour towards rehabilitation and environmental management are attained by means of education and training. (Actually) (Compare with Statement 2.3.2.)

Table 4.53 Statement 3.2.6

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6,3</td>
<td>2 4,2</td>
<td>2 4,2</td>
<td>7 14,6</td>
</tr>
<tr>
<td>Agree</td>
<td>16 33,3</td>
<td>12 25</td>
<td>5 10,4</td>
<td>33 68,8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>0 0</td>
<td>1 2,1</td>
<td>2 4,2</td>
<td>3 6,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>3 6,3</td>
<td>2 4,2</td>
<td>0 0</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>40</td>
<td></td>
<td></td>
<td>83,3%</td>
</tr>
<tr>
<td>General disagreement</td>
<td>5</td>
<td></td>
<td></td>
<td>10,4%</td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (68,8%) is agreement with the statement, and the general opinion (83,3%) is agreement. This means that a high percentage of the responding environmental
managers believe that education and training contribute to positive changes in both behaviour and concomitant rehabilitation and environmental management.

Statement 3.2.7 True profits are recognised only when none of the stakeholders incur losses from the process of profit generation. (Pareto)

Table 4.54 Statement 3.2.7

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th></th>
<th>Coal</th>
<th></th>
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<th>Total</th>
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<td></td>
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<td></td>
<td>No. %</td>
<td></td>
<td>No. %</td>
<td></td>
<td>No. %</td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4,4</td>
<td>1</td>
<td>2 2,2</td>
<td>3</td>
<td>6 6,7</td>
<td>6</td>
<td>13,3</td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>10 22,2</td>
<td>8</td>
<td>17,8</td>
<td>5</td>
<td>11,1</td>
<td>23</td>
<td>51,1</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>4 8,9</td>
<td>2</td>
<td>4,4</td>
<td>1</td>
<td>2,2</td>
<td>7</td>
<td>15,6</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>5 11,1</td>
<td>4</td>
<td>8,9</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>20,0</td>
<td></td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>General agreement</td>
<td>29</td>
<td>64,4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>9</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
Most respondents agree about true profits, the majority opinion being 51,1%. The general opinion is one of agreement (64,4%). Most of the respondents agree with this statement, which originates from Pareto's theory of welfare economics where improvement corresponds to gains by some while no-one loses (Perman, Ma & McGilvray 1996:85).

Comments on the group of statements from 3.2.2 to 3.2.7:
(Opinions on how the behavioural attribute of a good rehabilitation management accounting system is actually utilised for rehabilitation management purposes.)

Since the reaction to the filter statement (3.2.3) does not indicate confusion, this statement has been included in the comparison with this group of statements. It is assumed that the positive formulation of the statement would give the same percentage for general agreement as the percentage for general disagreement produced by the negative formulation. Statement 3.2.5 differs considerably from the other statements, and is omitted for purposes of comparison. This statement is the only one in the questionnaire which directly addresses an ethical issue. The opinions on this statement also follow quite a different pattern from the remainder of the statements in this group, and should not be
compared in order to obtain meaningful deductions.

The opinions in favour of general agreement with the positive formulations of the statements in this group, are 83.3% (3.2.2), 91.5% (3.2.3), 64.6% (3.2.4), 83.3% (3.2.6) and 64.4% (3.2.7). These opinions are illustrated in Diagram 4.10. It is encouraging to observe that most of the respondents are of the opinion that positive behavioural attributes are present in management accounting systems that deal with rehabilitation management.

**Diagram 4.10 Utilisation of the behavioural attribute (Statements and %)**

---

**4.5.8 Section 3.3: Opinions on the cultural attributes of a good rehabilitation management accounting system (Tables 4.55 to 4.57)**

*Statement 3.3.1 Cultural differences influence the process of rehabilitation management decision making. (Actually) (Compare with Statement 3.2.1.)*

**Table 4.55  Statement 3.3.1**

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>6,3</td>
<td>1</td>
<td>2,1</td>
</tr>
<tr>
<td>Agree</td>
<td>13</td>
<td>27,1</td>
<td>6</td>
<td>12,5</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>6,3</td>
<td>4</td>
<td>8,3</td>
</tr>
<tr>
<td>Disagree</td>
<td>3</td>
<td>6,3</td>
<td>6</td>
<td>12,5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>27</td>
<td>56,3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>11</td>
<td>22,9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

No majority opinion can be derived for this statement, and the general opinion (56.3%) is agreement. Although most of the respondents agree that cultural differences actually influence the process of rehabilitation management decision making, a relatively high response of 20.8% was given under the uncertain option.

Statement 3.3.2 People in the communities surrounding mines are dependant on the natural environment. (Actually)

Table 4.56 Statement 3.3.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6.4</td>
<td>0 0</td>
<td>0 0</td>
<td>3 6.4</td>
</tr>
<tr>
<td>Agree</td>
<td>9 19.1</td>
<td>14 29.8</td>
<td>6 12.8</td>
<td>29 61.7</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3 6.4</td>
<td>1 2.1</td>
<td>3 6.4</td>
<td>7 14.9</td>
</tr>
<tr>
<td>Disagree</td>
<td>7 14.9</td>
<td>1 2.1</td>
<td>0 0</td>
<td>8 17.0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
</tbody>
</table>

|                | General agreement | 32 68.1% |
|                | General disagreement | 8 17% |

Comments:

The majority opinion (61.7%) is agreement with the statement, and the general opinion (68.1%) is agreement. The remainder of the respondents are either uncertain (14.6%) or disagree (16.7%). According to most of the respondents, people in the communities surrounding mines are actually dependent on the natural environment. This fact should therefore be taken into account when deciding on the degree of rehabilitation to be implemented as part of the rehabilitation policy.
Statement 3.3.3 *More expensive processes are preferable when the surrounding community is better informed and educated about the natural environment.* (Actually)

Table 4.57 **Statement 3.3.3**

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Agree</td>
<td>6</td>
<td>12.8</td>
<td>5</td>
<td>10.6</td>
</tr>
<tr>
<td>Uncertain</td>
<td>5</td>
<td>10.6</td>
<td>2</td>
<td>4.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>11</td>
<td>23.4</td>
<td>8</td>
<td>17.0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.1</td>
</tr>
<tr>
<td>General agreement</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>23</td>
<td>48.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

Neither a majority opinion, nor a general opinion can be deduced for this statement. However, most respondents (48.9%) disagree that more expensive rehabilitation processes are preferable when the surrounding communities are better informed and educated about the natural environment. A relatively high response of 25.5% was recorded for uncertainty on this issue.

One of the respondents desired “a more balanced approach [to] be expected” when deciding on the amount of money to be invested on rehabilitation projects in areas of better informed or less informed surrounding communities. This means that less informed and less educated people in the vicinity of mines should not be negatively affected by cheaper and ineffective rehabilitation procedures.

One could deduce from this respondent’s reasoning that while money is available, whatever the amount, and time and organisational skills are being put into a rehabilitation scheme in any case after extraction operations have been completed, a proper job should be done. Other ways of reducing costs and overheads could be found, such as using more affordable labour in poorer communities.
This commendable attitude should be emphasised when preparing management accounting strategies for rehabilitation management purposes. There are indeed a number of environmental managers in the field who would question obvious conventions and widely applied practices such as reducing costs to deliver products of lesser quality to more poorly informed customers.

Comments on the group of statements from 3.3.1 to 3.3.3:
(Opinions on how the cultural attribute of a good rehabilitation management accounting system is actually is utilised for rehabilitation management purposes.)

Statement 3.3.3 is omitted for the purposes of this comparison. This statement was not formulated in the same strong ideological terms as the other two statements. The general opinions for Statements 3.3.1 (56,3%) and 3.3.2 (68,1%) compare favourably in respect of internal and external cultural influences on efficient management accounting systems. These opinions are illustrated in Diagram 4.11.

Most of the environmental managers who responded to these statements acknowledge that cultural attributes form an integral part of rehabilitation management strategies and of the accompanying management accounting systems.

Diagram 4.11 Recognition of behavioural attributes (Statements and %)
4.5.9 Section 4: General opinions (Tables 4.58-4.66)

Statement 4.1 Awards to encourage improved and successful rehabilitation management policies are important (similar to awards for safety hours). (Actually) (Compare with Statement 4.2.)

Table 4.58 Statement 4.1

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>5 10,4</td>
<td>5 10,4</td>
<td>1 2,1</td>
<td>11 22,9</td>
</tr>
<tr>
<td>Agree</td>
<td>10 20,8</td>
<td>10 20,8</td>
<td>6 12,5</td>
<td>26 54,2</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2 4,2</td>
<td>2 4,2</td>
<td>1 2,1</td>
<td>5 10,4</td>
</tr>
<tr>
<td>Disagree</td>
<td>5 10,4</td>
<td>0 0</td>
<td>1 2,1</td>
<td>6 12,5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>37 77,1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>6 12,5%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (54,2%) is agreement with the statement, and the general opinion (77,1%) is agreement.

The general agreement (77,1%) with this statement on the importance of the introduction of awards, does not differ significantly from opinions on a similar statement on awards to encourage successful rehabilitation management policies, namely Statement 4.2 (70,8%).

The environmental managers who responded expressed a relatively high response in favour of a system of rewards for excellent rehabilitation management policies. They agree that awards would lead to continuous improvement of existing rehabilitation management practices. The accompanying management accounting procedures would also follow a path of continuous improvement.
Statement 4.2 Awards for green reporting enhance the awareness of cost management for rehabilitation purposes. (Actually) (Compare with Statement 4.1.)

Table 4.59 Statement 4.2

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Agree</td>
<td>13</td>
<td>10</td>
<td>7</td>
<td>30</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>34</td>
<td>70,8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>6</td>
<td>12,5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
The majority opinion (62,5%) is agreement with the statement, and the general opinion (70,8%) is agreement. Most of the respondents agree that awards for green reporting enhance awareness of cost management for rehabilitation purposes.


Table 4.60 Statement 4.3

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Agree</td>
<td>11</td>
<td>8</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>Uncertain</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>29</td>
<td>65,9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2</td>
<td>4,5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Comments:

A majority opinion of 52.3% for agreement can be deduced for the statement, and the general opinion is agreement (65.9%). A relatively high response of 34.1% in respect of uncertainty indicates that the environmental managers are not sure whether the effect of Act 50/91 (amended by 103/93) could be determined at this early stage.

Further research on this aspect will need to be carried out ten or fifteen years after the promulgation of this Act. The influence of this Act should be more clearly visible in ten or more years from now.

Statement 4.4 The strategic management accounting dimensions of quality, cost and time (Section 2) should be combined for general rehabilitation management purposes. (Actually)

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Agree</td>
<td>18</td>
<td>12</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>Uncertain</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>General agreement</td>
<td>35</td>
<td>72.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>2</td>
<td>4.2%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

Both the majority opinion for the statement and the general opinion are agreement (72.9%). The environmental managers who responded were in favour of the combination of strategic management accounting factors of quality, cost and time, as formulated by Ansari et al (1997c:SMA-5).
Statement 4.5 The attributes of a successful management accounting system of technology, behaviour and culture (Section 3) should be combined for the benefit of rehabilitation management in general.

Table 4.62 Statement 4.5

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Agree</td>
<td>15</td>
<td>15</td>
<td>8</td>
<td>38</td>
</tr>
<tr>
<td>Uncertain</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Disagree</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

General agreement 38 79,2%
General disagreement 1 2,1%

Comments:

Both the majority opinion for the statement and the general opinion are agreement, at a figure of 79,2%. A high percentage of responding environmental managers agrees that the attributes of a successful management accounting system of technology, behaviour and culture as formulated by Ansari et al (1997c:SMA-9) should be combined for the benefit of rehabilitation management in general.

One respondent specifically supported this statement by mentioning that this approach would be more cost-effective.
Statement 4.6 To obtain maximum results the relationship between these strategic dimensions (Section 2) and attributes of good management accounting (Section 3) should be flexible.

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3 6.4</td>
<td>1 2.1</td>
<td>1 2.1</td>
<td>5 10.6</td>
</tr>
<tr>
<td>Agree</td>
<td>13 27.7</td>
<td>13 27.7</td>
<td>5 10.6</td>
<td>31 66.0</td>
</tr>
<tr>
<td>Uncertain</td>
<td>5 10.6</td>
<td>3 6.4</td>
<td>2 4.3</td>
<td>10 21.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>1 2.1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2.1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>General agreement</td>
<td>36</td>
<td>76.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>1</td>
<td>2.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (66%) is agreement with the statement, and the general opinion (76.6%) is agreement. Most of the respondents reacted favourably by agreeing that maximum results would be obtained when there was flexibility between the strategic dimensions (Statement 4.4) and the attributes of a successful management accounting system (Statement 4.5). Quite a number (21.3%) of respondents chose the “uncertain” option, which means that they are not sure how the flexibility of the combination of factors for strategic management accounting and the attributes of good management accounting would yield improved results.

Comments on the group of statements from 4.4 to 4.6:
(Combination and role of quality, cost and time as well as the attributes of technology, behaviour and culture, as compiled by Ansari et al (1997c:SMA-14))

These three statements did not differ significantly in respect of the opinion of general agreement expressed. The opinions of the responding environmental managers are 72.9%
This positive attitude towards new management accounting approaches could only benefit all the interested and affected parties involved in rehabilitation management at mines.

Statement 4.7 The strategic management accounting dimensions of quality, cost and time (Section 2) are combined in the interests of rehabilitation management at your mine/s. (Compare with Statement 4.8.)

Table 4.64 Statement 4.7

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>2 4.2</td>
<td>3 6.3</td>
<td>0 0</td>
<td>5 10.4</td>
</tr>
<tr>
<td>Agree</td>
<td>9 18.8</td>
<td>8 16.7</td>
<td>5 10.4</td>
<td>22 45.8</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3 6.3</td>
<td>4 8.3</td>
<td>1 2.1</td>
<td>8 16.7</td>
</tr>
<tr>
<td>Disagree</td>
<td>7 14.6</td>
<td>2 4.2</td>
<td>3 6.3</td>
<td>12 25</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1 2.1</td>
<td>0 0</td>
<td>0 0</td>
<td>1 2.1</td>
</tr>
<tr>
<td>General agreement</td>
<td>27</td>
<td>56.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td>13</td>
<td>27.1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

No majority opinion can be derived from the statement; the general opinion is agreement (56.3%).

About one-quarter (13 out of 48) of the respondents expressed an opinion of disagreement (27.1%) regarding the actual application of these management accounting procedures. This means that it was felt that the factors of quality, cost and time are not really combined in the interests of rehabilitation management at the particular mining operations of all the respondents.

The general opinion of agreement (56.3%) with this statement on the quality, cost and time dimensions of management accounting can be compared with opinions expressed on a similar statement on the technical, behavioural and cultural attributes of successful
management accounting systems in the mines of the respondents, namely Statement 4.8 (47.9%). The results of these two statements do not differ significantly. The latter statement (4.8), however, elicited a relatively high response (29.2%) in respect of the “uncertain” option, as well as for the general disagreement option (22.9%).

Although more of the management accounting principles reflected in the first statement (4.7) are implemented, in the opinions of the respondents, no definitive deductions can be arrived at by comparing these two statements.

Statement 4.8 The technological, behavioural and cultural attributes of a successful management accounting system (Section 3) are combined to serve the best interests of rehabilitation management in your mine/s. (Compare with Statement 4.7.)

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Agree</td>
<td>8</td>
<td>16.7%</td>
<td>10</td>
<td>20.8%</td>
</tr>
<tr>
<td>Uncertain</td>
<td>7</td>
<td>14.6%</td>
<td>6</td>
<td>12.5%</td>
</tr>
<tr>
<td>Disagree</td>
<td>5</td>
<td>10.4%</td>
<td>1</td>
<td>2.1%</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>2.1%</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

General agreement 23 47.9%
General disagreement 11 22.9%

Comments:

Neither a majority nor a general opinion can be deduced for this statement, although most respondents agree with the statement.

A relatively high number of respondents (29.2%) chose the “uncertain” in respect of the actual application of these management accounting procedures. Some environmental managers at mines do not know what management accountants actually do. This underlines the importance of internal benchmarking where management groups combine
their skills to achieve a system of best practices.

Statement 4.9 The respondent would like to attend seminars and courses on rehabilitation management.

Table 4.66 Statement 4.9

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Gold</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3  6,4</td>
<td>2  4,3</td>
<td>0  0</td>
<td>5  10,6</td>
</tr>
<tr>
<td>Agree</td>
<td>13 27,7</td>
<td>11 23,4</td>
<td>8 17,0</td>
<td>32 68,1</td>
</tr>
<tr>
<td>Uncertain</td>
<td>2  4,3</td>
<td>2  4,3</td>
<td>1  2,1</td>
<td>5  10,6</td>
</tr>
<tr>
<td>Disagree</td>
<td>4  8,5</td>
<td>1  2,1</td>
<td>0  0</td>
<td>5  10,6</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>0  0</td>
<td>0  0</td>
<td>0  0</td>
<td>0  0</td>
</tr>
<tr>
<td>General agreement</td>
<td></td>
<td></td>
<td>37 78,7%</td>
<td></td>
</tr>
<tr>
<td>General disagreement</td>
<td></td>
<td></td>
<td>5 10,6%</td>
<td></td>
</tr>
</tbody>
</table>

Comments:

The majority opinion (68,1%) is agreement with the statement, and the general opinion (78,7%) is agreement. An encouraging attitude towards improved knowledge of the broader spectrum of rehabilitation management, including management accounting, can be detected from the response to this statement. This positive attitude forms an integral part of the principle of continuous improvement in order to obtain maximum results (Schonberger & Knod 1994:27).

This is an area that should be researched and developed both by the private sector and by academic institutions.

Comments on the group of statements from 4.1 to 4.9:
(General opinion)

The statements in this group are not compared, although two smaller divisions are compared. Owing to the dissimilar nature of the individual statements, no meaningful
comparisons and deductions can be made in the group as a whole.

4.5.10 Respondents not familiar with concepts

The management accounting concepts that the respondents are not familiar with are given in Table 4.67.

Two telephone enquiries asking for more information on the meaning and application of terminology were received. These terminologies have been included in Table 4.67, but have not been added to the totals. One respondent requested an Afrikaans copy of the questionnaire in order to gain a better understanding of the meaning and context of the wording of the statements.
Three concepts in the statements can be distinguished from the others because they obtained the highest percentages. The first of these statements which proved to be unfamiliar to the respondents is Statement 2.1.3, which referred to the concept of a balance matrix between environmental rehabilitation inputs and gains. The corporate
environmental performance scorecards as propagated by Epstein (1996:235) could be illustrated in the form of a balance scorecard. This statement received the highest score, with 22.9% of the respondents indicating that they were not familiar with this concept. The second unfamiliar statement is Statement 2.2.6 on life cycle costs, with a 20.8% response. Life cycle costs are described in the Glossary (Par1.7).

The third unfamiliar concept is contained in Statements 2.2.9 and 2.2.10 on internal and external value-added and non-value-added environmental cost categories. These value-added concepts are included in value-chain analysis (Drury 1996:25) as well as in activity-based management policies, where a distinction is made between value-added activities and non-value-added activities (Drury 1996:517). Each of these statements on value-added environmental cost categories obtained 16.7% of the total response.

4.5.11 General comments by respondents (open-ended question/s)

General comments by the respondents are dealt with in the discussions of the statements to which they refer. Other general comments not pertaining to particular statements are analysed in this section. They are the following:

1. True environmental costs of mining are not currently addressed and such a system would be extremely valuable.

Comments:

This statement by the respondent supports the problem statement of this whole study.

2. Companies should be able to maintain financial privacy with disclosure only to regulated and applicable bodies.

Comments:

This remark is most probably aimed at “bunny-hugging” groups who are not familiar with the intricate nature of environmental and rehabilitation management issues. This fact emphasises the importance of the role of training and education in environmental matters.
to the broadest possible spectrum of the public.

Another deduction is that this enterprise may have lost repute in the eyes of the public or may have been prejudiced by bad publicity in the past, either justified or unjustified. In the case of justified bad publicity or court cases, remedial rehabilitation measures should be undertaken. Press releases could be issued to improve the public image of enterprises after successful remedial operations or the case of unjustified bad publicity.

In general one cannot agree with a statement such as the above in a country where transparency of actions forms the basis of the constitution. Interested and affected parties in the widest sense of the term should be appropriately informed about present and future environmental and rehabilitation strategies at mines. This practice of disclosure would undoubtedly lead to better relationships with stakeholders and to improved and satisfactory management policies and management accounting procedures.

3. No mention of income from rehabilitation, eg. gold production from demolition and rehabilitation of gold plants or sale of scrap steel, etc.

Comments:

This respondent emphasises the fact that rehabilitation is not confined to costs and expenses, but that income in different forms could also be generated in a system where adequate management accounting practices are applied.

4. In practice you should establish the link between management accounting and the requirements of the EMPR, especially those in Chapter 6.

Comments:

This remark refers to the environmental management program (EMPR) of Chapter VI of the Minerals Act (50/1991 as amended by Act 103/1993). The implications of the activities necessary in order to conform with this Act should be interpreted in terms of existing management accounting principles as well as in terms of developing and new approaches in cost calculation.
5. Rehabilitation incurs a cost that may not be seen as necessary.

Comments:

This environmental and rehabilitation manager realises that not enough attention is paid to the full implications of the costs attached to rehabilitation management. The decision-makers to whom this person has to report most probably do not see the necessity for any greater investment in environmental and rehabilitation projects than is needed to meet the minimum requirements laid down in statutes and regulations.

These responses to the open-ended commentary section should be taken into account when developing a comprehensive strategy for rehabilitation management accounting.

4.5.12 Respondents interested in a brief summary of the results

A brief summary were sent to respondents who indicated that they were interested in the results of the survey. This summary is provided in Annexure 4.1, which is attached.

A relatively high percentage of the respondents indicated that they were interested in a brief summary of the responses to the survey. In total 28 (58,3%) showed this high degree of interest in the empirical research project.

4.5.13 Comparison between the opinions of the chartered accountant and the opinions of respondents with other qualifications

Since management accounting forms an integral part of the syllabus of Chartered Accountants (CA (SA)), the only responding environmental manager with this qualification was immediately noticeable. A brief comparison is made of the opinions of this chartered accountant with those of respondents with other qualifications.

This respondent is in the age group between 31 and 40 years of age, one of the two best represented age groups in the survey (36,96% of the respondents). In most of the responses the opinion of this respondent falls into the category of general agreement or general disagreement with the particular statement. This means that the opinions of this respondent mostly fall into the same group as those of most of the respondents to the
questionnaire.

The chartered accountant differed from the above-mentioned opinions in the following respects:

- Statement 2.1.7 Uncertain about benchmarking
- Statement 2.1.18 Uncertain about measurable to be manageable
- Statement 2.2.5 Uncertain that monetary provision should be made for contingencies
- Statement 2.2.6 Uncertain that life cycle costs should be determined according to the value chain
- Statements 2.2.11, 2.2.12, 2.2.14 Uncertain of environmental cost categories prevention, assessment and failure costs
- Statement 3.1.3 Disagrees that contingency planning should exist
- Statement 3.1.4 Uncertain of local influence of the experience of other countries
- Statement 3.1.6 Disagrees that the knowledge of present taxation policies supports decisions on rehabilitation costs and expenses
- Statement 3.2.5 Agrees that an ethic of responsible rehabilitation management exists notwithstanding laws and inspections
- Statement 3.3.1 Uncertain about the influence of cultural differences
- Statement 3.3.2 Uncertain about the dependency on the natural environment of people surrounding mines
- Statement 3.3.3 Uncertain about more expensive rehabilitation processes in more informed communities
- Statement 4.1 Uncertain about awards improving rehabilitation policies
- Statement 4.3 Uncertain of positive influence of Act 50/1991
- Statement 4.9 Uncertain about attending courses on rehabilitation management

Comments:

This particular respondent never once chose the option of “not familiar with the concept”. Except for three statements, this particular respondent is uncertain about expressing an opinion when it is not in general agreement with the responses of the other participants.
No definite deduction can be made from this comparison. The views and opinions of a single respondent cannot be meaningfully compared with those of a group. Neither can the opinions of a single respondent, distinguished on the grounds of a particular professional qualification only, be taken as the norm for evaluating the remainder of the population. Furthermore, the opinions of a single respondent who has been trained in a specific profession cannot be taken as being representative of the general opinion of that particular profession. In order to obtain the latter opinion, quite a different population should have been selected for the survey.

4.6 LIMITATIONS, PROBLEMS AND BENEFITS EXPERIENCED

4.6.1 Limitations and problems experienced

Because facsimile facilities were used to send and receive the questionnaires, problems and limitations could be detected at an early stage during the process, and timeous steps could be taken to find solutions. Most of the problems were in connection with people in the target population who could not be reached easily.

The following problems and limitations were experienced and solved.

- Wrong number. In most of these cases an answering machine would provide the new or changed fax number. Other changed numbers were traced by phoning Telkom after hours (as their lines are too busy during office hours) at 1023.
- Mining companies that have ceased operations, especially gold mines in the Stilfontein area. An answering machine or private residence would confirm the fact.
- The new or changed number would be the same as an existing number of another mine. This duplication would then be detected in the follow-up questionnaires sent to the target group.
- In some cases the respondent’s facsimile machines were switched off. It was possible to overcome this problem by phoning the mine during office hours and requesting that the machine be switched on for documents intended for the mine manager.
- The returned questionnaires arrived at any conceivable hour on any day, even within an hour of the questionnaire having been sent off. Keeping the facsimile
machine switched on at all conceivable times, made it possible to receive all returned questionnaires. Some questionnaires were returned by ordinary mail.

- Busy lines. Most of these numbers could be reached by sending the questionnaires after hours, as most of the larger and busy mines have facsimile facilities that also function after hours.

- It was possible to reach about 50% of the target group at the first attempt to send the questionnaire. After repeated efforts - after hours, before office hours, on Saturdays, and during the lunch hour - most of the remaining numbers were eventually reached.

- Dead lines. These could possibly be attributed to telephone cables having been stolen, especially in the Witbank and Oogies areas. A week later some of these numbers could indeed be reached. Other dead lines are most probably fax numbers of smaller mines that do not exist any more, or else they belong to the group known as "fly by night" miners.

- Although the final questionnaires were sent out during May, the preliminary investigation and finalisation were conducted during April. Since April begins with the last few days of the school holidays, includes three public holidays and is linked to the public holiday on 1 May, most people take leave for most of the working days in April. It was really difficult to reach individuals and groups of people and request them to participate and to gain information on certain issues pertaining to the finalisation of the questionnaire.

- The filter statements did not perform the expected function of identifying those respondents who marked only one option throughout the questionnaire. When the first filter statement occurred (Statement 2.1.7), confusion could be detected among the respondents. They gradually overcame this hurdle and at the last filter statement (3.2.3) they reacted with a fierce general disagreement response of 89.6% with accompanying written comments. No single one of the respondents fell into the trap of indicating one option only. The deduction can be made that since the respondents generally hold high qualifications and responsible positions in a private sector environment, filter statements would not be necessary in this questionnaire.

### 4.6.2 Benefits experienced

The expected and unexpected benefits of this method of sending and receiving
questionnaires are the following.

- The number of wrong addresses and addresses at which mail could not be delivered could be determined more accurately. Of the initial 143 addresses only 123 (86%) could be reached.

- Time-saving. Two weeks after starting to send out the questionnaires (an operation which took about six working days to finalise), 22 (45.83%) of the responses had already been received, giving a response rate of 17.9% at that early stage. Follow-up questionnaires were then sent out. Five weeks after the first questionnaires had been sent to respondents, no more returns were received. The time used to send the questionnaires by facsimile is more or less the same as the time required to reproduce the questionnaire, fold and put the questionnaire inside the envelope, to address, franchise and close the envelopes, and to stand in the queue at the post office.

- The cost of sending questionnaires by facsimile compares favourably with the cost of traditional mailing. Telephone facilities and facsimile paper cost about the same as postage. Extra stationery in the form of photocopy paper and envelopes, as well as the cost of duplicating the questionnaire, would have been in excess of the cost of applying the facsimile equipment.

4.7 SUMMARY

All the statements in the questionnaire form an integral part of the opinions of environmental and rehabilitation managers in the mining industry on management accounting procedures and policies. In general most of the responses reflected support for good management accounting policies. Responses to 34 out of the 60 (56.7%) statements expressed general support with percentages exceeding 75% on the positive versions of the statements. Although all statements should be included in the strategic management accounting plan at one stage or another, the opinions of the respondents place emphases on particular aspects that should not be ignored.

Various deductions and conclusions would be possible from the analysed results, but only those concerning the aims and objectives of this study are discussed. Further research should be conducted on the other conclusions that could be drawn from the collected information.
Opinions expressed on various statements indicate that certain items should without doubt be included in a management accounting strategy for rehabilitation management. They are the following:

- A total, long-term strategy ranging from impact assessment to aftercare should be followed. (2.1.1, 2.1.4, 2.2.4, 2.2.1, 2.2.7.)
- Benchmarking should form an integral part of the search for best practices in order to improve existing rehabilitation policies. (2.1.5, 2.1.6, 2.1.8.)
- Feedback on successes and failures regarding rehabilitation inputs is important for management decision-making purposes. (2.1.9, 2.1.10.)
- A high percentage of the responding environmental managers mention that financial as well as non-financial inputs, results and gains concerning rehabilitation procedures are measured and disclosed to interested and affected parties. (2.1.11, 2.1.12, 2.1.13, 2.1.18, 2.2.15, 3.2.4.)
- In order to arrive at a balancing position in respect of rehabilitation cost management, financial, environmental, leadership and implementation issues should be considered. (2.1.14, 2.1.15, 2.1.16, 2.2.17.)
- Although the responses in favour of education and training as a means to eventually improving rehabilitation management strategies are not as high as in the case of most of the other statements, the general opinion is that investments in terms of money as well as time should be made towards this goal. Positive changes in rehabilitation management could be attained through education and training. (2.2.4, 2.3.2, 3.2.6.)
- Financial as well as technological provision should be made for contingencies. (2.2.5, 3.1.3.)
- The heritage of badly rehabilitated land is an important factor in strategic management accounting, and the separation of rehabilitation expenditure on rectifying inherited damage to land from rehabilitation as an ongoing process should be introduced. (2.2.8, 2.3.1.)
- The application of both ISO9000 and ISO14000 should be encouraged. (3.1.1, 3.1.2.)
- The experience of other countries does have a positive influence on local rehabilitation management and the accompanying management accounting strategies. (3.1.4.)
- A thorough knowledge of current local and national regulations, laws, fines and
taxation policies supports decisions on rehabilitation costs and expenses. (3.1.5, 3.1.6.)

- Behavioural as well as cultural aspects, such as local and internal attitudes, cultural differences and the dependence of the surrounding communities on the natural environment, should be considered for decision-making purposes. (3.2.1, 3.3.1, 3.3.2.)

- The inclusion of rehabilitation clauses in the mission statement and the statement of objectives has a positive influence on rehabilitation management behaviour. (3.2.2.)

- Impact assessments at the commencement of mining operations are of the utmost importance. (3.2.3.)

- Positive ethical considerations, such as inherent responsibility towards the natural environment, ignoring the stage of development of the surrounding communities, and the principle that profits cannot be pursued irrespective of the damage caused in the process, should be seriously considered. (3.2.5, 3.2.7, 3.3.3.)

- Awards for green reporting as well as for the encouragement of successful rehabilitation management policies, are important. (4.1, 4.2.)

- Act 50/1991/Chapter VI (amended by Act 103/1993) has a positive influence on the rehabilitation management of land disturbed by mining operations. (4.3.)

- The strategic management accounting factors of quality, cost and time, as well as the attributes of a good management accounting system of technology, behaviour and culture, should be combined for the benefit of rehabilitation management in general. (4.4, 4.5, 4.6.)

Results which provide opportunities for further research on management accounting, and which are not primary objectives of this research, are the following:

- Non-financial inputs, results, gains, assessments and disclosures in respect of rehabilitation management do occur. What is the extent of non-financial indicators in relation to management accounting? (2.1.12, 2.1.13, 2.1.18.)

- Investments of money and time in education and training have a positive influence on management decision making regarding environmental and rehabilitation policies. What is the extent of these investments, quality, results and influence on decisions and profits? (2.2.3, 2.3.2, 3.2.6.)

- Contingency planning in terms of technological and monetary provisions exists
with regard to rehabilitation management at mines. To what extent is contingency planning for an enterprise included in management accounting procedures? (2.2.5, 3.1.3.)

- Taxation policies influence rehabilitation management accounting decisions. How could the present taxation system be improved to encourage environmental responsibility? (2.2.8, 3.1.6.)

- There is agreement that the application of ISO9000 and ISO14000 should be encouraged. What are the local management accounting and cost implications and the results of the implementation of these international standards? (3.1.1, 3.1.2.)

- Awards for green reporting and successful environmental practice are important in order to encourage approaches that aim at continuous improvement. What is the extent of inputs and gains with the aim of obtaining awards? (4.1, 4.2.)

- Since Act 50/91 (amended by Act 103/93) is relatively new in the field of rehabilitation and environmental management, its effect after ten and fifteen years should be investigated. (4.3.)

- Most of the respondents are interested in attending seminars and courses on rehabilitation management. This need should be further investigated and affordable solutions should be found. (4.9.)

- The opinions of Chartered Accountants and cost and management accountants (CIMA) should be determined in respect of environmental and rehabilitation management accounting. If necessary, their courses could be adapted to include more environmental study material.

Useful data and deductions are obtained from this empirical research which could be utilised for the development of a comprehensive strategy on rehabilitation and environmental management accounting. Some of the acquired responses create opportunities for further research on other management accounting aspects, and should be investigated.
ANNEXURE 4.1

BRIEF SUMMARY OF THE COLLECTED INFORMATION FROM THE QUESTIONNAIRE

Due to rounding off, percentages do not necessarily add to 100%.

Background information

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Comments:

Each one of the respondents has at least one qualification over and above school education.
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### Opinions (% of total)

(“Not familiar with the concept” is analysed separately.)

(Filter statements: 2.1.7; 2.2.6; 3.1.4; 3.2.3)

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ANNEXURE 4.2: LETTER ACCOMPANYING SUMMARY

Attention: The Mine Manager

(for the environmental manager)

Number of pages (this one included): 5

PO Box 14919
LYTTELTON
0140
21 July 1998
Tel. 012-664-0825

Dear Sir/Madam

Accompanying this letter you will find a brief summary of the results of the survey conducted during May 1998 on rehabilitation management issues in respect of mining activities.

At the end of the questionnaire you indicated that you are interested in the results of the opinion survey.

I thank you for your participation in this research project which was successful in many respects. A special thanks to all of you who wished me success with my doctoral studies at the University of Pretoria.

Yours sincerely

........................................

Cecilia Beukes
A BRIEF ACCOUNT OF THE SITUATION IN THE REST OF AFRICA

5.1 INTRODUCTION

With the situation in respect of rehabilitation management in South Africa as the broad background, the world-wide management of rehabilitation in the mining industry was investigated briefly. The aim was to determine whether solutions to present and envisaged future problems could possibly be found and strategies could be formulated by studying the applied management and management accounting techniques used in other countries. Efficient overseas policies could be introduced locally, either unchanged or with the necessary adaptations. Improvements regarding current South African rehabilitation management issues could possibly be recommended, or incorporated into present strategic planning, after an analysis of the management accounting styles of other countries. On the other hand, a study of unsuccessful attempts to achieve an efficient rehabilitation management system as well as the reasons for such failures, could help to avoid similar situations in South Africa.

South Africa forms an important part of Africa in many respects. Not only is the country strategically well situated (see Figure 5.1), but its economic strength makes it the leading country in Africa. These attributes put South Africa in a very strong position to encourage and support positive developments in the rest of Africa, especially as far as the rehabilitation management of mining environments is concerned. Improved communication between the countries of the continent and specifically between the countries south of the equator enhances the prospects of mutual support and the exchange of useful knowledge between African countries.

As in Gore’s Global Marshall Plan (1992:295), in which he suggests that the global environmental crisis should be solved by means of a global cooperative effort, rehabilitation management in the mining industry should also be approached in a global way. The diversity among nations as well as their radically different stages of economic and social development make regional groupings a feasible proposition, with distinctive strategies for each region (Gore 1992:300). Africa south of the Sahara or even South Africa and the immediate neighbouring countries could form a region for the purpose of
cooperating on rehabilitation management. For instance, the exchange of expertise could reduce research and development costs, as well as transport costs where a country in a particular region (as indicated in Figure 5.1) is already using advanced technology. Under these circumstances it would be cost-beneficial not to import from outside the region.

The objectives of this chapter are to investigate the situation in Africa in respect of rehabilitation management, as well as the management accounting practices related to mining ecological environments, and to establish to what extent South Africa could benefit from the successes and failures of these countries. An analysis of developments in management accounting, and particularly any endeavours to identify and measure financial and non-financial environmental losses and gains, is included in these objectives. Attention is also given to analyses of details such as the role authorities play in encouraging rehabilitation by means of legislation and taxation, to the measurement and reporting of rehabilitation efforts to the stakeholders and the public, and investments in the training and education of staff associated with mining and rehabilitation activities, and to the way these issues could influence and enhance local South African management accounting strategies.

Figure 5.1 Africa

(Microsoft Bookshelf 1996)
5.2 EVOLUTION AND DEVELOPMENT OF MINING AND REHABILITATION

Mining has a long and important history in Africa, as it has formed the basis for trade across borders. Herodotus first mentioned the existence of trade in gold along the northern and western shores of Africa in the fifth century BCE (before the common era). After the Arab invasion of North Africa during the eighth century, full descriptions and records of the trade were provided by Moslem travellers, who noted the exceptional wealth of African kingdoms. Salt mined in the Sahara was exchanged for an equal weight of alluvial gold and for slaves from the western coastal regions of Africa. Jewish cartographers were depicting African gold on their maps by 1375, indicating excessive riches in Guinea, now one of the poorest countries in the world (Harries 1995:4).

The extraction and smelting of tin began by approximately 900 BCE in the northern parts of Nigeria. Before 1904, however, these operations remained small-scale local activities (Alexander 1990:44). The quantities of tin produced were probably sufficient to satisfy the needs of the local peoples, and no trade in tin was reported. The extremely hard labour required to exploit this metal also limited the trade in tin as only small quantities were eventually available. In those days labour was cheap and was not regarded as an expensive production factor, as it is today.

In Southern Africa the Wankie Colliery ("Wangi Kolia") in Zimbabwe occupied an important position in the economic history of much of the region's transport and railway networks as well as in the mining industry. Since production commenced on the mine in 1902, most of the economic activities of the region were directly or indirectly linked to the coalfield (Phimister 1994:1).

In North-Western Africa (as illustrated in Fig 5.2) the commercial mining of gold was not viable owing to the low average gold content of the ore, narrowly concentrated amounts of gold, and small and scattered deposits. Throughout the centuries artisanal mining had been practised, mostly as a sideline, and proved to be the only practical means of exploiting the low-grade ore. Mining activities were restricted by the dangerous and labourious nature of such mining and by floods during the rainy season and a lack of
water during the dry season. According to Harries (1995:6), the methods employed by
the Malian artisanal miner of today do not differ much from those of his ancestors. Scarce
resources limited mining and rehabilitation operations in the past and to a great extent
also do so today. The limiting factors are the low gold content, which does not yield
sufficient income, as well as a lack of modern technology to improve unsafe working
conditions and control climatic extremes. A further limiting factor is the average low
level of development of the inhabitants, who are not ready to apply the advanced
concepts originating from capitalism.

Foreign investment in these countries, supplied mainly by capitalist countries with the
object of introducing modern mining techniques, including rehabilitation management
practices, have been discouraged because of the unstable and unfavourable political
climate after independence.

Commercial mining during the pioneer years of mining in Africa left a legacy of damaged
and derelict land to the present generations. In Nigeria a worked-out mining landscape
of this nature of about 316 square kilometres is found on the Jos Plateau. From 1904
onwards the first tin prospectors used picks and shovels which left relatively shallow
mines of between three and four metres deep. By 1920 the pick and shovel had been
replaced by the bulldozer and other more advanced equipment that could exploit tin­
bearing ore from as deep as 10 to 30 metres and which caused much more damage than
the less advanced technology of previous decades. The landscape is described as
consisting of steep dumps enclosing these 30 metre deep hollowed-out areas (Alexander
1990:44,45). It would be difficult if not impossible for the present mainly impoverished
generation to generate or find funds to rehabilitate this damaged land. Damaged land does
not allow the inhabitants of the area to earn a proper living by means of agricultural
activities, for example. This dark picture of continuing degradation of land calls for a
rehabilitation management accounting strategy that would address all limiting factors, and
that would introduce basic training and education for all people involved in mining
activities.

In the overwhelming effort to minimise costs, the health and safety of workers on mines
were neglected to an appalling extent. Phimister (1994:14,15) records that before 1910
workers at the Wankie colliery in Zimbabwe had to work eleven hour shifts seven days
per week, on very low food rations. At one stage wages were also decreased by ten
percent to "economise wherever possible". The favourable position of this mine as the only one in the country resulted in perfunctory official inspections. This preoccupation of the managers of the mine with getting the coal out of the earth at the lowest possible cost, and at the cost of the health and safety of their workers, did not leave space in their minds for rehabilitation management. On the other hand, the workers who were battling to survive physically under extreme conditions were not in the least interested in the condition of the natural environment. The exploited land was the birth place of neither the workers, who came from other regions in Africa, nor the colonialists. The philosophies surrounding the roles of the colonial capitalist, the migrant worker, and the natural environment that were developed during these pioneering years of mining in Africa and Southern Africa cannot be changed easily.

Africa is rich in many minerals, gems and metals that can be mined successfully. Scattered over most of the continent (Fig 5.1), from Sierra Leone in the west to the Congo in Central Africa, from Morocco in the north to South Africa in the south, a large variety are mined for export purposes (Table 5.1). All of these mining activities have a very important influence on the economies of these countries as valuable foreign exchange is earned and internal employment opportunities provided. About four million people are making a living out of mining in Africa (Hollaway 1995:20). The majority of these people are small artisanal miners employing limited technology to extract riches from the land.

Although Africa is rich in minerals, and millions are making a living out of these, environmental management and control are very fragmentary. The abundance of natural wealth or capital, in the form of minerals, metals and people, does not compensate for the lack of rehabilitation management and the accompanying management accounting strategies.
Table 5.1
African countries: Principal exports in terms of minerals, gems and metals (excluding oil) (as a percentage of the total exports of the country)

<table>
<thead>
<tr>
<th>Country</th>
<th>Principal Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>diamonds (80%), copper-nickel</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>gold</td>
</tr>
<tr>
<td>Central African Republic</td>
<td>diamonds (70%)</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>copper (50%), cobalt, diamonds</td>
</tr>
<tr>
<td>Gabon</td>
<td>manganese, uranium</td>
</tr>
<tr>
<td>Ghana</td>
<td>gold (45%), manganese</td>
</tr>
<tr>
<td>Guinea</td>
<td>bauxite ore, alumina (70%)</td>
</tr>
<tr>
<td>Liberia</td>
<td>iron ore (60%)</td>
</tr>
<tr>
<td>Mali</td>
<td>gold</td>
</tr>
<tr>
<td>Mauritania</td>
<td>iron ore</td>
</tr>
<tr>
<td>Morocco</td>
<td>phosphates</td>
</tr>
<tr>
<td>Namibia</td>
<td>diamonds, copper, etc (50%)</td>
</tr>
<tr>
<td>Niger</td>
<td>uranium (70%)</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>rutile, bauxite, diamonds</td>
</tr>
<tr>
<td>South Africa</td>
<td>minerals, including gold (60%)</td>
</tr>
<tr>
<td>Togo</td>
<td>phosphates (25%)</td>
</tr>
<tr>
<td>Zambia</td>
<td>copper (82%), cobalt</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>gold &amp; other minerals</td>
</tr>
</tbody>
</table>

(Compiled from Africa Institute: Pretoria News: 4/6/97)

Although Africa has a selection of most of the known minerals and gems in the world, the continent remains in the raw material phase. In order to develop strategies that would improve the quality of land and to train and educate vast populations, strategic management accounting policies are needed (Yemi Adelakun 1996a:14-15). Initial capital is, however, required to generate and accumulate capital for these strategies. This initial capital should include financial and non-financial inputs in the form of know-how, modern technology, direct monetary inputs and rehabilitation management accounting strategies. As soon as the improvement gets under way more capital can be acquired in the process to generate and accumulate capital.
5.3 DIFFiculties Encountered With Rehabilitation Management

5.3.1 Introduction

As in South Africa, the basis of effective rehabilitation management, or even the introduction of rudimentary rehabilitation policies, stems from an awareness of the need to preserve the natural environment. It appears that even in the recent past the peoples of the rest of Africa had an attitude of environmental non-awareness in general. This can possibly be ascribed to economic factors such as the fact that most of the rural inhabitants of Africa have traditionally moved away from areas where they cannot make a living towards more fertile areas. These peoples generally need less than bare essentials to survive and are content with such a standard of living. They are not concerned about pollution from mining activities, and are ignorant or unaware of the negative effects of polluted air, water or soil which culminate in health and care expenses that would further reduce their standard of living.
As early as 1920 rural communities in Zambia exceeded the carrying capacity of the natural environment (Els 1996:2). At that stage there were already too many people and animals to survive according to traditional agricultural methods. People took more from the land than they were able to return for their own generation. Future generations were not taken into consideration. Communities have to make changes and gain living space by investing financially and non-financially in the rehabilitation of the areas surrounding mines.

Underlying the lack of awareness of the consequences of environmental rehabilitation of mining areas, are other environmental and economic issues. In order of priority they are: deforestation, poverty, water deficiencies and land tenure (Chamber of Mines Journal 1995c:12). Forests are being utilised and exploited for firewood and timber, and cleared for mining operations, and are destroyed by other causes such as acid rain. An extremely high percentage of the people of Africa are poor, and in the struggle for survival, conservation of the natural environment is given a very low priority. As on the asbestos mines in South Africa about one hundred years ago, poverty precluded advanced concepts, such as the rehabilitation of mining areas, from being included in management policies. Owing to the developing nature of most of the countries in Africa, sophisticated clean water supply systems are usually not present in rural towns. Existing water supplies are polluted by mining activities, among others. Although land was traditionally owned by tribal heads, all land belonged to everybody and to nobody, except for the “yard” and the cultivated field (Els 1996:495). In the end the responsibility for the conservation of the natural environment did not rest with any group or person.

Within the traditional view of abundance of good land, the value of land actually decreases and nobody realises or recognises that losses for present and future generations might occur. In the African situation various factors have a negative influence in respect of rehabilitation management, and should be taken into account in the development of a holistic strategy for rehabilitation management accounting. They are polluted air, water and soil, small-scale mining, illegal mining, the lack of law-enforcement, state-run mines, external pressure, international trade agreements, and the cultural heritage of the peoples of Africa.
5.3.2 Polluted air, water and soil

The major difficulties in respect of environmental management and rehabilitation in mining in Zimbabwe are given by Laurence (in Chamber of Mines Journal 1995c:17), and are largely applicable to Africa. Mining management, which includes the management accountant, has to find solutions to the primary problems of air pollution, surface and underground water pollution and damage to soil and land.

5.3.2.1 Polluted air

The air in the vicinity of mining activities is being polluted by dust spread by the wind from waste and sand dumps. In addition, the crushing and screening of mined ore emit more airborne dust. Workers and people living near the mines are exposed to gas from refineries, collieries and processing plants. Toxic chemicals and substances to which humans, animals, plants, soil and water are exposed are released into the air. Polluted air may come into direct contact with ecological systems near the source of pollution, or may be spread in the form of acid rain to more distant regions.

It is already difficult to measure the extent of pollution in the air. This is aggravated by the dilution of the pollutants as they are blown away from the source of emission. Many gases and toxic substances in the air cannot be observed without sophisticated equipment, and when they cannot be seen or smelled, they are unlikely to be detected by ordinary people. Methods of constantly assessing the pollution levels in the air, and of the damage caused by such pollution, should be found. These mostly non-financial assessments should be weighed against the cost of the introduction of measures such as the installation and maintenance of filters or cleaner processing methods in order to prevent or diminish the emission of damaging substances into the air. The cost of the rehabilitation of damaged areas caused by polluted air, as well as the potential cost of health claims and future fines, should also be considered.

5.3.2.2 Polluted surface and underground water

Chemicals used in processing, acid mine drainage and heavy metal particles are the main substances that end up in surface and underground water. As water masses usually do not remain in one area, but flow to lower levels, the pollution is spread both on the surface
and in underground water sources. Rivers become silted and polluted from unstable mining waste dumps, from gold panning, the removal of trees to make space for mining activities, and the diversion of rivers. Both opencast mining and alluvial mining operations alter water tables during excessive pumping from underground water aquifers. All these non-financial factors contribute to the already problematic situation in respect of financial investment in the provision of sufficient clean water to the inhabitants of Africa. Both the accountant and the management accountant are involved in a transformation process where the challenge is to include non-financial rehabilitation criteria in calculations and reports.

Since water resources are utilised not only for mining purposes, but also for agriculture and tourism, the management accountant should include this wider spectrum of affected and interested parties in strategies for rehabilitation management. In the Okavango Basin of Botswana there is increasing pressure from the population to divert water from the Okavango Delta for farming and the mining of diamonds (Encarta 1997). Large quantities of water are utilised to wash diamonds from the rest of the ore-bearing materials. Reduced water levels and polluted water coming from mining and associated operations have the potential to cause extensive ecological damage in a region that is known for its wildlife. Growing numbers of tourists, mostly South Africans or foreigners who are travelling through South Africa, visit the delta, providing employment to the local communities. Objections by residents, tour groups and environmental action groups lead to the decision to utilise underground water for mining purposes closer to the mine (Oliver 1997:18). Massive extraction of underground water without recharge could, however, also have devastating effects on the natural environment. Underground water tables could dry up at the higher levels, and so could wells and natural fountains which supply water to communities, animals and vegetation. It is possible that at a later stage water will only be found at very deep levels and withdrawing it will become very costly.

In this situation the management accountant, as part of the team of experts, should find a balance between the seemingly conflicting non-financial applications of water for the maintenance of wildlife and the potential financial income from tourists, and income from the mining of diamonds. It should be borne in mind that very high numbers of tourists could also damage ecological systems.

The number of years for which the natural ecological system could provide an income
to the country and sub-continent should be weighed up against the number of years for which the utilisation of water would provide an income for the miners before all the diamonds have been extracted from the earth.

As part of the rehabilitation management strategy, the muddy water produced by the washing of diamonds could be used to recharge the aquifers. Continuous geological changes, such as the gradual manmade and natural silting of the fingers of the deltas over several decades and even centuries and the influence of such silting on the availability of water for various purposes, should be included in long-term management strategies. Tourism is not the only aspect to take into account when determining those balances, one should not lose sight of the value of unspoilt ecosystems for future research projects to improve the quality of life of inhabitants of the region. An example of such future research is the search for remedies for ailments.

The basis of possible solutions to the water pollution problem is again the awareness of the mining sector of the environmental damage they have caused and the resultant effect on the people in the area. Once this awareness has been achieved the mining sector should be prepared to invest in more advanced technology and expertise in order to rehabilitate damage from past operations, and to prevent and reduce future water pollution. Continuous improvement by means such as investment in large-scale education schemes should be included as an important element of the quality management (Ciampa 1992:92-93) of the ecological aspects of mining operations, especially in Africa.

5.3.2.3 Polluted and damaged soil and land

Apart from the damage caused by polluted air and water, soil and land are also visually damaged by means of wind and water erosion. The adverse effects of mineral explorations include unprotected mine pits and shafts, uncapped drill holes, as well as drill pads, trenches and survey lines left unrehabilitated. Land surfaces subside from caved and collapsed stopes, and from underground pillar failures, making the area surrounding mining operations dangerous to people and animals. This may lead to extensive claims against owners or previous owners of damaged and dangerous land.

Even investments in the fencing off of dangerous areas, does not solve the problem. After mines had become worked out some mining companies in Zimbabwe used to fence mine
pit with the approval of the mining commissioner. In less than two years the fence would be gone, and the initial dangerous situation would again become an urgent problem (Chamber of Mines Journal 1995a:45), with an accompanying increase in failure and rehabilitation costs. Under these circumstances incurring the cost of an adequate preventive strategy would have preserved the value of the land.

The development of a management accounting strategy, both in Africa and in Southern Africa, for the management of the rehabilitation of damaged soil and land is a complex issue. These difficulties, which include the pollution of air and water, cannot be solved in the short term. A strategic management accounting plan should be developed in order to implement environmental and rehabilitation management gradually, in stages ranging from the creation of an awareness of environmental matters to education, from the implementation of more sophisticated equipment to the realisation of the benefits of continuous improvement.

5.3.3 Small-scale mining

Other more secondary difficulties in respect of environmental and rehabilitation management in Africa include the lack of cash resources to invest in rehabilitation operations. Smaller mining companies investing in Africa are not as meticulous about ecological concerns as larger companies. Small-scale miners are inclined to operate on a shoe-string budget, and in the process cause much more damage (Hollaway 1995:23) and reduce opportunities to restore dumps in the course of mining operations, for instance.

Small-scale mining, particularly in Zambia and Zimbabwe, has an enormous negative impact on natural environments. Smith (1995:33) describes the effect of small-scale mining activities in Zambia over an area of about one hundred and thirty square kilometres. There is no social infrastructure, with the result that water for sanitation and agricultural purposes becomes practically unusably polluted. Uncontrolled mining operations create a safety risk for workers and surrounding communities, and might eventually lead to high expenditure in terms of health claims, and rehabilitation inputs by future generations. It seems impossible to register mining operators in an effort to exercise some control over their environmental management. Small miners have almost no overheads, which enables them to produce more cheaply than larger enterprises.
But this situation of low production overheads effectively means a considerable cost to the natural and living environment. A portion of the cost savings should be ploughed back into the remediation of the land from which the savings and profits originated in the first place.

In Zambia efforts are made to influence buyers from small-scale miners to encourage and finance the improvement of environmental and rehabilitation management (Smith 1995:33). The importance of small-scale mining is recognised because this sector provides opportunities for the unemployed to earn a living. Authorities realise that this importance will increase in future, and that policies should be developed to reduce the negative impact on the environment.

About 25% of all gold produced in Zimbabwe comes from small-scale miners (Kumalo 1995:28). According to estimates, over 200 000 people were employed and self-employed in the small-scale mining business at the end of 1995. The effects of droughts, retrenchments and the troubled economy of the country will in future direct more people to small-scale gold panning. The ecological results of this mass movement towards the mining of alluvial gold are devastating. River banks are dredged and pits dug, and the result is that the rivers silt up over a distance of about 4 600 kilometres. This damage to the riverine system causes large areas of land to be degraded. In this continuous process of degradation, the value of land constantly decreases.

It is also extremely difficult for the authorities to assist in the management of small mining activities. Owing to poverty, these miners are often unable to invest in rehabilitative ecological operations. Miners and members of the communities are not environmentally educated and do not know much about the natural environment, and therefore do not care about damage caused to the land and water by unrestricted mining operations. Farming communities appear to be more concerned about their natural and living environments, however (Chamber of Mines Journal 1995a:45). Farmers have limited land available for farming purposes, whereas small-scale miners move on as soon as a patch of land is exhausted. Small-scale miners traditionally believe in the abundance of land, but farmers have to survive on limited resources, which makes them more conscious of the need to preserve the natural environment. This awareness creates the opportunity to employ people from the small-scale farming communities to positively influence the small-scale mining communities.
Increasing unemployment together with the resultant increase in poverty in South Africa could easily indirectly lead to neglect of rehabilitation management in the small-scale mining industry. Although the Minerals Act (50 of 1991) was promulgated to encourage the rehabilitation of mined-out areas, the law as such cannot prevent the damage effected by small-scale mining. The cost of rehabilitation would automatically be passed on to future generations.

Contrary to the aims of the Minerals Act (50 of 1991), however, the South African authorities (Department of Minerals and Energy 1997:17) are encouraging the development of a “junior mining sector”, a term which refers to small-scale miners. Under circumstances in which it is hardly possible to trace transgressors of environmental regulations in the larger mining categories, it would most certainly be impossible to supervise small-scale mining operations. A law means nothing if it is not enforced by an inspecting body. A costly situation to rectify, similar to that in the rest of Africa, could very easily develop in South Africa if adequate precautions are not taken timeously.

Management accountants, who are important members of multi-disciplinary teams in rehabilitation management, should be aware of the situation in the rest of Africa pertaining to small-scale mining as well as of the possible future attitudes of the national authorities on this matter.

5.3.4 Inadequate mining and rehabilitation methods

Inadequate mining and rehabilitation methods have the potential to cause pollution and eventually lead to major health disasters. These mining methods together with inadequate maintenance management policies could lead to enormous claims and resultant financial liabilities that could not be met, by either local or parent companies.

At Dunkwa in Ghana, where alluvial gold mining has occurred since the beginning of the century, contamination of water resources can be found for approximately fifty kilometres both above and below the mining town. During the process in which an amalgam is formed from the material before the gold is extracted, uncontrolled losses of mercury occur directly into water ponds (SA Mining, Coal, Gold & Base Minerals 1995:45). The amalgam is then smelted in two processes, first to recover the mercury from the first process, and secondly to recover the gold. In some dangerous spots the
mercury in the river water resources could take decades to decrease to acceptable levels. Dangerous levels of mercury in the air at the recovery plant pose a serious health hazard to workers as well as to people living downwind from the plant. Although high levels of mercury are found in the river water, the local community does not make use of that water, but use water from boreholes. Fortunately, government officials had already warned them not to use the river water because of other hygienic risks (SA Mining World 1995:14).

But the possibility still exists that mercury could enter the food chain and cause poisoning, although mercury has not yet been detected in fish eaten by the inhabitants of the town. Mercury can become bioconcentrated in fish and aquatic organisms, as fish have the ability to uptake mercury rapidly and have the inability to excrete mercury from their tissues (Sittig 1980:266). The presence of enormous mercury contamination in the water sources and the potential of mercury to enter the food chain could easily lead to a disaster similar to the one at Minamata in Japan during the 1950s. The inhabitants of the town suffered from severe physical and psychological disabilities, and 305 died, owing to mercury poisoning of the fishing water in the harbour. Chisso Corporation, the company responsible for the mercury pollution, was required by court to pay US $200 million in compensation to the 15 000 victims who filed claims by the middle of 1985 (Perkins 1990:210-211).

The long-term effect of such a disaster could be felt for centuries after the initial pollution occurred. Prevention costs and the expense of investing in environmental consultants and improved technology in order to prevent disastrous pollution, should be weighed against the repair costs of rehabilitating the environment and failure costs in order to pay the claims to victims of poisonous contamination effects. The role of the management accountant is to include assessments of previously invisible environmental costs into rehabilitation management accounting strategies. Maximum and higher profits as such should not be seen as all-important but other considerations such as the application of some of the profits to prevent the effects of severe pollution should also be taken into account when assessing performance values.

Merryweather, the head of a South African environmental consultancy firm who was approached by the State Gold Mining Corporation, the mining company that is in the process of privatising the mine at Dunkwa, made recommendations to reduce the risks
from mercury contamination and poisoning (SA Mining World 1995:14). These recommendations include investing in the redesign of the gold processing plant, the monitoring of the aquatic biological systems, and a suggestion that the mine should play a more pro-active role in society and in respect of the conservation and rehabilitation of natural resources. People in the vicinity of the mine could benefit from timber that is felled when clearing the forests for mining operations. They could also be able to continue farming on land that should be rehabilitated by the company after exploration.

These strategies proposed by the environmental consultants in Ghana contain elements of quality management as described in the "14 steps of Deming". They emphasise the elements pertaining to the correction of faulty systems and the wellbeing of the people (Riahi-Belkaoui 1993:3&4) who are directly and indirectly involved in the operations of the company.

In Nigeria incorrect soil removal procedures created considerable difficulties for subsequent attempts to rehabilitate dumps and holes. The commercial tin mining companies of the past did not follow the accepted practice of phased removal of the three different types of soil where topsoil, subsoil and overburden are removed and stored separately. Excavations involved the simultaneous removal of the three types of soil, resulting in the mixing of soil and the degrading of the reclamation properties of the area. As organic materials are usually only found in topsoil, the mixing of the different layers of soil decreases the average organic matter percentage and the capacity of the soil to be revegetated. The flooded holes in the countryside could be utilised to irrigate the revegetated dumps and undisturbed agricultural soil (Alexander 1990:45,49).

Management accountants should budget for adequate maintenance management after the completion of rehabilitation activities to prevent a situation similar to that in Nigeria. In 1959 the establishment of eucalypt plantations commenced on some of the reclaimed soil on the tin mining plateau in Nigeria without proper investigations and research on the effects of this scheme. From 1959 to 1983 nobody either questioned this policy or made any attempt to monitor its ecological impact. Timber was removed on a regular basis from the plantations. But all the leaves, twigs and other plant material that fell on the ground were also removed. This continuous removal of plant material nutrients from the system where soil and plants interacted continually decreased the ability of the land, already poor in nutrients, to be reclaimed (Alexander 1990:47,48). If the authorities still
aim to turn the damaged mine land back into agricultural land, the poor rehabilitation management of the past should be changed. Removal of any plant materials from the plantations except for timber should be prohibited. In addition, the example of one of the farmers should be followed. He utilised sorted urban refuse to increase the nutrient value of the soil on his farm. As eucalypts also have the natural tendency to cause long-term deterioration in soil conditions, the authorities were advised that the eucalypts should be replaced and vegetation with local trees and shrubs should preferably be included in the rehabilitation strategy.

Maintenance management of rehabilitated mining areas, such as in Nigeria, forms an integral part of the whole strategy of rehabilitation management. The United Nations Industrial Development Organisation (UNIDO) (1994:16) observed that managers and management accountants in developing countries such as in the rest of Africa include only the direct costs of maintenance. They are inclined to ignore other factors that should also be taken into account in the calculations, such as the negative effects on safety and the natural environment. The following three forms of maintenance are identified (UNIDO 1994:41):

- Design-out maintenance, which provides for less future maintenance expenses at the planning and designing phase, such as planning to revegetate with indigenous plants.
- Preventive maintenance, which includes periodic and condition-based maintenance, that are planned to reduce the eventual cost of maintaining rehabilitated areas.
- Corrective maintenance, which is unplanned maintenance such as in Nigeria, and which requires for higher financial inputs in the end.

In order to achieve quality rehabilitation management, ways and means should be introduced to continuously improve the methods and practices inherited from previous generations. A balance should be found between the cost of inputs in respect of improved management policies and actual benefits in the short and long term. To be able to develop strategies for improvement, especially in respect of financial and non-financial aspects on the input side of the proposed balance, the rehabilitation management accountant should consult with experts such as botanists on vegetation issues.
5.3.5 Illegal mining operations

The South African management accountant should be aware of both the short-term and the long-term negative effects of illegal mining operations in the rest of Africa. With this background information in mind, models and strategies could be developed to improve the rehabilitation management situation in South Africa.

Abandoned mining properties which were not adequately rehabilitated are targets for illegal miners. These illegal miners, especially in Zimbabwe, cause further damage to the natural environment, and are prone to fatal accidents inside old mines (Chamber of Mines Journal 1995c: 14,12). Before long enormous amounts could be claimed against previous owners of abandoned unsafe mines.

This negative influence of illegal mining on rehabilitation management appears to continue unhindered, and with the unofficial approval of the government, since officials are also involved in gold panning to supplement their low incomes. The extreme poverty of large sections of the communities forces people to embark on illegal mining activities (Kumalo 1995:28). While people are struggling to survive from panning gold, the legalisation of their source of livelihood or the rehabilitation of the surroundings are of no importance at all to them. Illegal alluvial gold panning in the rivers closer than the legal three metres from the banks causes siltation, resulting in the loss of species biodiversity and soil erosion. Future generations will inherit huge liabilities in the form of reduced land value and inadequate official measures to rehabilitate these vast areas at high cost.

In Zimbabwe alone the state lost over $1,4 million per month during 1995 to illegal dealers in alluvial gold which ended up outside the country (Kumalo 1995:28). This aggravates the financial situation of a poor country which needs more officials to legalise mining activities as well as for the enforcement of the legal buying and selling of gold produced by illegal small-scale miners. The government revenues lost should have been applied directly and indirectly to remedy the damage done in the past and provide for ongoing rehabilitation practices.

Illegal mining operations could have been prevented in the first place by enforcing the rehabilitation of mines that are closing according to predetermined specifications. As has
always the practice in the mining industry in South Africa, African governments should take responsibility for the rehabilitation of abandoned mines where owners have gone bankrupt or died. Experts such as environmental managers and management accountants employed by larger mines should train smaller miners in environmental and rehabilitation management before small-scale miners legally commence activities at abandoned mines.

Although the governments of Zimbabwe and Zambia realise the importance of small-scale mining to the social economies of these countries, the future financial impact of illegal mining operations and the lack of rehabilitation of such areas are not recognised. South African authorities and communities should take cognisance of artisanal mining in Africa, which causes severe environmental damage and gives rise to future rehabilitation costs, and should only allow this form of mining under certain conditions (Department of Minerals and Energy 1997:54). Future generations will inherit the rehabilitation liabilities as well as the decreased value of land, if management teams, including management accountants, do not act timeously by developing appropriate rehabilitation strategies.

5.3.6 Lack of law-enforcement procedures

The threat to the environment caused by inadequate mining rehabilitation practices in most of the southern countries of Southern Africa, excluding South Africa, is associated with good intentions in legislation, and an almost total absence of expertise among environmental managers, management accountants and law-enforcement staff, as well as a lack of funds for control purposes.

Hollaway (1995:23) provides examples of this attitude in various countries. An Environmental Protection Act which was promulgated in Zambia in 1990 sets standards for regulating the pollution of air, water and soil. But a lack of funds and legislation under which to prosecute air polluters makes these standards unenforceable for practical purposes.

In Ghana the Minerals and Mining Law of 1986 (sections 72 and 83) specifically deals with environmental concerns in respect of mining operations. In addition the national project, the Ghana Environmental Resource Project, was launched in 1993. The range of facilities and services for environmental control was, however, minimal in 1995
(Hollaway:23), while the main violators, the poor artisanal miners, are continuing with their activities which cause extensive damage to the natural environment, without any interference by the authorities.

For some years Tanzania has planned to introduce a set of environmental regulations, as the country does not have any. Mercury poisoning is the main danger in the gold mining sector. Almost all the gold produced in the country is the product of a process in which mercury is amalgamated with gold, and effectively none of this mercury is recovered. The mercury is discharged into the environment. Similar practices are followed in Ghana in the mining of the pillars of old gold mines by small-scale miners.

According to a 1992 review on seven of these southern countries, which included visits to 35 mines and mining enterprises, only Zimbabwe had a full range of environmental regulations. They are, however, scattered over eleven pieces of legislation and administered by four government departments (Hollaway 1995:23). Kenya has 66 pieces of legislation concerned with environmental protection, but these are scattered and ineffectual (Business Africa 1996:9). These legislative systems make it practically impossible to successfully implement environmental management principles or management accounting practices for rehabilitation purposes. Ultimately the value of land decreases and future rehabilitation liabilities are created.

Since 1946 legislation has existed in Nigeria in the form of the Minerals Act, which requires mining companies to restore worked-out sections of their mines. From 1948 most of these reclamation activities on the tin mines consisted of the removal of tailings from present excavation areas to partly fill up nearby abandoned mines. These rehabilitation efforts represent approximately one percent of the 316 square kilometres of derelict land left abandoned after mining operations ceased. Failure to implement law-enforcement procedures led the government of Nigeria to declare this area a "disaster area" in 1982. Public concern about the safety of this area as well as an attempt to obtain funds for reclamation purposes provided support for this step. But the political situation in the country with opposing groups in government and in various states, did nothing to promote rehabilitation management efforts. (Alexander 1990:44,45.)

This emphasises the fact that when authorities which should be the watchdogs of the natural environment do not perform their functions adequately, the result is chaos. At
this stage the necessary legal structures are not in place to enable rehabilitation management accountants to contribute their knowledge and expertise to the degree that is actually required by the natural environment.

Alexander (1990:45) explains the difficulties that have been experienced with the enforcement of the Nigerian Minerals Act since 1946. Vague wording such as “reasonable restoration” allow wide interpretation of terms like “reasonable”. Supervising authorities have been unwilling and unable to monitor and enforce legislation. Mining companies have been unwilling to surrender leases on land after the mines have been worked out, arguing that there is still some tin-bearing ore left. Restoration activities were therefore often postponed, and rehabilitation funds utilised for other purposes. Authorities appeared not to recognise the importance of the prevention of future environmental costs and decreases in the value of land.

Economic considerations such as the low market price for tin in the 1980s have meant that Nigerian mining companies would have become bankrupt if restoration legislation had been enforced. This would have caused the cessation of mining operations and would have led to unacceptably high levels of unemployment on the Jos Plateau. To prevent a situation where the cost of rehabilitation activities would cause such a negative impact on the economy of a region, provision should be made in advance, and the trust funds administered separately, to enable maintenance management to perform the necessary rehabilitation operations after the closure of mines or sections of mines. In South Africa, which is a more developed country, similar procedures are prescribed by the Minerals Act (50 of 1991). The rest of Africa should follow.

The lack of law-enforcement procedures in Africa emphasises the need for central control and monitoring measures to be included in total quality management policies. Juran defines quality control as the measuring of the quality of the actual performance, the comparison of this quality with the set standard, and the acting on any differences and deficiencies (Schonberger & Knod 1994:29). South African management accountants should realise that the lack of adequate involvement of authorities in rehabilitation management issues would make their task more difficult.
5.3.7 State-run mines

The major culprits in environmental mismanagement and pollution from mining operations in Africa seem to be state-run enterprises. They are usually driven into bankruptcy by political pressures.

Examples of these disastrous practices (Hollaway 1995:23,25) are found in Ghana at the state mines of Dunkwa, where alluvial gold mining dredging processes have polluted the rivers, and at Prestea, where tailings are dumped into the river system. In Zambia an estimated 500 tons of copper land in the Kafue River every month. Air pollution cannot be reduced because there are insufficient funds to replace expensive filters, although the African Development Bank secured a loan to introduce measures to stop the pollution of water and air. The loan was spent on other operations not specified in the original loan agreement.

The laissez faire attitude of these states in respect of environmental and rehabilitation management will cost the countries dear in future when usable river water and clean air will become unavailable. At present the availability of clean water is one of the major crises in Africa. It should be the duty of authorities to utilise the expertise of external environmental and rehabilitation management consultancies, such as are already available in South Africa, when they realise that they are not able to solve their ecological problems internally. In the process of utilising external experts, local managers and operators should also be trained and educated. Future financial and non-financial effects of polluted water and air should be measured against the cost of improving the present situation, and the benefits arising from such investment in improvements.

One aspect of quality management that should be included in the management accounting strategy in respect of pollution by state-run mines is continuous improvement, which also involves consultation with outside experts by authorities, and the resulting creation of an atmosphere of ongoing education and training. When South African management accountants develop new strategies and models to accommodate future rehabilitation management policies, tendencies like the change of ownership outlined in the Minerals and Energy Green Paper (1997:33) which could develop into the nationalisation of mines, together with the African experience of state-owned mines, should be included.
5.3.8 Pressure from outside on African mining companies

Management accountants in Africa and in South Africa should be conscious of the immense influence of international pressure groups on the economy of a country as well as on the resulting standard of living of the inhabitants. There is an increasing awareness world-wide of ecological matters and of the fact that global natural resources could be permanently exhausted by irresponsible actions. Evidence of the need to improve environmental management could be found in the United Nations Conference on the Environment and Development held in Rio de Janeiro in 1992. Agenda 21 was adopted, which emphasises the acceptance of environmental guidelines for the development of natural resources (Chamber of Mines Journal 1995c:15).

As mining is an export-oriented industry in Africa as well as in South Africa, in the final analysis international markets dictate mining rehabilitation policies. If the stringent environmental prescriptions of developed countries are followed in developing countries, economic development would be slowed down, since mining is one of the important growth industries in most of Africa.

Walde (1992:23) describes four different scenarios as regards the position of developing countries for attracting Western capital for the development of mining and accompanying rehabilitation operations.

1. Since African countries are dependent on finance, markets and technology from Western countries, conditions are added to loans. Lending countries attach preconditions for environmental and rehabilitation management when granting loans to borrowing countries. These loans include the whole spectrum from World Bank loans to government loans to private loans from banks.

2. Countries not complying with these environmental management prescriptions are penalised by the imposition of levies on metal imports.

3. Technologies for the mining industry are mainly developed in Western countries, and are adapted to the environmental regulations of these countries. In order to fully utilise the most advanced equipment, African countries are forced to introduce rehabilitation and environmental technologies.

4. Finally, with the Bhopal chemical environmental disaster as an example, it should be realised that judges in Western countries could impose enormous liabilities on
parent companies in Europe or the United States. Domestic circumstances and attitudes towards environmental and rehabilitation management of countries performing mining operations may not be applicable. In order to prevent such a costly situation, Western countries either do not invest in mining activities in Africa at all, or introduce strict control over safety and rehabilitation conditions.

The situation of Western groups vis-à-vis developing groups in Africa is complex. On the one hand it is relatively easier for the Westerner to criticise other people for damaging forests, landscapes, water and air for mining activities than to encourage their own group to diminish or even give up on the excessive use of the convenience and luxury items which are the products of the mined metals and minerals coming from Africa, such as cars, heating and cooling systems. On the other hand, Africa is over-populated with millions of people who are more concerned about food and shelter than about the ecological condition of the land which future generations will inherit.

Poor developing countries in Africa may argue according to the principle of national sovereignty that they have the right to pollute. According to their politically oriented arguments, economic development should be accorded more importance than environmental issues. They argue that the value of clean air, water and soil is incalculable. The desired economic development might however be reached within five to ten years if every capable citizen contributed his or her full share to the economy by exploiting the earth. But the recovery of damaged land, polluted by mining wastes in the air, water and soil over the same ten-year period, would take up to two hundred years on its own without the presence of any humans. After ten years the population may have monetary riches, but may not have a countryside, trees, clean water and an acceptable environment in which to survive. The invisible power of a damaged natural environment would eventually drive employers as well as employees - who are poor as it is - away. An integrated holistic management accounting strategy should therefore be devised in order to affect a gradual transitional process in rehabilitation management (Beukes 1998:13).

It would therefore be wrong and cynical to deduce that as natural assets do not have a visible price, that they are worthless. In this regard Oscar Wilde (1916:113) defines a cynic as “one who knows the price of everything and the value of nothing”.

In the opinion of Donaldson (1996:52), these extremes should be balanced by the management accountant; respect should be shown for core human values and for local traditions, and the context should be considered. When assessing the rights and wrongs of environmental management practices it is not always possible to evaluate developed and developing countries by the same criteria.

While pressure groups outside Africa realise that the lack of proper rehabilitation management in Africa could eventually lead to the collapse of life on this continent, they would continue to put pressure on mining companies in Africa to include environmental and rehabilitation management policies in their operating strategies. Since African leaders increasingly seek the approval of leaders from outside Africa, a new form of colonialism could involve the rescue of environmental policies on the continent (Von Keyserlingk 1998:5). These new leaders include the World Bank, the International Monetary Fund and even big investment companies in South Africa. This awareness of pressure from outside on African nations would influence the strategies to be developed by management accountants in South Africa.

5.3.9 International trade agreements

It could be argued that the current international trading conventions add significantly to global resource degradation. Trade rounds such as the World Trade Organisation (WTO) propagate freer trade in order to encourage economic growth, which in turn would damage the ecological environment of the producer country. Strict quotas and tariffs on imports in the international trading system serve as protection measures, but they are often overruled by international agreements. This freer trade enables countries to produce various commodities which may then be transported over many thousands of kilometres to their destination markets. The cost of transport decreases the calculated profits considerably. In an effort to bring down costs, funds for rehabilitation purposes are applied for transport (Pearce 1995:74; Cheru 1992:502). To increase foreign exchange income, these countries have to export more products, and therefore further reduce the value of the natural resources.

Both in South Africa and in the rest of Africa management accountants should develop strategic plans that would prevent mining resources from being exploited simply to gain foreign exchange in the short term, at the expense of the natural environment. These
programmes should be aimed at the rehabilitation of the natural environment which is the source of mineral wealth.

The heritage from the colonial era in respect of international trade (IUCN 1986:31) adds to the difficulties of implementing rehabilitation management in Africa properly. In an effort to supply Europe with raw materials, the original economic systems in Africa were distorted. Nearly all the natural and evolutionary mechanisms, such as mobility and epidemics, which previously kept the demand for natural resources low, were removed. A dependence on cash from products and commodities developed during the colonial period, but during the 1960s and 1970s production for export became too costly. Ineffective management of centralised marketing institutions which these countries inherited from the colonial era, aggravated the inadequate economic situation.

The lack of efficient international marketing mechanisms for raw products, together with the inability to further process these raw materials locally for external markets, have a negative effect on the economies of African countries. Turning the clock back to the good old times of the pre-colonial era would not be feasible either, as the citizens of African countries have reached a certain phase of development and should be encouraged to advance.

Under the circumstances created by international trade agreements, the management accountant acts as advisor as well as arbiter. Investments in continuing improvements and education are elements of quality management that would lead to better centralised costing policies and rehabilitation management in mining in future.

5.3.10 Cultural heritage

Traditionally peoples in northern America had a strong relationship with the earth, as can be deduced from the following reply by a chief when approached to sell his land (Gore 1992:259):

How can you buy or sell the sky?...
Will you teach your children what we have taught our children? That the earth is our mother?...
After displacement from their land, the Taos Indians wrote (Daly & Cobb 1989:101)

...This was our land

The land that provided everything good for my people...

The worship of a single earth goddess who was the source of all life and who was responsible for harmony among living creatures spread from India and the Near East to ancient Europe (Gore 1992:261).

But in Africa south of the Sahara, before the era of colonialism, no such cultural elements of the strong relationship between people and earth were found (Baines 1994:92). In this region people believed that they had the right to consume everything in nature before somebody else could do so, and that this right is not negotiable (Els 1996:396,471). These people’s perception of time is mainly confined to the present time, is strongly focussed on the past, but has virtually to grasp of the future (Vorster 1981:39). The needs of the present time are regarded as the first priority, and are put before the needs of the future. Short-term pragmatical rational judgements regarding the utilisation of nature are given preference, because people have to live from one day to the next (Els 1996:396, 472).

Mining activities would leave behind useless dumps and holes, and pollution of the air, water and soil. Adversity under these circumstances is attributed to transgression of tribal taboos, or to witchcraft. The sufferers did not see that they had done anything wrong, were not considered to be responsible for ineffective environmental management and were regarded as innocent. Somebody else had brought the bad luck on them and had to be identified and punished (Vorster 1981:41,45). The reason for guilt was regarded as external to the person. They did not really understand why they should act responsibly towards nature and why they should exploit the natural environment carefully (Els 1996:403).

As a result of their cultural heritage, the peoples of Africa south of the Sahara traditionally do not make provision for the future (Baines 1994:120), reason that they are not guilty of mismanagement of the natural environment, and find somebody else to blame for their failures. These traditional conceptions mean that people are unlikely to effect changes on their own (Els 1996:iv).
These cultural attitudes influence management decision making as well as management accounting assessments. The mindsets of groups of people with the same ethnical background have the potential to negatively dominate quality decisions (Ansari et al 1997c:SMA-12).

The solution would be to begin cultivating an awareness of present and future dependence of people on the natural environment, and to invest in education and training to continuously improve perceptions of the importance of providing for the future and future generations. The campaign should continue along the lines of the effective measures introduced by colonialists. Although schools in South Africa, for example, provide programmes on environmental awareness, and awareness talks are given to rural male adults, Els (1996:498) is of the opinion that these programmes are still inadequate. All pupils should understand why they should be conscious of their natural environments, and the women, who have a great influence on the positive changing of traditional attitudes in future generations, should also be included.

As South Africa forms an integral part of Africa, these aspects of the cultural heritage of the peoples of Africa should not be ignored by management accountants when formulating rehabilitation management strategies. The UNEP (United Nations Environmental Programme) of 1993 identified five major environmental education needs, of which greater environmental awareness is the first one mentioned (Ulhøi, Masden & Rikhardson 1996:141). This was followed by the need to educate present and future managers, environmental specialists, engineers and professional people, and workers.

Management accountants have the task of preparing both short-term and long-term budgets which make provision for investments in education and training in natural environmental management. The financial statements of mining companies should also be modified so as to include specific disclosures such as contributions towards natural environmental education and relevant training of workers and their families (Oberholster 1997:7).

South African management accountants should be sensitive to the African culture surrounding rehabilitation management in the mining industry. This would enable them to understand how rehabilitation management issues should be approached, what management information should be provided, and how the necessary information should
be presented for decision making (CIMA 1996:30).

5.3.11 Conclusion

The South African management accountant is confronted with numerous difficulties that exist in Africa in respect of rehabilitation management in the mining industry that could to a large extent be attributed to a lack of awareness of the need for an acceptable natural environment.

Polluted air, water and soil are the primary areas of concern. These pollution problems are caused mainly by a combination of small-scale mining operators, inadequate mining methods, illegal mining operations, the lack of law-enforcement procedures, state-run mines, pressure from outside on African mining companies, international trade agreements, and the cultural heritage of the inhabitants of the African continent south of the Sahara.

The management accountant is confronted with a situation where

They draw too heavily, too quickly, on already overdrawn environmental resource accounts. ... They may show profits on the balance sheets of our generation, but our children will inherit the losses.

(Meadows, Meadows, Randers & Behrens 1992:44 quoting the World Commission on Environment and Development.)

Since the greater part of the continent of Africa south of the Sahara experiences more or less similar difficulties in rehabilitation management, cooperation in the form of a regional group included in Gore’s Global Marshall Plan (1992:300) should be seriously considered. Smaller groups of countries could support each other financially as well as in respect of non-financial issues like knowledge and technology. Inside the group provision could be made for benchmarking, communication, cooperation and a review of positive and negative experiences as well as expertise. A team approach should be followed in which the management accountant has a major role to play when developing strategies on rehabilitation management.

These proposed management accounting strategies are based on the attributes of a good
management accounting system, namely technical, behavioural and cultural attributes (Ansari et al 1997c:SMA-9). The characteristics of strategic environmental management which are based simultaneously on quality, cost and time aspects (Ansari et al 1997b:MMEC-2), are linked to these attributes of good management accounting (Ansari et al 1997c:SMA-14).

5.4 SUCCESSFUL REHABILITATION MANAGEMENT

5.4.1 Introduction

Despite economic forecasts of high growth rates in Africa in the 1960s, both output per capita and living standards deteriorated greatly up to the early 1990s. Signs of improvement have been detected during the past few years, however. Inflation, governmental borrowing and deficits have declined while the per capita output has increased by more than 1% a year since 1995. These improvements in a number of countries could have been encouraged by the pressure of diminishing inflows of overseas development funds. In order to sustain the present growth tendencies, still further reforms are needed, such as the upgrading of the infrastructure and legal systems, reduced corruption and better financial systems (Chote 1998:1). This economic environment of growth and improvements in some of the countries south of the Sahara is likely to encourage more acceptable rehabilitation management strategies in the mining sector. This process draws on the knowledge and skills of the management accountant.

Although there are numerous and complex difficulties with rehabilitation management in Africa, management accountants should also take note of efforts towards successful environmental management in the mining industries. The most important of these are policies that bring about continuous improvement in existing practices, such as improved rehabilitation management policies, more positive legislative and taxation approaches by the authorities, an awareness of the measurement and reporting of rehabilitation efforts, and investments in environmental education and training.

5.4.2 Improved rehabilitation management policies

South African management accountants should also note that improvements are taking place in Africa in respect of rehabilitation management. These positive trends should be
considered when compiling strategies for rehabilitation management accounting purposes.

In Nigeria, for example, after initial rehabilitation policies had been attempted after the introduction of regulations governing rehabilitation from 1948 onwards, additional research projects were undertaken during 1983 to improve the situation. The whole purpose of rehabilitation management and the methods employed at tin mines were reviewed. Researchers then found that the eucalypt plantations were not serving the original purpose for which they were introduced to the dumps, and that alternative strategies should be considered. The purpose of rehabilitation policies is to return as much land as possible to agriculture in the short and long term. As traditional agricultural systems depend on rainfall only, flooded mine shafts could be utilised to sustain crops on the poor quality soil. Consultants also recommended that sorted town refuse be applied as organic material, and that the levelled areas be landscaped to fit the natural contours of the countryside, especially where natural streams and rivers flowed (Alexander 1990:48,49). The cost to the community for disposing of urban waste were added to the costs of mining enterprises for remedying damage from operations, and both parties gained by reducing costs.

Some of the principles of quality management were applied in Nigeria, such as the principles of adopting new philosophies in seeking expert advice, of working towards continuous improvement, and of producing a product (the natural environment) of better quality (Deming 1982:16,17). Input costs for rectifying inherited mistakes and introducing rehabilitation management into the current system of mining operations were kept to a minimum in accordance with the means of the communities, most of which are impoverished. Relationships inherent to quality management could be distinguished such as the relationships between time and quality and between performance and quality (Kennedy & Sugden 1994:17). If tactical and strategic planning of this kind could be executed properly in future by a team of experts which included a management accountant, the agricultural sector at least would reap the benefits. In the long term the people on the Jos Plateau would have a better natural environment with all the benefits associated with it. Both financial and non-financial inputs were applied and the result was financial as well as non-financial benefits to the affected and interested parties.

Another example of a company which improved its rehabilitation management policies is African Associated Mines (AAM) in Zimbabwe, which spent about $4 million (out of
an annual turn-over of $600 million) on the rehabilitation of asbestos dumps during 1995 (Chamber of Mines Journal 1995d:37). Although it is extremely difficult to revegetate asbestos dumps, a local consultancy succeeded in revegetating the flat tops after three years. The mining company made further financial provision to revegetate the slopes as well. Since 1960 AAM has been undertaking projects to rehabilitate this area, the first of which was the reduction of atmospheric dust.

AAM regards the reduction in the impact of their activities on the natural environment as an ongoing process. The quality management goal of continuous improvement was achieved as quality principles were reinforced through ongoing benchmarking, communication and observations (Russell 1990:73). These successful rehabilitation policies indicate that management and the management accountant at AAM were able to find a balance between financial and non-financial inputs and the positive results of these investments. This could make a valuable contribution towards rehabilitation management strategies in the Southern African context.

Anglo American Corporation (AAC) of South Africa took over the Wankie Colliery Company in 1953, and introduced improvements, both to the town and to the technical and administration efficiency of the mine (Optima 1962:38). Since 1985 financial as well as non-financial means were put into the rehabilitation of badly damaged land (Chamber of Mines Journal 1995e:38). This mine is the biggest opencast mine in the country and this rehabilitation programme is also the biggest in Zimbabwe. Worked-out areas were transformed from burning dumps to natural landscapes. The principle that the management team of these mines applies, is that the surfaces of opencast mined-out areas should not be left in a worse state than before the commencement of mining operations. It was found that it is more directly cost-effective to plant vegetation that has been removed from new sites on old sites than to wait for some years and then invest in plant material. Indirectly the pollution and damage caused by abandoned sites could be lessened, and the cost of rectifying the situation at a later stage would be reduced.

Other mining operators in Africa, as well as extended management teams which include management accountants, could benefit by gaining information on the extent of the investments made and the short-term and long-term effect of such investments. These successful opencast rehabilitation efforts by AAC were recognised by the Chamber of Mines which awarded AAC the first prize for the fifth consecutive year (Chamber of
The National Resources Board (NRB) in Zimbabwe was established by means of an Act of Parliament in 1941. To encourage mines to rehabilitate abandoned areas, the NRB introduced an annual competition and awards in 1982, which resulted in positive attitudes and improved management and accounting policies. The BNC nickel mine, the award winner for 1995, applied improved rehabilitation policies which resulted in better relations with employees and surrounding farming communities. Management of the BNC mine would like the competition to include the broader aspects of environmental management as contained in BS 7750 and ISO 14000. (Chamber of Mines Journal 1995 Nov:40,41.)

On the one hand mining companies are prepared to invest extra money and reduce profits in order to gain recognition as award winners in rehabilitation management and for the positive publicity. But on the other hand the management teams of companies realising the long-term financial and non-financial benefits of their rehabilitation efforts also gain some short-term recognition from the authorities.

At the Mhangura copper mine in Zimbabwe, Northard and Figg (1992:11) reports that the construction and siting of slimes dams made it really difficult for management to implement rehabilitation strategies. But rehabilitation programmes were introduced with such marked success that after revegetation no further maintenance expenditure was necessary for rehabilitated areas. The success of this rehabilitation project is ascribed to the drive, co-operation and team effort of all the people involved in the improvement of the natural environment, from management right down through all ranks. Maintenance costs are kept at a minimum level in a poor community if the correct rehabilitation procedures are followed from the start. A successful rehabilitation project could be compared with quality of conformity, with the associated cost categories of prevention and appraisal costs (Welsch, Hilton & Gordon 1988:313), as well as of internal and external failure costs.

Companies also invest in profitably processing tailings dumps from previous decades, as in South Africa. On the border of Zambia and the Democratic Republic of the Congo (formerly Zaire), America Mineral Fields (AMF) plan to recover annual amounts of 30 000 tons of copper, 200 000 tons of zinc and 400 000 tons of sulphuric acid at Kipushi.
Tailings resulting from about 70 years of mining could have a potential value of $800 million (Business Times 1997:18; Sake-Beeld 1997:4). Not only do these financial investments in rehabilitation result in direct monetary gains for employees of the company and profits for investors, but in non-financial terms they also mean that the natural environment may benefit after many years and provide a better quality living space for the inhabitants of the area.

A process of continuing improvement is noticeable in some African countries. Elements of continuous improvement that could be perceived to a lesser or greater extent, are innovations and flexibility (using urban waste as fill in poor communities), short lead times (rehabilitation as part of the mining process), and quality and cost consciousness (rehabilitated land ready for general use) (Kennedy & Sugden 1994:20). Investments are made in research projects, external advisors, and revaluation schemes concerning previous rehabilitation efforts. Awards are introduced by authorities to encourage investments in rehabilitation management policies. These positive trends should be noticed by South African management accountants and supported in order to allow them to develop and expand to all the countries of the region. Positive tendencies in rehabilitation management in Africa are important factors to be considered in the development of strategies and models for rehabilitation management accounting in South Africa.

5.4.3 The role of authorities

Since management accountants are important members of the team involved with rehabilitation management, they should be informed about the legislation and taxation policies of African authorities and the possible influence of these attitudes on South African authorities and strategies.

At the Environment Conference in May 1995 in Zimbabwe various issues concerning mining rehabilitation in the country were discussed. These discussions highlighted the importance of communication between regulators, legislators and the mining industry. Each group represented a different part of the same business sector. Communication between interested and affected parties is a primary element in the development of management accounting strategies concerning rehabilitation policies.
Johnson realised that some tax benefits should form part of the financial incentives offered for dealing with abandoned mine sites from the past (Chamber of Mines Journal 1995b:49). Reduced taxation liabilities would increase the financial resources available for rehabilitation purposes. He cautioned authorities not to impose statutory standards that are impossible to implement, such as over stringent prescriptions for water and soil quality standards. In a poor country compulsory immediate huge investments by mining enterprises to achieve the required quality standards for water and soil could ruin the mining industry financially. On the other hand owners of mines would simply ignore the standards that had been imposed when they could not afford to implement them. The role of proper legislation was recognised by Johnson, who highlighted the devastation of uncontrollable levels of small-scale mining operations in other developing countries like Brazil. The authorities realised that the legal regulation of small-scale mining should be just as important as the legal issues associated with the large-scale mining sector in Zimbabwe. This would influence the cost and value of the land occupied by small-scale miners.

In July 1994 the United Nations General Assembly adopted a code of conduct for sea-bed mining that would ensure that the profits which are generated by sea-bed mining are shared with developing countries (Murray 1994:16,17). An example is the mining of diamonds in Namibia off the coast. To reduce the incentive to mining operators to go offshore for tax purposes, African countries substantially revised their mining laws to provide more attractive local investment conditions. These included internationally acceptable regulations for investments in rehabilitation management projects.

Failure costs in the form of fines and penalties are becoming reality. The Zambian government has started imposing fines on polluting mining companies, such as the recently imposed monthly fine of US$40 000 on the Zambia Consolidated Copper Mines for the emission of toxic gases into the air. Environmental impact assessments are also compulsory for many projects (PanAfrican News 1997).

The role of legislation and taxation is recognised by some authorities in Africa as an important tool for regulating rehabilitation management in the mining industry. This is an important positive element for the management accountant to reckon with when preparing strategies for rehabilitation management accounting procedures.
5.4.4 Measurement of and reporting on rehabilitation efforts

A positive aspect regarding the measurement of and reporting on rehabilitation efforts in Africa is the gradual development of the awareness of accountants of the need to disclose rehabilitation information to interested and affected parties. Although there is no clear policy on the reporting of rehabilitation management policies and expenses in Zimbabwe, for instance, Johnson (Chamber of Mines Journal 1995b:49) is of the opinion that the mining industry is entitled to a reasonable set of standards for the disclosure of their rehabilitation activities. In addition to the disclosure policy, he also stressed the need for reliable data sets on environmental practice in the country. In most developing countries enough data is already available for consultants to prepare environmental and resource accounts (Ahmad 1989:6) which could assist policy-makers, but it would take time to prepare such accounts.

The implementation of the reporting of rehabilitation expenses, the disclosure of projections of future investments in mining rehabilitation operations and the publication of the results of these investments, should serve as an incentive to management accountants to recommend investments in and the introduction of more and better rehabilitation strategies. New approaches should be considered, such as the treatment of depletable natural resources as inventory and not as fixed capital, with the depletion treated like the sale of assets (El Serafy 1993:17). Rehabilitation expenditure could be regarded as expenditure on maintaining the value of depletable natural capital resources, such as land.

Complicated calculations are required to find a balance between the output of metals and minerals from a natural resource and the input in terms of polluted air, water and soil. This could be accomplished by means of the assessment of the long-term limits to throughput for these elements (Meadows et al 1992:46). Suggested limits are the following:

- For renewable resources such as water, soil and animal life, the rate of use should not be greater than the rate of regeneration.
- For non-renewable resources such as coal and fossil water, the rate of use should not be greater than the rate at which a renewable resource could be substituted for the resource being used, for example the development of solar energy and water
purification systems.

- For a pollutant the rate of pollution should not be greater than the rate at which that pollutant could be recycled, absorbed or made harmless to the environment.

These groups of throughput assessments are the primary focus of rehabilitation management accounting, and should in particular be included in long-term strategies. This emphasises the important role of non-financial criteria which encourage technical improvements in the form of better processes, methods and equipment (Kennedy & Sugden 1994:149). The principle applied by Meadows et al is to maintain natural capital resources.

There is a relation between the rate of growth and the economic development of a country, and the adequacy of the accounting system and the degree of accounting development (Riahi-Belkaoui 1994:21). Economic growth and development could also include an increase in various forms of capital, such as better rehabilitated mining land and a better trained and educated workforce. Since there are promising signs of economic growth in some of the African countries, the accompanying development in accounting procedures should also be present. Better accounting and management accounting proficiency and information inevitably lead to better decision making and increased growth.

5.4.5 Investment in training and education

Education and training equip people with environmental and ethical consciousness, values, attitudes, skills and behaviour which eventually lead to human development. Emphasis on and investment in training and education by authorities with the aim of reducing ecological damage to the environments of mining communities, is yielding positive results, especially in Zimbabwe. In that country an evolutionary process is already noticeable which can largely be attributed to the efforts of the Chamber of Mines. The main objective of one of its committees is to put an end to dangerous situations before they can become a real source of dissatisfaction to local and international communities (Hollaway 1995:25). The envisaged result is that financial and non-financial preventive actions will diminish future failure costs such as fines (Ansari et al 1997b:MMEC-4) as well as health and medical claims.
Other local mining companies in Africa have also adopted good environmental and rehabilitation standards. Hollaway (1995:25) mentions examples in Ghana and Tanzania where both gemstone and gold mines follow such policies, usually initiated by managers with previous training and experience on large, well-operated mines.

Further training and education methods for rehabilitation managers and management accountants are seminars, such as the one organised by the Environment Forum of Zimbabwe during October 1994 (Chamber of Mines Journal 1995a:43). By means of such seminars a wide selection of participants from both the government and the private sectors are brought together for benchmarking with the object of jointly finding the best practices in order to solve rehabilitation management problems. At these gatherings the management accountant as part of the team of experts, is well equipped to find a possible balance between the negative impacts of mining and the economic benefits arising from mining operations. Relationships could be developed and established which are of benefit both to local communities and to the country and region as a whole.

This seminar opened the debate on the cost of maintaining environmental policies after the closure of sections of mines, and whether the next users of that piece of land would be able to survive. Such policies would form the basis for the assessment of the cost and value of closed mine properties. At this seminar participants resolved to establish a Southern African Regional Forum that would pursue policies such as the communication of issues and strategies among all relevant parties, and to ensure that the cost of environmental management policies is incorporated in all budgets and research studies (Smith WE1995:37). Large mining companies would have the responsibility for setting the example of adequate rehabilitation and environmental management (Chamber of Mines Journal 1995a:45).

Expertise will therefore be exchanged across borders, and South Africa could both contribute to and benefit from such strategies. International cross-cultural and cross-functional environmental management teams in the southern region of Africa (Department of Environmental Affairs and Tourism 1998:38) would therefore cooperate in accordance with a regional grouping of the global plan of Agenda 21 (Department of Environmental Affairs and Tourism 1998:4). This phenomenon of globalization could have a positive influence on education systems and people’s access to and choice of environmental management information (Department of Environmental Affairs and
Tourism 1998:78). Expenditure on training and education as well as on research and development to devise new rehabilitation schemes which might already exist in other countries in the region could be reduced significantly for participating countries.

5.4.6 Future perspective

In order for management accountants to assist in the development of strategies for rehabilitation management, they should be conversant with the perceptions of the future of African people as well as with existing tendencies that are likely to influence events in the near and distant future. Future expectations pertaining to financial and non-financial inputs and gains regarding rehabilitation management accounting developments should be emphasised.

The time perspectives of African peoples are changing, mainly as a result of Western education and technology. Their ideas about the future are becoming more pronounced, especially as regards issues concerning Western practices. But the traditional concept of the future is still strongly present in their thinking, attitudes and basic needs (Baines 1994:120,121).

The lack of environmental indices to indicate whether a country is more or less habitable in different years, was noted by Toffler back in 1973 (411). Present day short-term policies could not be compared with suitable future long-term social and ecological goals, as “economic indicators” such as the gross national product (GNP) were the only yardsticks of measuring economic performance. There were no “social indicators” or “environmental indicators” for the assessment of the health of society or the natural environment outside the formal economic sector. Gross national pollution (‘GNP”) should for instance be considered as an index next to the gross national product (Porritt 1984:35,36) to permit a more complete comparison of gains and losses.

The expenses involved in controlling pollution could be quantified in most instances, but it is more difficult to attach a monetary value to the benefits derived from such expenditure. This can partly be ascribed to an ecological time-lag because when it is much too late to do anything about it damage could become apparent (Porritt 1984:35,36) and unpredictable amounts would have to be invested to rectify the damage and rehabilitate the land. Time perspectives, as non-financial indicators, should be included
in a comprehensive rehabilitation management accounting strategy. Time should be regarded as a source of capital in the context of a scarce natural resource. Rehabilitation costs incurred at present or in the near future would be relatively much less than after a few decades. Other than in Africa, a more fully employed and high-growth economy would allow people the time to become aware of pollution and their natural environment.

Although formal environmental assessments are not yet visibly being applied in most of Africa, efforts are indeed being made towards the improvement of the future situation in respect of the disclosure of rehabilitation management strategies in the mining sector.

In this regard the Minister of the Environment and Tourism in Zimbabwe made the following recommendations at the Environmental Conference on 15 May 1995 concerning future rehabilitation management policies in Africa (Chamber of Mines Journal 1995b:47).

- Training in environmental issues is regarded as fundamental to the future development of the mining industry.
- Formal and public environmental policies should be introduced.
- Environmental impact assessments should be considered.
- Data on the performance of rehabilitation management policies should be collected and disclosed.
- The mining industry should develop guidelines for rehabilitation and encourage their implementation.

In order to comply with these suggestions, management accountants should budget for money that should be provided or reserved for purposes of short- and long-term rehabilitation management policies. The results should be measured after one, two and ten decades.

The mining sector in Zimbabwe is already progressing towards the best contemporary practice (BCP), but the standards of existing and new mines should differ (Chamber of Mines Journal 1995b:49). Within the next fifteen years BCP could be achieved. The concept of best available technology not entailing excessive cost (BATNEEC) has been recommended. This has already been attempted in South Africa for the rehabilitation of abandoned mining areas (Baxter 1993:15).
In support of the views of the mining sector in Zimbabwe, Yemi Adelakun (1996b:21) propagates future joint venture agreements between the owners of technology and local African producers of raw materials. This would improve the capitalisation process and eventually the financial position of the inhabitants. Instead of raw minerals and gems being exported at very low prices, only to be re-imported at a later stage as finished products at very high prices, further local processing could generate local and overseas capital. From training and education to research and development programmes, the management accountant could help to bring about a variety of improvements that could be achieved by joint investments of capital, labour and raw materials. Simultaneously, technology and expertise for the rehabilitation of mines should be included in these joint ventures.

Just as the twentieth century (1880-1980) was hailed as the century of socialism, Bramwell (1989:247) predicts that the next century will be the century of the global ecologist. Care should, however, be taken to prevent radical situations such as those that occurred in the Eastern Bloc where ecological damage and massive pollution were allowed as a result of socialism at the cost of capitalism and private enterprise. Preference was given to investments and developments that would promote the socialist ideologies of human equality, and the natural environment and pollution were not regarded as being of much importance. Radical ecology theories in the next century could easily result in a return to primitive living conditions. Where expenditure is directed solely to restoring original natural environments, the result under extreme circumstances could be negative growth and reverse development.

It is therefore important for policy-makers, including management accountants, to develop long-term strategies that would result in lower key, holistic balancing positions. The problem that must be solved, is to make the “best choice among given alternatives” which would lead to a paradigm shift (Dopfer 1976:5). The solving of the ecological problem should be approached in a way that includes a holistic perspective (Dopfer 1976:34) within an interdisciplinary system with the emphasis on long-term solutions, taking into account historical facts as well as current political structures.

5.4.7 Conclusion

Successful rehabilitation management policies in the mining industry are emerging in
Africa. In view of these successes, the management accountant can be sure of positive developments in rehabilitation management accounting issues.

There have been notable improvements in practices and approaches of the past. Such improvements are encouraged, for example, by awards given by authorities. Legislative and taxation intentions reflect the concerns of authorities about adequate rehabilitation management policies. There is a notable awareness of the need to measure and report both financial and non-financial rehabilitation inputs, and to compare these inputs with the gains obtained. Underlying all these improvements and successes are increasing monetary contributions towards better education and training in rehabilitation awareness and technology. In Zimbabwe on the coal mines, for example, it would seem that rehabilitation management issues are moving in the direction of a future balance between monetary inputs and the reduction of profits, and the long long-term financial and non-financial benefits that the natural environment would produce.

5.5 SUMMARY AND CONCLUSION

The South African management accountant should realise that rehabilitation management accounting practices in the rest of Africa stem from a history and culture of inadequate rehabilitation management policies. As this heritage still has an influence in day-to-day mining rehabilitation activities, management accountants should include these factors in rehabilitation management accounting models.

Difficulties in respect of rehabilitation management in Africa are based on a general lack of awareness of the necessity to make provision for a habitable natural environment for the future. The major sources of concern are polluted air, water and soil, the product of unacceptable mining methods. Contributing factors to these pollution effects are small-scale mining activities, inadequate mining methods, illegal mining operations, a lack of law-enforcement procedures, state-owned mines run by unstable authorities, external pressure on African mining enterprises, limiting international trade agreements, and a cultural heritage that does not include a future perspective. What these negative factors have in common is the aim of extracting minerals, metals and gems at the lowest possible cost, and immediately exchanging these valuables for money. There have been no long-term strategies, and even the short-term management strategies are very short-sighted.
During the 1950s the first steps were taken towards formal rehabilitation management strategies in Africa. These included various policies to improve existing situations, and contained elements of quality management, such as the introduction of new ideas. Strategies were devised to implement rehabilitation procedures at the lowest possible cost in communities that are poor for the most part. At Mhangura, for example, financial and non-financial successes were ascribed to the cooperation of all members in team context (Northard & Figg 1992:11). The important role of training and education, is continually realised, both in the primary phases of awareness of the natural environment, and in the advanced phases of rehabilitation management leadership.

As with the project in Mali where South African expertise was applied to start a $250 million gold mining operation, including appropriate impact studies (Harries 1995:9), there is a need to share the know-how of various countries and inter-disciplinary groups on the African continent. Both ancient and modern mining activities are accommodated in this project.

Non-financial management accounting approaches can no longer be ignored; for example the latest and best mining technologies cannot be separated from environmental technologies. Both technologies are included in advanced methods where the complete process from exploration through to production and environmental costing is selected and designed. Rehabilitation technology and environmental management should no longer be regarded as an add-on cost to remove the pollution caused by operations at the end. The total cycle and its implications for the environment should form the basis (Department of Environmental Affairs and Tourism 1998:21) for determining an optimum combination of investments in both types of technology at an early stage of the development of strategies.

The solution to the problems of mining rehabilitation management in developing countries in Africa is summarised by Walde (1992:27) in the guidelines on minimum standards for governments, mining enterprises and mineral industries. The management accountant has a key role to play in all of these management teams, and should consider the following steps towards a rehabilitation management accounting strategy.

(1) Assign high priority to environmental management. Establish environmental accountability at the highest policy-making levels.
(2) Encourage employees at all levels to recognise their responsibilities in all phases of mining operations.

(3) Adopt the best practices in the absence of specific environmental regulations. Adopt appropriate technologies that would reduce waste products in all phases of mining activities, including small-scale operators. Try to obtain additional capital to improve the environmental and rehabilitation policies of existing mining operations.

(4) Adopt risk analysis and contingency strategies for the handling and disposal of hazardous mining and other wastes.

(5) Reinforce the whole infrastructure around environmental and rehabilitation management regarding all mining activities.

(6) Avoid the application of restricting environmental regulations which may prevent trade and investment opportunities.

(7) Recognise the balance between ecology, socioeconomic and cultural conditions, and the health and safety of the workers, both in the workplace and in the surrounding natural environment.

(8) Evaluate and adopt appropriate economic and administrative measures, like tax-incentives, to encourage the reduction of pollution and to introduce improved methods and technologies.

These guidelines coincide to a large extent with the principles contained in the White Paper on Environmental Management Policy for South Africa (Department of Environmental Affairs and Tourism 1998:13). Management accountants link these guidelines with their primary functions of gathering, reporting and analysing relevant information, together with their support to management (Rayburn 1986:12) in making decisions and interpreting results.

South Africa is playing a leading role on the continent and is in a better position to survive economically than many of the poorer African countries, mainly because of advanced mining and rehabilitation activities of the past. But South African management accountants, as part of the teams responsible for rehabilitation management, should also learn from the lessons and mistakes of the rest of Africa, and try to avoid surrendering the positive leading position they occupy.
CHAPTER 6

REHABILITATION MANAGEMENT IN CANADA, THE UNITED KINGDOM AND THE UNITED STATES OF AMERICA

6.1 INTRODUCTION

The mining industry in South Africa can no longer afford the luxury of investing money in research and development programmes in respect of rehabilitation management in the mining industry if existing rehabilitation procedures in developed countries of the world could be introduced unchanged, or in an adapted form, for local management purposes at lower cost. As social issues such as development programmes, wage increases and pressure from labour unions increasingly claim a greater share of profits, less money is likely to become available for rehabilitation purposes. In many instances choices have to be made in respect of the application of funds between provision for necessities for the poor, and the rehabilitation of damaged land (Department of Environmental Affairs and Tourism 1997:11). In the process of adopting international rehabilitation management techniques, the management accountant would have to face the challenge of playing arbiter when the company has to decide which unacceptable aspects should be excluded, and what investments should be incurred to expand basically good practices.

The objective of this chapter is to investigate rehabilitation management issues in regions such as Canada, the United Kingdom and the United States of America in an effort to find solutions and improved management accounting procedures which could be applied in South Africa. These three regions are regarded representative of the general approaches in developed countries in the world, just as most of Africa could be taken to represent the developing countries. Both stages of development are found in South Africa, although the country is classified as a developing country. It is therefore appropriate to investigate environmental and rehabilitation management systems, the measurement and reporting on environmental efforts, and the role of authorities in order to form a picture of a successful total quality environmental management system. The contribution of the informed environmental management accountant in South Africa is linked to the entire environmental rehabilitation effort in the mining industry.
6.2 CANADA

6.2.1 Introduction

Mining rehabilitation management in Canada is of particular importance for the purposes of this investigation as this country is regarded as the most developed country according to the Human Development Report of 1997 released by the United Nations Development Programme (Wrottesley 1997:8).

This region, however, also has a history of dead zones caused by mining activities. About a century ago, between 1896 and 1936, in British Columbia virtually all conifers within 19 kilometres of nickel mining activities were destroyed and 63 kilometres away trees showed signs of retarded growth. An area of 10 400 hectares in Ontario was an environmental disaster area where little or no vegetation survived, and where the fish populations were destroyed in lakes 65 kilometres away, owing to acid pollution from nickel operations. (Young 1992:21.)
Environmental disasters like these have fostered an awareness of the negative financial and non-financial effects of uncontrolled mining operations. As early as 1975 the Centre for Resource Studies at the Queen’s University started a multidisciplinary research programme on the national impact of mining in Canada (Ripley, Redman & Maxwell 1978: iii). The seventh study in the group was on the environmental impact of mining in the country.

The various stages of mining activities are distinguished, and the effects of each one on the biological environment are analysed. The model commences with the exploration phase, which produces temporary and moderate disturbances that increase with the intensity of activities. During the second stage development activities occur that prepare the chosen mining site for production, causing negative environmental effects of a local nature. In the third or extraction phase the ore is conveyed to the surface, generating waste rock. Surface-mining operations cause a far greater tonnage of waste materials. Although environmental damage is caused over a larger area, the effects on the biological environment are local in extent in the extraction phase. During the beneficiation stage or fourth phase, the primary separation is made between the minerals and the undesired elements of the ore. Tailings are reclaimed, but the wind and water erosion distribute dust and potentially toxic substances over larger areas. In the next stage the further processing of the metals occurs. During the last phase the mine is abandoned after the exhaustion of deposits. The effect on the environment is more obvious, with vast areas being disturbed. While the mine is operating, inspections and maintenance management ensure that the waste dumps and roads are in an acceptable condition. The potential for environmental disturbance continues after abandonment until nature is able to stabilise and revegetate the area. (Ripley et al 1978:7-10.)

The research group, however, realised the importance of making design and rehabilitation projections during the initial planning stages for the operation of mines in Canada. Natural stabilisation and revegetation should be encouraged from the start to minimise undesirable consequences in the long term. Planning in the long term as well as in the short term is one of the most important functions of the management accountant, and forms part of the control process in which expected and budgeted information is compared with actual performance, for decision-making purposes (Maher et al 1994:7). This planning function of management accountants worldwide is changing at present. Management accountants are increasingly forming part of an interactive planning team.
of which each member is an expert in a particular field and adds value in the value chain from design to disposition.

Approximately two-thirds of the mines in Canada are surface operations, and produce most of the country’s iron ore, asbestos, coal, copper, lead and zinc. In all phases of management planning natural environmental issues are dealt with in the mining industry. Highly mecanised equipment, modified for the extreme climate, as well as sophisticated computerised systems are being used (Singhal, Collins & Fytas 1995:58).

6.2.2 Environmental and rehabilitation management systems

Canada could be regarded as a leading country in many respects in the field of environmental and rehabilitation management accounting systems. This includes aspects such as the functioning of environmental management processes, the presence of ISO14000 elements and leadership characteristics. In this regard the Canadian Mining Journal (1996b: 21) confirms that according to a survey by KPMG, 83% of the Canadian companies in the natural resource and energy industries have an environmental management system in operation. Of these only 10% have all the necessary components to be effective in this management operation. The main reason these (17%) companies gave for not implementing an environmental management strategy at all is that they deal with environmental issues only when required. The survey also found that 44% of these responding companies are interested in ISO14000 certification.

When the findings of this survey are compared with Epstein’s “Corporate environmental performance scorecard” (1996:235), it seems that 10% of the companies in the natural resource and energy industries are complying with all ten of the components of environmental integration criteria. When all the companies under investigation are measured against the criteria of environmental leadership on this scorecard, no company can be regarded as an environmental laggard in the last position. (“Scorecard” is discussed in the next chapters.)

Environmental management systems, techniques and tools are in the process of being standardised globally by the International Organisation of Standardisation (ISO), with its headquarters in Geneva, Switzerland (Powers 1996:53). This will change existing environmental management systems where every mining company has its own perception
of good environmental standards. The Standards Council of Canada and the Canadian Standards Association are taking the lead in developing standards regarding environmental management, and consequently in financial measurement and reporting (Harris 1994:57). The first five standards in the ISO14000 series are based on the Canadian environmental standards (CSA Z750-94) (MacDonald 1996:35). In Canada it is expected that European companies will start refusing to trade with suppliers that are not ISO14000 accredited. Traditionally the management accountant was the last link in the decision-making chain. This situation is in the process of changing, however. It is being replaced by a situation where management accountants are increasingly forming an integral part of each link of this chain.

Symposiums such as the annual Mine Reclamation Symposium in British Columbia, which has been held since 1976, are organised to allow the delegates to exchange knowledge and expertise (Canadian Mining Journal 1996b:21). Financial and non-financial issues concerning water management, computerised planning, rehabilitation policies and management regarding the closure of mines are discussed. At the same time awards are presented in different categories to encourage outstanding achievements in mining rehabilitation programmes. Specific problem areas in rehabilitation management are identified and efforts are made to find cooperative solutions. As acid rock drainage, for example, is a major problem in Canadian mining operations, the British Columbia Acid Rock Drainage (BCARD) task force was founded in 1987 (Singhal et al 1995:61). The aims of this task force were to gather stakeholders from government, industry and academic institutions to discuss the problem, and to find and develop solutions for the prediction, prevention, treatment, and control of acid rock drainage, and the financing of such measures. Then the organisation had to ensure that the mineral resources of the provinces are developed in an environmentally acceptable manner.

Another example of the development of techniques for solving long-term maintenance policy problems is the permanent closure of a site by Gold Corporation of Quebec. An amount of about $5.2 million was invested in a project to “fully” rehabilitate the abandoned area, and enabled the mining directors to “walk away” from the site without the need to maintain it afterwards (Canadian Mining Journal 1997b:39). If one considers the number of taxpayers who would otherwise indirectly contribute towards this rehabilitation project, the community indeed obtained some benefits from this large investment in rehabilitation by the company.
By identifying and assessing problems, and by continuing to find solutions, such as at symposiums or as the BCARD did, managers can apply point five of the fourteen points for management identified by Deming (1982:17). Deming (1982:30,31) propagates the constant improvement of production and service systems, including the continuous reduction of waste, and improvement of quality in every activity. In order to achieve these functions, a wide spectrum of experts should participate in the evaluations, such as management accountants, engineers, chemists, and other people conversant with the problems.

As in South Africa, advanced technology is used in Canada to recover gold profitably from gold mine tailings left over from past mining operations. At Rambler about 80% of the gold contents of tailings are recovered, and the company expects to reach 85% (Canadian Mining Journal 1996b:21). After thirty years of mining operations, the Kidd zinc mine in Ontario developed closure plans in accordance with the provincial government regulations (Canadian Mining Journal 1996a:39). These plans include the returning of waste rock to underground sites, which would eliminate the treatment of run-off water from dumps, the removal of all buildings from the site as well as the revegetation of land. The success of these plans is demonstrated by the fact that the original herd of twelve buffalo introduced to the first rehabilitated land of Kidd in 1974 has grown to about eighty in 1996 (Canadian Mining Journal 1996a:49). Environmentally unacceptable scars of the past could therefore be successfully managed and utilised by future generations who would also lessen their negative impacts.

Hemlo Gold Mines faced immense challenges in the area of management of environmental costs when the closure plan for the mines involved raising the walls of the tailings dams at a cost of millions of dollars (Whiteway 1995b:19). After just more than two years of research and discussions with expert consultants, Hemlo decided to put the tailings underground. If only one-third of the produced tailings could be placed underground, the project would prove worthwhile both from an environmental point of view and from a cost-benefit analysis point of view. Freed truck time which had previously been needed to move tailings is included in the non-financial calculations and gains.

Research and development have reached such an advanced stage in this country that the mining of gold in a national forest is possible where all the tailings can be disposed of by
means of a new technique. In Montana Crown Butte Mines developed a technique which the engineers claim would prevent acid rock drainage from contaminating underground water, and which is decades ahead of other similar projects (Daniels 1994:59). The tailings disposal plan would seal toxic metals to prevent them from seeping into ground water in the surrounding nature reserve and the neighbouring national park. Investments in research and development projects form part of the principle behind quality management which aims at the constant improvement of past and present methods and approaches.

Research in Canada (Klassen & McLaughlin 1996:1212) indicates that firms that received awards for investing in products, designs and processes that minimised their adverse impact on the environment improved their environmental safety systems and developed strong management programmes. Award announcements are associated with greater increases in market valuations, while smaller increases have been observed for industries in environmentally unacceptable industries.

To illustrate this fact, Louvicourt in Val d’Or, Quebec, is regarded as the most advanced, energy efficient, environmentally friendly base metals mine in Canada (Whiteway 1995a:11). The best available know-how combined with the extraordinary efforts of about 600 people over six years of planning culminated in the commencement of operations at these mines. Outstanding initiative, leadership and accomplishment regarding environmental responsibility earned this company the environmental award in 1995 from the Prospectors and Developers Association of Canada (Canadian Mining Journal 1995:39). The tailings facility at the site helped to reduce the original capital costs of the project by about $5 million. Backfill technology developed in South Africa for the return of mined rock waste into the worked-out sections of the mines was also introduced. An important element of quality management can be recognised in the approach at Louvicourt. Time, effort and money were put into thorough strategic management planning which resulted in cost effective and environmentally acceptable operations.

The introduction of quality management measures in Canada is one of the contributing factors to the successes of this country. But there are still management policies that could be improved (Laughlin & Varangu 1991:43) along the lines of the principle of continuous improvement.
6.2.3 Measurement of and reporting on environmental rehabilitation efforts

Canadian mining companies are becoming aware of the challenges involved in calculating and controlling environmental costs more accurately. In this regard Golden Giant estimates that this gold mining company spends 4% of its total production costs on environment-related operations (Whiteway 1994:17).

According to Rubenstein (1992:33), a Canadian accountant, basic accounting concepts should be modified to reflect the real interests of the environmental stakeholders of companies. As an initial step towards the disclosure of these details, he redefined accounting as follows:

Accounting measures the resources consumed producing goods and services for trade and for promoting public welfare, as well as the resources preserved, and wealth created for future use (italics added), in accordance with conventions mutually agreed upon by both the stewards of these resources and the stakeholders to whom they are accountable.

The essence of measuring and reporting on rehabilitation operations is contained in this definition. Basic accounting concepts are modified in accordance with changing circumstances and emphases, so that they include the depletion of natural resources. The real and unique interests of environmental stakeholders are redefined for assessment and reporting purposes. Not only is traditional historical information evaluated, but projections of future wealth are also made. “Resources consumed” implies that full cost accounting, the cost of the extended enterprise and life cycle costs from design to disposition, are accounted for. Provision is made for the contribution of natural capital which was formerly regarded as free goods, such as water, air and soil. The goods and services which are produced do not include the production of waste, which means that the production processes are aimed at quality management. These goods and services are exchanged with the objective of gaining profits for distribution to the providers of money, labour and the government in the form of taxation.

This definition also promotes public welfare which includes issues such as rehabilitation management and the Pareto condition of efficient resource allocation. The Pareto condition is defined by Miller and Meiners (1987:567) as
... an allocation of goods such that, when compared to any other allocation of goods, all parties are at least as well off and at least one of them is actually better off.

Provision is therefore made for the resources to be preserved and not exploited more than necessary. For waste to be minimised and for care to be taken of the natural environment. In this process transactions are made with future generations, and wealth is created for future use in the form of rehabilitated land for agriculture and recreational facilities. All these accounting actions are in accordance with the views of the stakeholders and stewards of the resources.

Chartered accountants in Canada realise that they should keep abreast of the latest developments in verifying environmental performance and should be able to distinguish between valid environmental data and “greenwash” (Harris 1994:58). To be effective advisers, Harris is of the opinion that accountants should fully understand the economic circumstances of an organisation, the regulations and guidelines of the industry and the influence of the customers.

Environmental pollution and sustainable development is a difficult issue to assess as a general unit of measurement is not readily available. The challenge of comparing human activities with environmental damage is seen at three levels by Laughlin and Varangu (1991:47,48). All the relevant factors should at first be identified, such as emissions into the air, water and soil, and the depletion of land. At the second level a decision should be taken on how to assess these factors. Assessment would probably be carried out in multi stages, as from the tonne of discarded rock to the concentrations of toxic substances in the air. At the last level these figures and results should be brought together in a “balance sheet” to provide information that would make informed decisions possible about options for creating a minimum predetermined standard for a habitable environment. Canadians in the waste management industry, like Laughlin and Varangu (1991:43), are of the opinion that more imaginative management accounting approaches should be developed in order to find solutions to these problems.

Harris (1994:59) reports on an environmental survey conducted by the Canadian Council of Ministers of the Environment to determine future environmental issues. The issue of human health, the urgent need to deal with negative environmental effects, and the need to find assessment criteria led to a response of “How fast will it kill you?” Included in
this question are yardsticks like time in terms of months, years or decades, as well as medical accounts of people in the surroundings. The decline in the numbers of animals ranging from large mammals to insects could also be included in this question. An example of the deterioration of the quality of life owing to unhealthy mining activities could be found in the asbestos industry in South Africa some decades ago.

Ripley et al (1978:147-153) constructed a framework for the measurement of the environmental effects of rehabilitation management as early as 1978. First, all the possible impact areas of mining operations are identified, such as agriculture, forestry, freshwater fisheries, wildlife, recreation areas, the scenic character of the landscape and the health of the people. In the next step values are attached to each of the negative impacts, for example, agricultural or forestry losses caused by mining activities, expressed in dollar terms. It is as difficult now as it was twenty years ago to attach a dollar value to lost resources such as endangered species. Finally these losses are compared with the value of the benefits of mining. According to these models the costs of rehabilitation management are estimated to vary between 3 and 20 percent of the net income in the Canadian base metal mining industry (Ripley et al 1978:151). The large differences are ascribed to the type of ore, the age of the mining installation and to the age of the tailings disposal facilities.

After comparing the negative impacts with the benefits of mining in this model, the total costs of pollution control should be determined. These costs include capital and operating costs varying from the cost of new equipment to the cost of modifying processes, from changed siting and installation costs to changes in the application of materials, the use of less water, and recoveries and reuse policies. Secondary costs such as delays and limitations regarding decisions should also be included. Reclamation costs for covering abandoned tailings and rock dumps, open pits and building structures, are also added to obtain the total cost of rehabilitation management. Non-financial indicators such as the level of pollution control and the time required to reach that level, and the sacrifices of the community if mining activities have to be reduced to accommodate rehabilitation management policies, are also taken into account. In developed countries like Canada, a balance or compromise could be reached by mutual agreement between the rehabilitation managers, including the environmental protection groups, and the community. In South Africa, however, which is a developing country where the people have different cultural backgrounds, other methods should be found to work towards a balance, such as top-
down decisions.

Canadians (Eckel, Fisher & Russell 1992:20) realise the importance of the development of performance measures to assist management and stakeholders in decision making and assessments. To enable management accountants to efficiently assist in decision making, the whole process of decision making should be understood (Drury 1996:8). In this regard a system of target costing is developed which is applied throughout the management accounting process to include the life cycle and value chain of the products and activities (Ansari et al 1997d:TC-3).

Eckel et al (1992:21) emphasise that information concerning the natural environment forms an integral part of the control function of management. Relationships between cause and effect should basically be reflected in these measures. The actions of the company in respect of input, such as the investment of funds, to prevent natural environmental deterioration as a result of operations, would be the cause. The result of these inputs in the form of the actual reduction of harmful substances, such as sulphates and carbon dioxide, into the natural environment, would be the effect. These authors also realise that the effects should be carefully defined in order to endeavour to correctly solve environmental problems.

The Canadian Institute of Chartered Accountants (CICA) (1994:8) proposed a framework for identifying the information to be included in environmental reports. This information briefly consists of the profile of the organisation; its environmental policy, objectives and targets, and its environmental performance analysis. When environmental reports are prepared, the various audiences should be identified and approached in different ways as the individual groups have different information needs (CICA 1994:14,15). Communication should be directed to the employees, the investment community, creditors, suppliers, customers, the community, government, associations in industry, activists, and the media. More specifically accountants should include in their preparation when drawing up financial statements, aspects such as the separation of site restoration costs, environmental capital expenditure, compliance with environmental laws and regulations, and the need for environmental information (Buhr 1994:314).

The CICA (Canadian Institute of Chartered Accountants) Handbook makes provision for methods of accounting for the costs of future removal and site restoration costs (Neu &
Simmons 1996:420,421). Section 3060.39 of the Handbook gives a choice between a deferred charge method and a note disclosure on the one hand, and a choice between a retroactive approach and a prospective approach on the other hand. An annual amount for site restoration costs is determined under the recommended deferred charge method. This amount is charged against current income and offset to the deferred charge account on the balance sheet. The account for deferred charges will continue to increase over time until the actual costs associated with the restoration of the site are incurred. If the costs of future restoration cannot reasonably be determined, the company may choose the note disclosure option.

Since the implementation of Section 3060.39 of the Handbook in December 1991, companies opting for the deferred charge approach may also choose between the retrospective and the prospective application. This choice is largely influenced by the decision regarding the timing of expense recognition by management. The retrospective application is when the asset and liability accounts are adjusted to reflect the site restoration costs as if the company had always been using this method. Retained earnings would reflect an immediate large decrease in respect of charges that should have been deducted from earnings in previous years, but the influence on future earnings would be less. Under the alternative option of prospective application the entire amount of site restoration costs would be taken from future earnings. The CICA expressed the opinion that the retroactive application would be a better way to present financial information, although the prospective application would be easier to perform (Neu & Simmons 1996:426). The companies would be better prepared to absorb the expected future rises in site restoration costs through the absorption of the current costs with retained earnings. Future expenses regarding current liabilities could therefore be lowered.

A corporation’s environmental performance is as important as, or even more important than its financial performance to some stakeholders in Canada. In an effort to satisfy these clients, the CICA issued various publications to chartered accountants in practice, industry, government and academic institutions, such as the CICA research report, Environmental costs and liabilities, Audit of financial statement items affected by environmental matters (Harris 1994:57).

At a symposium where the CICA and the Canadian business community were present discussions were held on how financial reporting might better reflect the information that
users need. The future disclosure of non-financial data and leading indicators about forward-looking information were among the issues that participants generally agreed upon. The CICA is in the process of developing an integrated performance measurement framework to supplement traditional published financial information. This process involves business, education and government organisations, among others (Hague 1997:10).

In Canada the structures already exist for the development of detailed environmental accounting systems, such as the integration of full cost accounting. The principles applied by Ontario Hydro, the largest electrical utility in North America, could be expanded to include mining industries. Full cost accounting is being implemented in order to understand and allocate environmental costs better; to define and quantify the external environmental impacts of the operations better; and to integrate environmental impact and cost information into the planning and decision-making processes (Boone & Howes 1996:22,23) (Figure 6.2). This approach has the potential to improve the management accounting relationships among economic, financial, environmental and human resources and would therefore allow management performance to improve competitiveness.

**Figure 6.2 Full cost accounting for environmental management** (Ontario Hydro)

<table>
<thead>
<tr>
<th>Non-monetised external impacts</th>
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</thead>
<tbody>
<tr>
<td>Monetised external impacts</td>
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<tr>
<td>Internal environmental costs</td>
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Internal costs excluding environmental costs

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<th>Long-term aim: internalise external impacts into business decisions</th>
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(Adapted from Boone & Howes 1996:23)

The number of options available to mining companies for ensuring that money is available for closure activities has increased as a result of amendments. This has led to more simplified closure plans. In this regard the Peachland copper mine in British Columbia presents an example of the amounts provided in the reclamation funds
About fifty percent of the total estimated closure expenditure is provided for in a fund for reclamation purposes.

Canadian mining management, including both accountants and management accountants, has made progress towards finding ways to measure and report environmental rehabilitation efforts. This movement is strengthened by the overall advanced level of awareness of rehabilitation effects, or the effects of the lack of rehabilitation, by the majority of the inhabitants of the country.

6.2.4 The role of the authorities

Traditionally the government in Canada, as in South Africa, has encouraged and supported mining and other environmentally degrading operations by means of favourable taxation policies, while rerefining, recycling and reuse of waste materials have not received similar benefits to make the latter activities more cost-effective. During the late 1970s and the 1980s a worldwide awareness of the squandering of natural resources developed, resulting in December 1990 in the Canadian Government’s Green Plan, which provided an initial amount of C$3 billion towards a five year scheme for sustainable development (Laughlin & Varangu 1991:43,44).

Management accountants are aware of the fact that regulations to command and control environmental rehabilitation are moving in the direction of more market-based instruments, such as tradeable emission permits and “green” taxes. According to Harris (1994:57) the “react and cure” and “end-of-the-pipe” approaches to environmental pollution and damage are in the process of being replaced by emphasis on pollution prevention. The latter attitude towards control is not found to such a large extent in South Africa. It would also be difficult to develop such an attitude as South Africa is categorised as a developing country. The social and cultural environment in South Africa differs to a large extent from that of Canada. Local social and cultural differences cause a conflicting situation where the developed group of the population is more inclined to shift towards market-based management, while some of the developing groups might realise that damage has been done as a result of mismanagement and would then react by rehabilitating damaged land afterwards. Some groups would not even notice the damage.

This attitude in Canada of incurring prevention costs rather than rehabilitating at much
greater expense at a later stage also spread to the mining industry, where further developments occurred. A national committee, Mine Environment Neutral Drainage (MEND), was founded in 1988 and consisted of 17 mining companies, three government departments, and the provincial governments of British Columbia, Manitoba, Ontario, Quebec and New Brunswick (Singhal et al. 1995:61). The major objectives announced by MEND include the following:

- To create a comprehensive basis that would allow industry and the authorities to predict long-term management requirements for tailings and waste rock.
- To establish techniques to enable the operation and closure of tailings and waste rock areas in an environmentally acceptable manner which is predictable, timely and affordable.

Although there are considerable variations in environmental regulations governing mining among leading mining producers in industrialised countries, common elements can also be found. In Canada, the USA and Australia the following common approaches to environmental regulations have been identified (SA Mining, Coal, Gold & Base Minerals 1993a: 22 & 36):

- Mining is precluded from areas where environmental losses are considered unacceptable. These areas include wildlife management regions and national parks.
- Environmental impact assessments are required to inform the authorities of the environmental consequences of planned mining activities. Government approval is required, the condition being that preventive measures are in place and that all the necessary alternatives have been identified and considered.
- Permit requirements limit the generation of large amounts of smoke, dust, solid, gaseous and liquid waste materials in the form of overburden, tailings, sludge and toxic water. Discharges to surface and underground water are comprehensively regulated, and the management and monitoring of the effects of pollution on water are receiving increased attention.
- Upon cessation of mining activities the rehabilitation of the surface areas is compulsory. Individual rehabilitation requirements vary, but all of them include revegetation and the protection of water resources.
The first and third approaches are not applied in South Africa, however. Mining still occurs and is permitted in areas which are sensitive to disturbances, such as in natural wetlands and certain coastal regions. Supervisory activities and regulations such as permits for air, water and soil pollution under predetermined circumstances are not yet included in the policies of the authorities. Permits to authorise the emission of contaminated effluent from mines during floods are in the process of being officially recognised. These approaches should be considered and implemented on an experimental basis by the authorities. Management accountants have to observe approaches like these because the developed countries might in future expect similar operations from South African mining companies as a condition for international trade.

Environmental management has become a top priority for many producers since the amendments to the Ontario Mining Act, and to the Canadian environmental legislation (Heffernan 1996:34). Owing to the fact that these legislative measures are constantly changing in order to adapt to changing circumstances, uncertainty surrounds the issues of the regulation of and compliance with certain aspects of this legislation. The Mining Association of Canada (MAC) submitted a statement in this regard to the House of Commons Standing Committee on Energy, Mines and Resources and to the Standing Committee on Finance (Singhal et al 1995:60). MAC protested that mining companies with proper authorisation to proceed with their mining operations were officially prevented from continuing by public pressure.

During the second half of the 1970s the Canadian Department of the Environment had already drafted regulations and guidelines (Ripley et al) on

- an environmental code of practice for mines regarding liquid effluents, waste rock and tailings
- the control of effluent from existing mines, and the measurement of toxicity and control of effluent from new, expanded and reopened mines

Recently several environmental guidelines and regulations regarding mine development (Singhal et al 1995:61) were issued by provinces in Canada. Regulations regarding rehabilitation differ from one province to another. In Alberta a detailed rehabilitation programme for coal mines is required (United Nations 1991:15). This development and rehabilitation plan must include reports on surface disturbance, the management of
surface and ground water, and the control of pollution. In British Columbia regulations require a plan for the protection and rehabilitation of soil and water sources at the time of the closure of the mines.

According to the federal Environmental Assessment and Review Process (EARP) a diamond mine in the Northwest had to conduct environmental and socio-economic studies before it could begin exploration activities (Scales 1995:13). The absence of chemicals in the operating processes, the collection of data and development ways to rehabilitate the area, and the gathering of the opinions of the surrounding populations are all considered to contribute to the success of the prescribed environmental study, as recommended by the authorities.

Under present legislation the directors of mining companies are liable for the long-term aftercare of closed mines, but proposals are developing in the direction of the establishment of a corporate entity that would perform these tasks. The Canadian Mining Journal (1997a: 28) reports that this entity would be financially responsible for the monitoring and reclamation of mining sites after closure before these sites are returned to the government. These proposals are in line with the functions of planning, control and organising of the management accountant (Drury 1996:13), as well as with the aspects of strategic management accounting which are quality, time and cost orientated (Ansari et al 1997c,b: SMA-5, MMEC-2).

When the authorities take the lead in rehabilitation management policies as in Canada, management teams in the mining industry are influenced in a positive way to prevent and reduce the pollution generated by their operations. Under these circumstances the management accountant is aware of tendencies pertaining to cost issues which are in the process of being developed and might be incorporated in future legislation. The management accountant has an important role to play in this team approach towards rehabilitation management initiated by the authorities.

6.2.5 Summary and conclusion

Although the mining industry in Canada is going through lean times, as in South Africa, its rehabilitation and environmental management systems are to a large extent based on total quality environmental management which include keeping pace with the advances
of the high-technology and computer era. Singhal et al (1995:61) confirm that the Canadian mining industry, and in particular the open-pit mining section, manages its environmental programmes very well. Operations relating to abandoned mines, the stability of geotechnical structures, water quality, environmental impact assessments and rehabilitation management accounting are all included in the strategic planning processes. These operations were initiated and are being supported on a continuous basis by the authorities through emphasis on prevention and cost-effectiveness in a market-based environment.

Prevention, assessment, control and failure costs and activities in respect of environmental management accounting (Ansari et al 1997b: MMEC-5) are mostly present and to be distinguished in Canada. The successful environmental management accounting procedures can largely be attributed to the implementation of the aspects of quality, time and cost which form the basis for good strategic management accounting (Ansari et al 1997c: SMA-5).

The management accounting functions of planning, control, organising, communication and motivation (Drury 1996:14,15) are noticeable in the rehabilitation management procedures in the Canadian mining industry. Models have been developed to determine the total financial and non-financial inputs in preventing pollution as well as ways of finding compromises between the various interested and affected groups involved in the different pollution cost categories. The Canadian Institute of Chartered Accountants, as well as the engineering community, contribute to the relative success of total quality environmental management in Canada.

The management accountant is increasingly contributing to decision making on rehabilitation management in this country where research and development have reached one of the most advanced stages in the world.
6.3 THE UNITED KINGDOM

Figure 6.3 United Kingdom

Like South Africa, the United Kingdom has a history of losses suffered in terms of the natural environment in the process of extracting riches from the earth. Since Roman times, 55 BCE (before the common era) to 410 ACE (after the common era) (Scannell 1965:143), 400 000 hectares of agricultural land have been lost as a result of metal mining and smelting (Young 1992:21). Although coal had been mined since the thirteenth century in Britain, the invention of the steam engine during the eighteenth century increased the demand for this fuel (Scannell 1965:754, 762).

Coal mining in Britain actually accounts for less than 20% of the total area of damaged land. However, the coal mines are the centres of industrial and other activities which attract high populations, and which also result in unusable and damaged land, and polluted water and air (Bradshaw & Chadwick 1980:123).

But today it is almost impossible to tell where coal has been mined by means of strip-mining, for example. A well-defined management strategy is followed where the overburden, sub-soil and topsoil are replaced, and drainage of effluents is undertaken to
return the land to its former land-use, or to a different but equally acceptable state (Bradshaw & Chadwick 1980:163).

Apart from the high level of development of the people of the United Kingdom, one of the main reasons for their history of successful environmental management is the relatively high density of the population distribution on the land available. In South Africa the idea of “abundance of land” in the past was one of the major reasons why adequate rehabilitation cost management policies were not introduced or not taken seriously. The argument was that it should not be necessary to spend money when there was enough living space in any case for everyone (as well as for animals and wildlife according to other perspectives). The result was that the quality of the “living space” degraded extensively.

6.3.2 Environmental and rehabilitation management systems

In the United Kingdom the Opencast Executive of the National Coal Board aims to completely restore land to its former use - usually agricultural purposes (Bradshaw & Chadwick 1980:10). As a result of this attitude to rehabilitation management natural environments have often been improved. The Opencast Executive holds a worldwide record of rehabilitation projects which have been performed at a cost that is beneficial even under stringent reclamation conditions (Whitworth 1989:67). A better understanding of environmental costs by management accountants and management could assist companies to increase profits, choose and use materials more efficiently, manage the cost of pollution-generating procedures, determine costs and prices more accurately and improve their general environmental performance (Ranganathan & Ditz 1996:38,39).

Coal mining sites are returned to their former uses in agriculture or as roads, housing or industrial sites or as holes to be filled with refuse from local authorities or with colliery spoil and backfill from nearby active mines (World Mining Equipment 1984:37). Farmland is being returned to the community while the mining work is in progress. In 1987 £9 million were spent by the Executive on 18 projects, including all kinds of rehabilitation schemes (Whitworth 1989:73). Apart from direct rehabilitation management, the communities surrounding the opencast coal mines also received benefits from the mining authorities to the amount of £30 million over the five years up to 1989. These benefits were mostly in the form of roads, parks and recreation facilities.
Although the effect of environmental management is recognised in the United Kingdom, Baker (1996:46) is of the opinion that the conventions of management accounting, such as strategic management accounting, are still ineffective in providing information to management on the cost implications of their environmental decisions. The ultimate goal of the United Kingdom is the integration of environmental and economic criteria, which is known as environmental management accounting, into the national accounts. Ranganathan and Ditz (1996:40) emphasise the management accounting principle of better information on environmental costs that would inevitably lead to better decision making (Maher et al 1994:5). They, Ranganathan and Ditz (1996:40), suggest that the following elements of better management of environmental costs should be integrated into the existing management processes:

- information to decision-makers on environmental costs
- accountability of managers for costs they generate
- incorporation of environmental costs into management plans
- identification of other indicators of environmental costs
- integration of environmental cost accounting into all processes

The integration of these elements into existing environmental accounting procedures would increase the ability of management accountants as well as managers to make appropriate decisions.

The management of British Coal Opencast integrates mining operations, environmental control and the restoration of the mining site into a single process (Buchanan & Brenkley 1994:82). Environmental impact assessments are performed for every operation and are included in the integrated environmental management approach which is based on the following principles:

- The polluter pays, where the operator is held responsible for the full cost of compliance.
- Precautionary principle, where the operator demonstrates that there will be no environmental damage.
- BATNEEC (best available technique not entailing excessive costs), where the operator applies the best available technique not entailing excessive cost.
Communities and mining management realise the importance of finding a balance between environmental disturbances and the economic benefits of coal extraction. The local community of Barnsley, for instance, protested against the opening of an open-cast mine on the site of closed under-ground mines, knowing from past experiences about the disturbance caused by mining activities. British Coal agreed to lower limits on these disturbances and to extract the coal according to the principles of quality, quantity and market price (Bowhill 1989:535).

In this regard the British Geological Survey (BGS), an institute of the UK Natural Environment Research Council (NERC), serves as a neutral force in the economics-versus-environment debate, providing managers with relevant available information (Arthur 1995:36). From experience BGS argues, for example, against unrealistic environmental standards for the purity of emissions, as some toxic substances sometimes occur in nature at concentrations high above any that would be allowed during mining operations. This information institute does what a management accountant should do (Maher 1994:5), namely it combines all financial developmental and non-financial environmental data needed for decision making and supports managers in their efforts to find a balancing point. The BGS of the United Kingdom provides this expertise on a worldwide basis, especially in developing countries.

The United Kingdom is a leader when it comes to dust reduction measures. For developments in this field, and to encourage investments in rehabilitation management, the Queen’s Award for Technological Achievement was awarded to British Coal for six years up to 1991 (Buchanan & Brenkley 1994:76).

Training of people in environmental rehabilitation is undertaken in the new unstructured and flexible organisation where people are unable to work unless they know what they are actually doing. There is a shift in the attitude of management, which is changing from seeing a company’s people as assets, to managing them as a resource. People resources are assessed in the context of the culture, structure and processes of the company (Dalmahoy 1996:27). Since 1990 CIMA has been involved in initiatives to train and educate people in the management accounting profession on environmental cost issues, and this organisation is constantly developing new issues (Phillips 1992:97). To enable the accounting profession to take the lead in environmental issues such as environmental reporting, Ing (1992:292) suggests that measures such as the following be taken:
Professional institutes and associations should add environmental reporting to the syllabuses for professional examinations.

These associations should prepare minimum general standards, principles and guidelines for environmental reporting.

Accountants in practice should include environmental reporting in their individual education programmes and they should plan for adequate time to undertake these new responsibilities.

The aftercare aspects of rehabilitation management have indeed been recognised for more than a decade by managers in the mining industry in the United Kingdom. During the first years of reclamation grass and lucerne are being planted. When the soil has been stabilised after a few years, agricultural crops are introduced. Budgets must therefore make provision for a restoration fund to which the authorities also contribute. These land reclamation and aftercare procedures result in consistent successes in environmental and rehabilitation management systems in the United Kingdom (Bradshaw & Chadwick 1980:180).

Budgets which make provision for restoration funds for aftercare form the focal point of strategic rehabilitation management. From the commencement of prospecting work to the day when a mine closes, financial provision should be made for aftercare and maintenance after closure. As the surrounding communities would also benefit from the utilisation of the rehabilitated land after closure, authorities should contribute a percentage of taxpayers’ money towards this fund for aftercare and post-closure maintenance.

For a few decades managers in the United Kingdom have been conscious of quality management issues. ISO9000 is based largely on the British standard BS 5750, which was first published in 1979. The BS 5750 was developed from the BS 5179, which has been a guide on standards for non-military quality systems since 1974. The International Organisation for Standardisation (ISO) initiated this international quality standard in 1983, and published ISO9000 in 1987 (Sadgrove 1994:20).

Environmental rehabilitation management in the United Kingdom largely satisfies the conditions of quality management as given by Juran (Schonberger & Knod 1994:29) of quality planning, quality control and quality improvement. The success the United
Kingdom has achieved in environmental rehabilitation management, making it a world leader, can be ascribed to the successful implementation of the goals of Russels's (1990:18) quality management plan, which are

- the integration and promotion of quality management
- the development of organisations which are responsive to the needs and wants of the stakeholders, and the consistent provision of value to the stakeholders
- the achievement of continuous improvement

One of the bases for the success achieved in Britain is to be found in the advanced stage of development of management in general and in the mining industry in particular. Although the first three levels or generations of management may be found in different combinations in most successful operations (Joiner & Reynard 1994:8-10), these management systems in Britain may be between the third and the fourth generation of management. At the third level or generation, management functions by results obtained through independent delegation, and at the fourth level better results may be obtained through fundamental improvement by means of quality, a scientific approach and everyone functioning as a single team.

6.3.3 Measurement of and reporting on environmental rehabilitation efforts

In the United Kingdom management accountants and accountants realise that environmental care is becoming more costly and that they should be involved at an early stage in the calculation and reporting of rehabilitation efforts (Vann 1993: 22). In the past companies argued that since there are no requirements regarding the cleaning up of contaminated land, no adjustments should be made on the balance sheet. Managers have traditionally been trained to regard the natural environment as given. Historically the environment was treated as a free good, and the management accounting systems reflected environmental assets as such. Emphasis on corporate performance was normally in terms of profitability and efficiency for short-term decision-making purposes, but environmental pollution was not a measured variable. Ecology and the decrease of environmental pollution were not included in long-term management accounting strategies.

One of the major reasons why environmental pollution and the natural environment were
given low priority is the inclination to assess matters in financial terms only. Various
models have been developed where both financial and non-financial indicators are
applied to influence analyses of the life-cycle of operations (Evans 1996:49). By
including both financial and non-financial information in the framework for decision
making for the natural environment in respect of mining, a more accurate analysis of the
whole strategic management approach can be obtained.

For the purposes of valuation of land a clause is now often added to the effect that the
assumption is made that there is no contamination. By the time a financial report, which
would include some environmental rehabilitation information, is published, the report is
already out of date. But environmental issues are mostly concerned with the long-term
management of resources for future decades or generations. Provision for cleanup costs
is also frequently used although it would not be sufficient to return the land to its original
natural state. As an example, British Coal provided £48 million in 1991/1992 for the
rehabilitation of abandoned shafts and mine surfaces (Vann 1993:20). According to Cowe
(1992:129) present environmental reporting does not satisfy information needs, because:

- Objectives are only reflected in the broadest terms and the measurement of
  resources is based on a combination of historical costs and valuations..
- No specific plans are revealed.
- Resources which are not involved in transactions are excluded.

Reporting of environmental matters by British companies is still committed to general
environmental issues, emphasising the need to improve reporting. The reported
information could often be positively misleading, being not directly related to the quality
of environmental performance (Harte & Owen 1991:59; Healy 1991:8), or would only
disclose the positive impact of environmental activities (Derwent 1989:94). According
to a study by Robertson and Nicholson (1996:1104) on corporate social responsibility
disclosures, which include environmental rehabilitation issues, there is more variability
in internal communications than in external communications, emphasis on stakeholder
groups varies in industry, and corporate rhetoric dominates the clear presentation of
specific actions and plans.

The measurement of and reporting on environmental rehabilitation efforts should be
couraged, not only because stakeholders have to know what is done with their inputs
and natural surroundings, but also because the awareness of environmental investments and results reported on enhances existing positive environmental rehabilitation operations. But the danger of misrepresentation or misleading reported information should also be avoided. Watchdog organisations in the management accounting and auditing professions as well as among the public, should constantly take action to prevent the preparation of environmental reports only for the purpose of misleading advertising or window dressing.

Jones (1996:281) suggests in respect of reporting that a system of accounting for natural assets should be developed. In the first stage the habitats would be established and the level of inventory determined. These habitats would be valued in the next stage either at market value or at an amenity value together with an ecological grading. In the last stage all these results would be published in the annual reports in a summarised format.

Gray and Gray (1990:34,35) suggest that the accounting for environmental resources should be reconsidered. They propose that a definite distinction should be made between manmade and natural or environmental capital (see: Cowe 1992:131). In the case of natural capital management accountants should combine their skills, imagination and experience to find a means of measurement as monetary prices would be difficult to attach to these assets and might well not be adequate. Filsner and Cooper (1992:125) support the view that the accountant and management accountant face many challenges as well as opportunities, and that support for scientific assessments would often be needed from outside their field of expertise.

Van der Schroeff and Groeneveld (1984:114) from the Netherlands, on the other hand, distinguish between three relative functions of land in the process of placing a value on these assets. They are the functions of domicillium, of supplier of replaceable goods in vegetative production processes and supplier of irreplaceable goods in the extractive processes. All of them, in the reverse order of importance, are applicable when valuing mining land.

In the case of mining metals and minerals, these commodities cannot be returned to the land in the form of gold and coal. The value of the land decreases to a large extent because of the exhaustion of the irreplaceable extracted wealth. But the land can indeed be rehabilitated sufficiently in terms of adequately clean soil, water and air to be regarded
as a supplier of vegetative production in the agricultural and forestry business sectors. Quite large amounts sometimes need to be invested in order to prepare the land for agricultural production. Depending on the depth of current and previous mining activities, and the stability of the layers of soil and rock, the value of dwelling land should not necessarily be influenced drastically when acceptable rehabilitation programmes have been implemented. In the case of opencast and shallow mining operations the danger always exists of minor or major sinkholes occurring in weak areas.

Other leading United Kingdom experts realise that certain issues concerning the company's environmental and rehabilitation policies are material to the financial statements. In this regard the British Institute of Management prepared a policy for management and the environment for consideration by all members (Lester 1992:46). Collison (1996:328) suggests in this regard that the following considerations should be included in financial reports:

- contingent liabilities on contaminated land caused by unauthorised spills and emissions, and provision for rehabilitation, abandonment and waste disposal commitments; and for insurance and legal costs
- reserves for unforeseen disasters
- valuation of fixed assets such as land and buildings, and a depreciation policy to incorporate the shorter life of assets under the BATNEEC (best available techniques not entailing excessive cost) system
- additional capital cost of productive assets needed to bring existing plant and equipment within the present required standards
- obsolete inventory and inventory costs owing to adapted environmental policies, including storage, disposal and recycling commitments

There are promising signs that both financial and non-financial information regarding environmental management is indeed disclosed in some of the financial statements and reports in the United Kingdom. The traditional view that a single indicator in monetary terms only gives management and the stakeholders a clear picture of how the enterprise is performing is being ignored. Resource and pollution flow accounts contain a combination of both monetary and non-monetary information. One of these groups of accounts is the environmental expenditure accounts which consist of capital and operating expenditures (Atkinson & Hamilton 1997:68).
Since managers increasingly require balanced information on both financial and operating matters to indicate how results were achieved, the balanced scorecard was developed (Kaplan & Norton 1992:72). Owing to the particular holistic characteristics of this management tool, it has many positive application possibilities for assessing rehabilitation management accounting policies. These include the simplicity which equips it to become the core of the management system (Brady 1993: 147), the focus on the impact of non-financial factors on long-term profitability (Newing 1995:23), its ability to motivate and drive the processes of change (Kaplan & Norton 1993:142) and to link long-term strategy with short-term actions (Kaplan & Norton 1996: 85), the approach of putting strategy and vision instead of control at the centre (Kaplan & Norton 1992: 79), and its ability to provide meaningful feedback on operations (Maisel 1992: 49).

The optimum combination of non-financial measurements in the disclosing documents, however, is limited to the goals of the organisation of efficiency in work performance, economy of resource utilisation, and effectiveness in terms of quality and quantity (Smith 1994:178,182). As the non-financial indicators are in the process of development and refinement, the management accountant should take care to select only those which are relevant to decision making. The application of non-financial indicators might over-emphasise the importance of operational details and might neglect the major strategy in which these operational goals are included (CIMA S4 P16 1996:181).

A survey of voluntary disclosures conducted by Jupe (1997:5-8) on corporate environmental reports of 1994/95 indicates that quite a variety of non-financial environmentally related information could be disclosed in annual reports (Figure 6.4). Although the environmental disclosures were informative, they are only provided by a minority of the big companies in the United Kingdom, and so yield little insight into actual impacts.
Figure 6.4  Financial and non-financial environmental information disclosed in published reports

<table>
<thead>
<tr>
<th>Items</th>
<th>(Number of disclosing companies: n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial</strong></td>
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</tr>
<tr>
<td>Total expenditure on environment</td>
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</tr>
<tr>
<td>Individual items of expenditure on environment</td>
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</tr>
<tr>
<td><strong>Non-financial</strong></td>
<td></td>
</tr>
<tr>
<td>Discussion of environmental regulations/requirements</td>
<td>21</td>
</tr>
<tr>
<td>Specific environmental policies</td>
<td>25</td>
</tr>
<tr>
<td>Conservation of natural resources</td>
<td>15</td>
</tr>
<tr>
<td>Case studies of positive environmental practices</td>
<td>22</td>
</tr>
<tr>
<td>Environmental awards won</td>
<td>7</td>
</tr>
<tr>
<td>Environmental awards sponsored</td>
<td>7</td>
</tr>
<tr>
<td>Environmental training of staff</td>
<td>14</td>
</tr>
<tr>
<td>Recycling efforts</td>
<td>21</td>
</tr>
<tr>
<td>Reduction of harmful emissions</td>
<td>23</td>
</tr>
<tr>
<td>Environmental audit/impact assessment</td>
<td>15</td>
</tr>
<tr>
<td>Environmental office/committee</td>
<td>15</td>
</tr>
<tr>
<td>Waste reduction efforts</td>
<td>12</td>
</tr>
<tr>
<td>Support for community environmental projects</td>
<td>14</td>
</tr>
<tr>
<td>Prosecutions for environmental offences</td>
<td>10</td>
</tr>
<tr>
<td>Environmental targets set</td>
<td>15</td>
</tr>
<tr>
<td>Environmental performance measured against targets set</td>
<td>13</td>
</tr>
</tbody>
</table>

(Jupe 1997:6, adapted.)

By integrating financial and non-financial performance measures generated internally and externally, elements of quality management such as continuous improvement, benchmarking and customer-environmentalist partnerships are enhanced. A managerial form of accounting is developing with less emphasis on quantitative accounting and more on qualitative aspects. These new managerial themes form part of the system of accounting for strategic positioning as predicted by Kaplan about a decade ago (Roslender 1995:55). Although the role of the management accountant is expanding to include total quality management measures, care should be taken not to neglect the management accounting system. In New Zealand, for instance, Fowler (1996:54) found
that a significant number of management accountants involved in the implementation of total quality management did not modify and incorporate quality principles in their management accounting systems.

Most companies found that the exercise of regularly measuring their environmental activities for reporting purposes encouraged better environmental management policies. The Chartered Association of Certified Accountants of Britain holds an annual competition for the best environmental reports to support these developing environmental policies, and suggests that estimates of future environmental costs, as well as expenditure on rehabilitation as a percentage of sales, should also be disclosed (Cairncross 1995:207,208).

Managers, decision-makers and management accountants in the United Kingdom are increasingly realising that failure to take the cost of environmental damage into account is inefficient and is an obstacle to increased income and well-being for the mines internally as well as for the external community. Steer (1992:18) bears this out:

Without environmental policies, development will be undermined.
Without development, environmental protection will fail.

6.3.4 The role of the authorities

Environmental mining disasters are mostly due to uncontrolled and illegal mining operations. The role of the local and national authorities is to prevent such mishaps and to control these activities by means of laws and regulations. In the United Kingdom state regulations for coal mines date back to 1842 (Buchanan & Brenkley 1994:76), and for the prevention of pollution in rivers to 1876 (Cairncross 1995:90). These early regulations were introduced in response to disasters, but it was only in 1974 that this reactive cycle was effectively broken by the promulgation of the Health and Safety and Work Act (Cairncross 1995:42). In the opencast coal mining industry all production contracts now have to include 35 clauses dealing with the natural environment. Environmental assessments are carried out in advance and consultations with at least 20 different consultants are required (Whitworth 1989:69).

Management accountants should be informed about the extent and the details of the
action taken by local and central authorities regarding rehabilitation and environmental management. They should for example (Gray 1990:66) be able to

- deal with new taxation laws
- take other than traditional factors into consideration in the appraisal of investments and add cost aspects to new pollution control measures
- find alternatives to materials that damage the environment and consider recycling and rehabilitation procedures
- estimate the effect of environmentally conscious stakeholders on the authorities and the market

Common law does not provide for damage that has not yet occurred, but statutes could establish a system of permits and licences that could regulate mining activities that might cause pollution before the actual pollution occurs. Furthermore, common law cannot be applied where numerous polluters are involved (Cairncross 1995:90).

Provision is made for discharges from operating mines in England and Wales under the Water Act of 1989, which has been consolidated into the Water Resources Act of 1991 (Pentreath 1994:125). These provisions include conditions regarding the quality, quantity, discharge procedures and the monitoring of the water of the mine, and distinguish between underground and above-ground mining activities. After closure the owner has the option of cancelling these discharge permits. Similar practices for the discharge of polluted mine water during floods are found in South Africa. The regulation of these practices is still at the planning stage.

Other than in South Africa, local authorities in the United Kingdom have the power to acquire derelict land in order to return it to use in terms of the Town and Country Planning Act of 1944, and the National Parks and Access to the Countryside Act of 1949, amended in 1963 (Bradshaw & Chadwick 1980:22). Unsightly and abandoned land should be rehabilitated in terms of these Acts to improve its appearance and to bring it back to its original use, mostly as farmland. Other Acts and regulations pertaining to local authorities that are mentioned by these authors are:

- the Mines and Quarries (Tips) Act of 1969, which provides that disused dumps are not a danger to the public
the Minerals Workings Act of 1951, which makes provision for the establishment of a fund for financing the rehabilitation of mined land and land adjoining mines.

- the Town and Country Planning General Development Order of 1973, which requires the National Coal Board to submit a waste disposal and landscaping scheme aiming at the restoration of the mining site.

In response to the European Community Directive 85/337/EEC of 1985, environmental assessment was given legal effect in the Town and Planning (Assessment of Environmental Effects) Regulation of 1988 (Buchanan & Brenkley 1994:75). In this regard British Coal has produced an assessment for every planning application for several years. The major environmental impacts which must be assessed are visual intrusion, dust control, noise, blasting, traffic and water affairs (Buchanan & Brenkley 1994:82). In this regard the UK Noise at Work Regulations were promulgated in 1989 (Buchanan & Brenkley 1994: 8). In South Africa similar impact assessments have been required by law since the promulgation of the Minerals Act 50 of 1991.

Conservation management within predetermined environmentally sensitive areas and on sites of specific scientific interest is encouraged by the authorities in Britain. Government authorities enter into formal agreements with the owners and occupiers of such areas to negotiate procedures and policies (Brotherton 1991:1183).

Environmental taxation reform is also a component of the role of the authorities in rehabilitation management, and is defined as “designed to create a framework of taxation which maximises the efficient use of resources and minimises pollution emissions” (Liberal Democrats 1993:3). The income generated from this tax should be reinvested in the economy in the form of compensation for those who are unable to adapt easily to higher standards. The aims of environmental taxation (Liberal Democrats 1993:6) would be:

- to include the cost of damage to the natural environment caused by the product in the price that the consumer pays and which the producer receives.
- to compensate for the inadequate provision for the depletion of non-renewable natural resources in the pricing procedure.

Management accountants should make adequate financial provision for the changing attitudes of authorities, and should recognise and anticipate new trends. One of the aims
of the British Environmental Protection Act of 1990 was to discourage the gentlemanly approach of the government which had prevailed for more than a century in order to raise the standards of pollution control. Angus Smith (Cairncross 1995:56), who initiated the British pollution inspectorate in the middle of the nineteenth century, remarked in this regard

There are two modes of inspection. One is by a suspicious opponent, desirous of finding evil and ready to make the most of it. The other is that of a friendly adviser, who treats those whom he visits as gentlemen desirous of doing right.

6.3.5 Summary and conclusion

In the United Kingdom the mining industry is aware of the scientific principle that the extraction and processing of metals and minerals does not need to destroy and damage the environment and human health (Arthur 1995:37). Proper management and control combined with the application of the best available management accounting and other techniques would give the best rehabilitation management results. Where well-planned strip-mining and rehabilitation practices have been followed in the United Kingdom, it is almost impossible to tell where coal has previously been mined (Bradshaw & Chadwick 1980:163). The Opencast Executive holds a global record for the rehabilitation of sensitive environmental areas that are cost-beneficial even under the most difficult conditions.

Better environmental management policies in the mining sector are encouraged by the regular assessment of environmental activities for reporting purposes. Estimates for future rehabilitation costs as well as rehabilitation expenditure reflected as a percentages of sales should be disclosed so that they can be considered for the best annual report awards in the region.

The need for and lack of appropriate instruments for environmental management accounting, are still felt to a certain extent, however, and will be felt for some time to come. But mainly traditional attitudes and values, as well as the lack of appropriate knowledge and professional expertise, are obstacles in the way of these developments (Birkin 1996a:37).

In the United Kingdom the aim of environmental taxation reform by the authorities is
considered to be minimising pollution emissions and maximising the efficient use of natural resources. The taxation collected should be applied to compensate for the non-renewability of natural assets. The management accountants in this country are mostly aware of the fact that they should be familiar with new regulations and taxation laws. They realise that they need to be sensitive to all cost aspects arising from pollution control measures and to provide adequate and accurate information to environmentally conscious stakeholders.

The relatively successful implementation of rehabilitation management and the accompanying management accounting procedures in the mining industry in the United Kingdom is largely attributable to the high level of total quality environmental management achieved in this region.

In this regard South Africa could benefit by researching the management accounting methodologies applied in the United Kingdom. Since the composition of the populations and the climate of these two regions differ considerably, provision should also be made for adaptation to the local circumstances.
6.4 UNITED STATES OF AMERICA

Figure 6.5 United States of America

Since the first recorded mining operations for coal in 1730 in the South East in Virginia near Richmond, both the mining and consumption of coal have caused environmental damage in the United States of America (USA) (Grolier 1996). The cleaning up of these legacies in the mining industry requires the moving and treatment of extraordinarily large quantities of materials spread over large areas. An example is the more than 200 million cubic metres of mining waste materials stored in 3 500 hectares of tailings ponds in the Clark Fork area in Montana in the North West (Young 1992: 36). Approximately 3,3 billion tons of material (seven times the amount taken from the Panama Canal) were taken from the copper mine in the Bingham Canyon in Utah in the South West, leaving a hole 774 metres deep, making it the largest human excavation in the world (Young 1992:22). Abandoned sites like these which are extremely difficult to rehabilitate continue to pay negative dividends in the form of acid drainage, blocked rivers and contamination for centuries, unless the necessary remediation and cleanup procedures are implemented.
The management accountant should therefore be prepared to function in a milieu where environmental rehabilitation management systems need to accommodate policies aimed both at repairing past damage and at applying rehabilitation measures as part of an ongoing practice. On the other hand, shareholders and stakeholders are demanding more accountability from management structures. They want more funds to be invested in the prevention and diminution of pollution, as well as in cleaning up after operations, even if they have to forfeit dividends (Epstein & Pava 1992:32).

6.4.2 Environmental and rehabilitation management systems

Management of successful coal mining companies realise that environmental and rehabilitation management is an inescapable part of their business in a highly competitive industry, where oil prices are relatively low, and where they have to operate under the close scrutiny of regulatory authorities. As in any other area of planning, operating and marketing, these USA companies are continually seeking new ways to improve rehabilitation efficiency and to limit costs (Carter 1989:44). These elements of continuous improvement form an integral part of total quality management (Deming 1982: 111), even when they are the result of a competitive market.

As enormous amounts are involved in environmental and rehabilitation management systems in the mining industry in the USA, efficient cost planning procedures in the long term as well as for the immediate future are necessary. It is estimated that it would cost the country between $32 billion and $71 billion to rehabilitate the 557 600 abandoned mines alone (Rosenbaum 1997:25). In 1993 (Ichniowski:7) these estimates for total mine rehabilitation were put at $71,5 billion. In the Sierra Nevada area in the South West, for example, $5 million was contributed to the cleanup of the 136 year old Penn Copper Mine where 330 000 cubic yards of mine waste are to be buried in a nine-acres landfill (Rosenbaum 1997:25). Since 1982 the Department of Energy invested $1,4 billion in a project involving the safe disposal of radioactive ore residues at abandoned plants (Kemezis 1991:23). According to estimates (Chironis 1987:58; Carter 1989:48), the coal mining industry spent more than $1 million per day on the treatments of acid mine water drainage, and such treatment is still continuing after mining has ended. In West Virginia in the South East 12 000 to 15 000 acres annually are rehabilitated on active coal mine sites and about 2 500 additional acres are rehabilitated on abandoned mine land which was unreclaimed before 1977. In this state the mining industry has paid $300 million into
the fund for abandoned mine land since its establishment in 1977 (Coal 1990b:20).

When contamination is covered by insurance policies, the insurers need adequate information about how remediation technologies are applied, a cost framework for proposed rehabilitation, and documentation of total costs at comparable mining sites (Bowen & Lambe 1994:72). Costs might differ substantially from one site to another, such as from $25 to $50 per cubic yard for bioremediation, from $100 to $200 per cubic yard for liners, from $50 000 to $550 000 for laboratory and pilot studies, from $50 to $250 per cubic yard for stabilisation, from $50 000 to $1 million for feasibility studies, and from $30 to $130 per cubic yard for soil treatment. The insurers therefore want to obtain a thorough overview from the environmental management accountants and their teams of the various alternative choices, and their advantages and disadvantages, as well as of the parameters of the project, such as its duration and the determination of the stage when the contaminated area could be declared to be satisfactorily rehabilitated.

Although the mining industry might be in a decline, the cleanup and rehabilitation of defunct mines that are due to be closed is becoming big business. Over the next two decades an estimated amount of $1 trillion could be spent on 200 to 300 companies for rehabilitation services (Jones 1993:32). Twenty-two direct and indirect jobs are created for every $1 billion spent on the rehabilitation of abandoned mine land (Chemical Marketing Reporter 1993:18). There are opportunities for gaining in the process of developing rehabilitation management instruments, such as compliance with a more cost-effective environmental strategy, and secondly by developing technology for the external market (Gertsch 1991:1306). The ideal situation, however, would be to plan for long-term rehabilitation measures while the mine is still operating, and to prevent large cash outflows at closure when the cash inflows are small.

However, the projection of what environmental rehabilitation projects might cost involves various external risk factors that should be dealt with. Project managers in the USA are often unable to estimate rehabilitation costs, or even average amounts. They easily underestimate from 30% to 50% of the budget (Daniels 1995:46). These contingencies, which comprise about 35% to 40% of the cost, result from regulatory changes, public involvements and possible litigation. For the management accountant this implies a reorientation from traditional cost accounting procedures to procedures which could include the investigation underlying causal variables, methods and techniques. The
convention of using historical data, for example, as the basis reduces the accuracy of rehabilitation budgets. In an effort to reduce contingencies on any rehabilitation project as much as possible, suitable goals, policies, procedures and responsibilities for the estimation of contingencies should be found. Contingency analysis requires that the management tasks of the project should be broken down, with the emphasis on high risk tasks. In this regard Wendel (1995:44) names the following factors that could affect contingency planning:

- changes in regulatory requirements, especially when dealing with more advanced rehabilitation projects, or with extraordinarily expensive schemes
- access agreements that may delay the scheduled reclamation activities, extensions to the review process required by the EPA or the public, and delays as a result of EPA final approval of current plans
- changes in rehabilitation contractors, with the result that time gets added to the schedule and fines for not keeping to the approved schedule
- new technology that might prove not to be acceptable and need to be replaced
- changes in assumptions such as the level of remediation or the number of samples required that may influence the initial cost estimates
- a combination of apparently minor incidents such as a series of relatively insignificant delays to the schedule which could result in a fine

The international set of standards governing environmental policy, ISO14000, describes a system of environmental policy, objectives, targets and programs for its implementation, monitoring and measurement, and for corrective action. A survey in the USA of executives in 115 large businesses revealed that 61% expected to meet ISO14000 specifications in order to gain a competitive advantage (Begley 1996:50). These international standards have the effect of reducing trade barriers, both for importing and for exporting, and could form the basis for environmental excellence. They have the potential to replace the traditional regulatory system of command and control.

The lending community has relied since 1988 on the World Bank Environmental Guidelines to determine environmental risks. The USA proposed Export-Import Bank Environmental Review Procedures with more detailed criteria for the quality of water, air, noise and for hazardous and toxic materials (Henderson 1995:50). This step is intended to encourage the application of voluntary international environmental
management standards, such as ISO14000, when providing funds.

In order to support financial and non-financial rehabilitation and environmental management procedures, several projects are being researched in the Northern Central States (Coal 1990a:11). Rehabilitation research areas are identified for both active and abandoned coal mines, and the results are sent to potential users in industry and at academic institutions and to the authorities. Increasing pressure to operate in a more cost-efficient manner brought governmental and industrial environmental rehabilitation parties together to share details about their respective projects and to pool information on rehabilitation cost management. Both private and public cost managers are accepting uniform approaches, and formulating standardised procedures for emergency situations and for long-term strategies (Rubin 1995:46). Slomp (1993:55) supports the view that the combined knowledge and experience of people from other professions, such as scientists, lawyers, engineers and financial accountants, would produce better environmental management results. These management policies of co-operation between various sectors in the economy and the forming of groups of cross-functional teams of experts coincide with point 9 of Deming’s (1982:17,35) 14 points of total quality management where he emphasises the importance of breaking down barriers between departments in an economic system.

Since the passage of the Surface Mining Control and Reclamation Act (SMCRA) of 1977, it has been a requirement that mined agricultural land should be returned to 100% of its original productivity (Sprouls 1990:52). In Ohio in the Middle Atlantic States, the Waterloo coal mine, for example, had about 700 head of cattle on rehabilitated land, the beginning of a secondary beef operation (Chironis 1982:63). This company first introduced fast cover plant materials to hold the soil and to retain moisture, such as wheat in autumn and oats in spring, followed by permanent grass species to finally prepare the land for further agricultural use. Mining companies demonstrate that mined land can indeed grow good crops and could be returned to beneficial agricultural use, but time will tell how rehabilitated farmland of this kind will yield in the long term.

Another example of the successful implementation of rehabilitation management following the SMCRA of 1977 is to be found in Colorado. A surface coal mine in this South Western State succeeded in achieving soil recovery and revegetation after experimenting, resulting in the improvement of wildlife habitat on reclaimed land (Carter
Next to the still operating draglines of the Trapper coal mine up to 500 elk could be spotted grazing on the revegetated land. The manager of Trapper is of the opinion that this successful conservation strategy requires an ongoing commitment of time and money, and that the results in terms of the reduction of soil loss and the potential savings in dollars follow a three-year rehabilitation program. Nieman and Merkin (1995:422) suggest in this regard that the potential to provide linkages between present wildlife habitats should be investigated, should coal mine rehabilitation sites be in the same region. The long-term post-mining rehabilitation planning framework should therefore make provision for the resettlement of fish and wildlife, according to regional policies.

Experts such as botanists could support the management accountant when calculating the costs and benefits of rehabilitation policies. In this regard it is estimated that the application of plants to reduce waste substances would eventually cost one-tenth of the amount that would have been invested in environmental engineers (Carey 1996:56). Plants such as Indian mustard are able to absorb metals, and the transgenic variety can transform a dangerous form of mercury into a less harmful one. Limitations to the applications of vegetation to purify soil and water, are the limited area that can be reached by the roots, and the danger that waste-absorbing plants could turn into hazardous waste themselves and become a danger to grazing animals. Wetland plants, such as cattails, remove metals from acid water in the coal mining industry by means of absorption, consumption and filtration (Public Utilities Fortnightly 1989:5). About ten years ago it cost approximately $10 000 to $15 000 to build such a wetland. In view of their low maintenance costs, these wetlands could pay for themselves within a few months (Chironis 1987:60). Symbiotic microbes and fungi provide essential organic material for the initial introduction of plant life, especially on iron-mine dumps where about two-thirds of the unearthed rock is dumped as waste (Cohen 1992:21). The cost of introducing fungi-treated trees such as pine, oak, fir, cedar and spruce on abandoned mine sites amounted to about $300 per acre, which was several thousand dollars less than the cost of the traditional resoiling processes (Wolf, Cordell & Keller 1982:64).

When comparing the costs and benefits of the long-term effects of revegetation with the costs and benefits of continuous engineering projects, revegetation obviously represents the better option in the USA. The long-term objectives of cost outlays for the establishment of revegetation (Johnson, Cooke & Stevenson 1994:34) are
that the stability of the land surface would ensure that there is no surface erosion by water or wind
- the reduction of leaching into ground water and surface water to reduce releases of potentially toxic elements
- the development of a vegetated landscape or ecosystem which is in harmony with the surrounding environment
- the addition of some positive value to the aesthetic, productive or conservation environment

The Department of the Interior annually announces the names of winners of reclamation awards to encourage investment in sound rehabilitation management policies. Central Ohio Coal Company in the Middle Atlantic States, for instance, received the award for rehabilitation with recreation as the post-mining use (Coal 1992b:9). The company donated 9 000 hectares of reclaimed land on which coal had been mined as an international breeding centre for endangered animals. Other categories are for the rehabilitation of farmland, for reforestation, and for mountaintop mining (Coal 1991a:13). The winners are described not only as improving the land left behind, but also as leaving it in a better condition than before the commencement of mining operations. The Interstate Mining Compact Commission annually announces similar rehabilitation awards to mining operations in five coal and non-coal categories in which there were outstanding achievements (Coal 1991c:24).

Although the mining industry may be an easy target for environmental movements because of the high visibility of their past and present mistakes, mining in the USA should nevertheless change its relatively passive and reactionary attitude towards rehabilitation and environmental management systems (Gertsch 1991:1306). The major task of the environmental cost manager is to work towards a balance between the potential return from the enhanced applications of rehabilitated land, mostly in the long term, and the immediate expenditure in terms of resources, cost and time required to prepare permit applications and execute the eventual rehabilitation plan (Carter 1989:44). In this regard Orr (1994:59) quotes the World Commission on Environment and Development on the development required to achieve this balancing position:

... development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
6.4.3 Measurement of and reporting on environmental rehabilitation efforts

As early as 1970, Beams (657) realised that the accounting profession should introduce changes to accounting processes to include provision for the deterioration of industrial sites, and for the reestablishment of assets that were deteriorating as a result of pollution. Polluter companies undermined the comparability of the financial reports of major and minor contaminators by failing to account for the full cost of all resources consumed. Beams (1970:660) suggested that accountants should coordinate their efforts with those of industrial engineers, legal consultants and inspectors of the authorities to enable them to challenge the changing business environment. These words could have been written more than two decades later, and should have included management accountants as well.

The obvious degradation of the natural resources in most of the developing countries of the world is completely ignored in the 50-year-old framework of the United Nations System of National Accounts (SNA). Repetto (1992:64), a USA economist, emphasises that by failing to recognise the correct asset value of natural resources, the supporting accounting framework which provides the principle instruments for economic analyses misrepresents past policies and leads to inefficient future policies.

There are different approaches to the calculation of the full cost or true value of assets which can be applied to their environmental consumption. As early as 1967 Ijiri (97) defined the value of total assets as consisting of the value of the present assets together with the value of basic future positive assets minus the value of basic future negative assets, and defined income for a period as the difference between the value of assets at the end and at the beginning of the period. According to Repetto (1992:66) the value of an asset is not reflected in the investment cost, but in the present value of its income potential. He defines the true measure of depreciation as the “capitalized present value of the reduction in future income from an asset because of its decay or obsolescence”. The true definition of income includes sustainability “which meets the needs of the present generation without sacrificing the welfare of the future”, and in addition to current earnings also includes changes in the asset position. Smith (1994:16) emphasises the need to introduce the natural resource damage liability as an instrument to determine the natural resource damage assessment. This liability regards the natural environment as an asset that provides services to outside markets and to society.
Failure to adequately account for all the elements of rehabilitation policies, varying from successful efforts to failures, might lead to inefficient management decisions. The non-disclosure of the full range of rehabilitation results, in both monetary and non-monetary terms, to stakeholders would provide an incorrect reflection of their interests in the enterprise. The contribution of natural capital in the form of air, water and soil is not adequately recognised in industrial activities. These natural elements are lent for use and not provided for free consumption (Rubenstein 1992:29), and should be accounted for. In the pursuit of satisfactory profits the natural source of the profits could be damaged beyond repair. It is therefore necessary to determine the full cost and resultant profits which encompass both the internal and the external factors. Both the financial and non-financial elements need to be included when arriving at these assessments. All the various cycles and processes are aggregated in the value chain to reflect a complete view of full costs and true values.

Incorrect measurement criteria and methods of assessment could easily give the impression of prosperity while in fact the real situation is quite the opposite. Repetto (1992: 64) remarked in this regard that

A country can cut down its forests, erode its soils, pollute its aquifers and hunt its wildlife and fisheries to extinction, but its measured income is not affected as these assets disappear. Impoverishment is taken for progress.

In addition to the direct costs involved in determining rehabilitation budgets, estimated land reclamation costs should also include indirect costs such as opportunity costs, indirect effects of taxation, secondary equipment requirements, and royalties (Misiolek & Noser 1982:82). The choice of rehabilitation machinery and equipment influences the utilisation of its capacity, and has an indirect effect on the estimation of costs. The single largest cost item appears to be the removal and replacement of topsoil, constituting about 50% of the rehabilitation costs at a coal mine.

Freeman (1982:4) suggests that the benefits of pollution control could be measured either by comparing environmental quality levels with and without a specified degree of environmental control, or by comparing the actual quality levels for a year before the implementation of the policy with levels a year after its implementation. These benefits to individuals can be classified according to biological and nonliving systems, and the
economic effects of the benefits can be measured by means of the market and non-market (physical) channels to individuals (Figure 6.6).

**Figure 6.6 Measurement of benefits of pollution control**

<table>
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<td>Morbidity</td>
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<td>Water-based recreation</td>
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<td>Species diversity (count)</td>
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<td>Ecosystem stability</td>
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<table>
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<td>Damage to materials</td>
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<td>Reduction in quality</td>
<td>Changes in weather, climate</td>
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<td>Indirect effects:</td>
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<td>Visibility</td>
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<td>Tranquillity</td>
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(Adapted from Freeman 1982: 9,10.)

The economic impacts of surface coal mine rehabilitation procedures were researched (Schlottmann & Spore 1976: 265) after the introduction of legislation in 1973 to control surface mining, particularly for coal. The authors found that the incremental production costs for adequate rehabilitation efforts were not excessively high, and that rehabilitation projects could be implemented in a cost-effective manner. Similar research in 1984
(Bishoff:170) revealed that, with proper initial planning postmining monetary deficiencies could be avoided. Through establishment of a surcharge on production for rehabilitation purposes, and the accurate maintenance of this complex cost issue in a model, reclamation standards and requirements could be reached, especially for new coal mining operations. These fixed and variable costs should be weighed against the economic losses of the temporary or permanent closure of the mining company as a result of environmental problems (Rosenblatt & Floyd 1992:24).

Roan and Martin (1996:186) developed a model in which production and rehabilitation costs are regarded as joint products in the mining process. The costs associated with particular environmental standards or requirements are estimated, in addition to the cost of policy changes. Changed or additional standards could be a barrier to the entry of new mines as more profitable ore should be processed to reach the same estimated profit levels. At existing mines the present profits could be reduced due to the changed additional environmental rehabilitation costs to be incurred, or as an alternative the life of the mine could be shortened.

In South Africa provision should be made in terms of the law (Act 50/1991 as amended) for future and current rehabilitation costs. Should the guidelines or standards for rehabilitation management change, these provisions would have to be adjusted. The result would be that profits as well as declared dividends would decrease, unless more profitable methods could be developed. New mines would have to make adequate provision for these additional standards from the time operations commenced. Other changes such as the introduction of labour recommendations from unions and central government could also influence decisions on the funding made available for rehabilitation projects.

Unlike in financial reporting, in environmental reports there are no strict rules on the information that must be published. Cairncross (1995:204) found that in the USA most environmental reports contain only quantitative data which are seldom verified by means of actual site inspections by experts and that the companies only disclose what they are obliged to mention. No indication of the relative reliability of the disclosed information is provided. Even when the disclosure of pollution-related information is required by law, as in the case of the involvement of an enterprise with rehabilitation programmes required by the Superfund, companies prefer not to disclose these data (Freedman & Stagliano
Illegal non-disclosures keep stakeholders in ignorance of activities that could influence future profits and the health of the community. Powerful business interests could exploit the masses, as in Vietnam when the workers were not informed about the potential health dangers of working in asbestos mines (Freedman & Stagliano 1995: 171). If mining enterprises are compelled to make projections of future rehabilitation costs, in the first instance the enterprises themselves would be informed about the financial implications of rehabilitation processes. When this information on rehabilitation is internally available, it could easily be disclosed to external stakeholders. In a democratic system stakeholders need to be informed in order to be able to make decisions and protect their rights. It is, however, necessary to enforce these environmental disclosures since laws do not work when they are not enforced.

Environmental disclosures in financial statements of companies could be measured either as the number of individual items or as a total. According to Patten (1992:473), total disclosures are measured as the number of pages included in the annual financial report, in 1/100th of a page. The number of sentences are also used, in Canada for instance, as a measure of disclosure of environmental performance in published statements (Buhr 1994:84). According to Patten an information item on the annual financial report should be regarded as an environmental disclosure when it could be related to one or more of the following subjects:

- environmental regulations or requirements or standards mentioned
- company environmental policies or company environmental concerns
- conservation of the natural environment or natural resources
- awards involved with environmental policies
- efforts to recycle
- expenditures and costs in connection with environmental activities
- litigation related to environmental procedures

Traditionally management accounting does not distinguish between different environmental costs. In order to achieve a distinction between the costs in this broad category of environmental costs, Ansari et al (1997b: MMEC-5) suggest that the various environmental activities should be identified. Each type of activity has its corresponding
environmental cost. They determined the following groups of activities:

- Prevention activities would eliminate potentially damaging environmental impacts. Prevention costs include the cost of redesigning to minimise the generation of hazardous waste materials at source.
- Assessment activities would measure and monitor potential causes of environmental damage. Examples of assessment costs are the monitoring of mercury levels at gold mines and the cost of environmental audits.
- Control activities have to control the damaging substances and waste products which are processed or produced. Control costs include costs incurred for the treatment of waste water, and for the safe disposal of waste products on dumps.
- Failure activities have to remedy accidental and careless damage to the environment. Failure costs are cleanup costs for past activities and for the treatment of contamination caused by present operations.

Freedman and Wasley (1990: 191) investigated the association between environmental disclosures in financial reports and the actual environmental performance of enterprises in the USA. They found that these disclosures are not indicative of actual environmental performances, and suggest that these disclosures should be regulated and improved standards and requirements should be prepared. They emphasise that the disclosed environmental items should be meaningful and reliable to the potential stakeholders, as the potential users would incorporate this information in their decision-making models. This is related to one of the major functions of the management accountant, namely to provide appropriate information to help users make better decisions (Drury 1996: 17).

Non-financial measures in management accounting such as quantity and quality have been known for many years (Ijiri 1967: 101), but have not been directly applied in respect of environmental rehabilitation policies until recently. More recently, however, it was stated (Shevlin 1996: 41) that financial accounting information to management and stakeholders is only value-relevant after the inclusion of non-financial information, and that variables for both non-financial and financial management accounting indicate incremental explanatory power when both are included in information models.

Cormier and Magnan (1997: 235, 236) measured environmental performance using the actual pollution of water against the levels allowed by the authorities. They found that
enterprises' pollution control activities were negatively related to the market value, suggesting that the enterprises have environmental liabilities which are not accounted for in the balance sheet. Analyses and ratios based on relatively high incorrect figures in the financial statements which did not take environmental liabilities into account, could lead to wrong decisions and judgments. As the current financial statements do not adequately reflect environmental performance, Cormier and Magnan recommend that the following alternatives be considered by the setters of standards and requirements:

- The expanding of the section of the report dealing with management analyses of environmental issues should be considered. The section dealing with financial obligations should include a discussion of poor environmental performances which might require future resources to rectify the situation. Future cash outflows would be required to finance items such as fines, penalties, lawsuits and remedial action.
- The measurement criteria for environmental liabilities should be revised, in view of the existing uncertainty and freedom in their formulation. Proposed accounting standards on environmental liabilities in Canada (CICA 1995), the USA (FASB 1996) and the UK (ASB 1996) should be used as a basis. The most probable value should be disclosed with other valuations as a footnote.
- Auditing standards should be tightened in order to allow independent auditors to increase the consideration of environmental issues such as risks, the sources of risk, and the consequences of risks.

Although environmental management accountants are continuously becoming aware of the importance of arriving at more accurate ways to measure and report on environmental performance, much still needs to be done to improve on the current approaches. As in South Africa and in any other country which takes environmental rehabilitation management accounting and total quality management seriously, the principle of continuous improvement should constantly be applied (Deming 1982:30).

6.4.4 The role of the authorities

Management accountants in the mining industry should be informed about the attitude of the authorities in order to be able to make adequate provision for the treatment of waste and to rehabilitate according to set guidelines. At the Atlas Corporation, for
example, the company planned to bury radio-active mining waste materials on site on the bank of a river at an estimated cost of $13 million over three years. But the Nuclear Regulatory Commission insists that the only viable method would be to dispose of these wastes off the site, and at a cost of $100 million, which would take 10 to 12 years (Engineering News Report 1994:21).

The attitude and commitment to environmental protection in the USA has increased drastically during the past. The National Environmental Policy Act passed in 1969 was the earliest national measure in the world to give legal effect to environmental assessments (Buchanan & Brenkley 1994:75). The types of economic instruments that the authorities could apply to influence environmental management policies include charges and taxes, tradable permits, deposit-refund systems and subsidies (Barde 1997:225). In addition to these instruments about 30% of the land area of the USA owned by the national government consists of environmental reserves and is therefore not available for mining purposes (United Nations 1992: 10). Surface coal mine operators, for example, are unconditionally required by national laws to restore a mining site to a reasonable condition similar to the position before mining activities commenced (Sims 1994:703). In 1970 less than 1% of the gross domestic product (GDP) was devoted to environmentally related policies, in comparison with the estimated more than 2.5% of the GDP by the year 2000 (Rabe & Arbor 1996:372). Increasing trends such as these should be reckoned with by the management accountant when preparing long-term budgets for rehabilitation management purposes. As in South Africa, the evolution of regional, financial and taxation policies to promote the application of environmentally friendly rehabilitation technologies should be noted, and monetary and non-monetary projections for future developments should be made well in advance.

Authorities that impose restrictions on the use of land have the difficult task of finding a balance between the quality and quantity of preserved natural assets and on the delivery cost price of products such as coal. Theoretically, under a policy of complete rehabilitation, profits in the mining industry could be restricted extensively. With the introduction of the Federal Land Policy Management Act and other restrictions on the use of land, 27% of the minable surface coal in the country could not be processed at a profit (Watson 1996:126). When natural preservation restrictions were relaxed to a certain extent in an effort to minimise rehabilitation costs, coal could be delivered on the national and international markets at competitive prices with “minimal” impact on the natural
assets. On the other hand, protection measures of this nature in the coal mining sector undoubtedly do environmental damage, and allow management policies to be less efficient than they would have been without subsidies from the authorities.

In an effort to consolidate responsibility for environmental rehabilitation and remediation, and to centralise the national management system, the US Department of Energy (DOE) established the Office of Environmental Restoration and Waste Management (EM) in 1989 (Jackson, Gillette, Goldberg & Hooper 1994:29). A similar project was launched in South Africa, but final comprehensive legislative measures had not yet been agreed upon. Parties interested in the DOE decision-making processes in the USA made contributions during both the design and the execution phases of the programme. EM developed the long-term and billion-dollar programmes and management structures for this complex project. But this scheme later evolved towards the next phase of effectiveness and efficiency, which includes cost improvements. For the cost improvement initiatives, benchmarking was applied to determine cost issues such as programme classification, a nationwide cost improvement survey, paired cost comparisons and component benchmarking.

A series of statutes is enacted in the country to protect water, soil, air and wildlife. The laws are mostly not aimed at particular industries such as the mining industry, but are directed in general to the protection of human health and of ecological concerns. In order to construct and operate a mine, the company needs to obtain a series of permits from the various authorities (United Nations 1992: 11,12), such as the following:

- a permit under the Clean Air Act to limit the emission of pollutants into the atmosphere
- a permit under the Clean Water Act to appropriately treat discharges into rivers
- a permit under the Resource Conservation and Recovery Act to ensure that solid waste materials are managed in an environmentally acceptable manner
- a permit under the National Environmental Policy Act to prepare an environmental impact statement in respect of operations that would significantly influence the quality of human living environments

Under the Surface Mining Control and Reclamation Act (SMCRA) of 1977, administered nationally by the Office of Surface Mining, coal mining states have primary responsibility
for the rehabilitation activities on abandoned and operating surface mines. In order to upgrade and improve this program for surface coal mine rehabilitation, West Virginia in the South East, for example, had to add $4.7 million in 1991 to its annual budget for the employment of inspectors and supporting personnel (Coal 1991b:15).

On the other hand, some laws such as the Mining Law of 1872, are still in operation, although they permit the mining approaches of “take the minerals and run”, leaving a contaminated legacy for the taxpayer to rehabilitate (Chemical Marketing Reporter 1993:18). The mining industry as well as the commercial industry urge much needed changes to this ineffective legislation of 1872 (Warner 1993:50). Authorities also need a system of continuous improvement, which is included in total quality management, to ensure the successful execution of their programmes.

The Abandoned Mine Land (AML) reclamation programme was established as part of SMCRA in 1977 with the aim of rehabilitating abandoned mine areas where the original mining companies and operators were not able to perform these activities. Federal auditors estimated that less than 2% of these abandoned sites in the coal mining sector, at a total estimated reclamation cost of $60.8 billion, had been rehabilitated since 1977 (Coal 1992a:11). The AML reclamation fund obtains its income from fees and charges on mined coal, amounting to about $2.3 billion from 30 states, and allocations of about $2 billion have been made to 35 states (Coal 1989:9). These appropriations increased to $3 billion by 1993 (Chemical Marketing Reporter 1993:18). Huge amounts are involved in the rehabilitation of abandoned mine sites such as the $100 million needed for a company that went bankrupt in 1993 after a century of mining and processing that contaminated the Silver Valley in Idaho in the North West (Steubner 1995:36-37).

Management accountants should have a knowledge of the enormous amounts involved and the many years needed to rehabilitate abandoned and active mining sites. They form part of the team of experts who know to what extent these rehabilitation costs are deductible for taxation purposes.

Rehabilitation and taxation issues might occur (Panock 1994:71) when

- the taxpayer is advised by the national, state or local authorities or the EPA that the mining site will have to be rehabilitated or restored
rehabilitation is part of the normal activities of the enterprise
the property is acquired
investigations indicate that possible contamination occurred before the acquisition of the asset

The treatment of expenses, such as surface mining rehabilitation for taxation purposes, given in sections 468 and 468A of the Internal Revenue Code (Sims 1994:703), is based on the principle that costs are deductible when they are regarded as ordinary business expenses. Expenses that are capitalised are not deductible. The Internal Revenue Service (IRS) stated that the following conditions (Emory, Swenson, Lerner & Fuller 1993:125; Gibby & Patella 1993:44) should be met in order for remediation costs to be currently deductible:

- The expenditure on the environmental repair should be incidental.
- The cost of the remediation should not materially add to the value of the property.
- The expenditure on the repair should not appreciably prolong the useful life of the property.
- The purpose of the expenditure is to keep the property in ordinarily efficient operating condition.

These conditions for the deductibility of remediation costs in the USA are not satisfactory. Contrary to the suggestion that environmental repair should cost a minor amount and be of minor importance, remediation activities should be regarded as being of the utmost importance. The second condition implies that remediation should be so limited as not to add value to the property, but any remediation pertaining to air, water and soil would indeed increase the value of damaged property. In contrast to the view expressed in the third condition, the objective of repair to the environment is to prolong the useful life of the property, if not for mining, then for other purposes, in accordance with the fourth condition.

In TAM 9315004 the IRS ruled that the costs of environmental rehabilitation operations are capital expenditures. These expenditures include costs incurred for assessment, remediation, transportation, disposition of contaminated soil and the cost of newly acquired soil (Emory et al 1993:125). When expenses such as environmental audit costs and research and development expenses could be regarded as part of the environmental
rehabilitation plan, these expenses should be capitalised, but legal fees paid to defend the company are deductible in the year in which they are incurred (Gibby & Patella 1993:46). Rev. Rul. 94-38 (Langstraat & Harrast, 1995:325; Witner & Lynch 1995:274) state that the costs of the rehabilitation of land and the treatment of ground water are deductible if no permanent improvements to the land have been produced. These costs include the cost of soil removal, backfilling, monitoring and remediation of ground water. The costs of the construction of the facilities for treating the contaminated water are non-deductible capital expenditures. To be deductible the expenditure should return the property to the state it was in before the commencement of operations, and it should not make the property more valuable, usable, increase its capacity, enhance the safety or efficiency, or extend its productive time (Weld & Price 1997: 221; Sharp 1992:55).

The return of the property to the state it was in before the commencement of mining operations would mean that the extracted gold, coal and other valuable commodities would have to be put back into the soil. The real value of the land would be less after mining activities ceased owing to the potential non-profitable extraction of what is left. It is impossible to actually comply with these rules for the deductibility of repair costs, and they should be redefined to encourage rehabilitation projects.

In the case of post-acquisition rehabilitation expenses, those payments are capital expenses regardless of what they would have been if the previous owner had had to incur these expenses (Lipton 1996:77). The contingent liability included in the purchase price was part of the cost price of the assets acquired (Fox & Solomon 1992: 15). It might be a better policy for the buyer to negotiate with the seller to adjust the purchase price, and let the seller pay the rehabilitation expenses. The seller is in a position to deduct these costs for taxation purposes, or add them to the original price of the property. The buyer could avoid future disputes with the IRS and may recover the additional costs through depreciation if the asset is depreciable (Megaard & Megaard 1994:203).

Sims (1994:703) argues that the interpretation of the moment of deductibility is not clearly stated in the laws. Either the deduction might be allowed when the rehabilitation costs are actually paid, or the discounted entire future amount might be allowed immediately. The management accountant is aware that this would clearly reflect different profit figures in the financial reports and would influence present and future cash flow budgets. Deductions which are allowed when the rehabilitation expenses are
paid would lead to lower cash outflow provisions in the particular taxation year when the costs are incurred. On the other hand, deductions allowed on discounted entire future amounts would immediately reduce cash outflow provisions for taxation purposes.

In the USA the taxation issues on environmental rehabilitation still contain several inconsistencies and the IRS pronouncements conflict with each other and with those of judicial authorities (Witner & Lynch 1995: 268, 273). These conflicting measures contribute to the present unfavourable taxation attitude of the authorities towards most environmental rehabilitation cost categories, and discourage the incentives to mining companies to voluntarily undertake reclamation projects unless they are legally required to do so.

The contribution of the mining sector towards the economy of the country includes direct employment to 120 000 workers in hard-rock (excluding coal) mining, about $32 billion to the national economy, and $117 million in taxation from the copper industry alone (Warner 1993:50). The authorities are therefore directly and indirectly involved in the processes of economically and technologically rehabilitating mining areas.

In comparison with the nonmining industries, industries drawing up land usage plans for mining purposes were the first to be compelled by law to present environmental impact studies. Approximately 700 square kilometres of land were stripped annually for urban construction purposes, and for every kilometre of a two-lane highway 35 acres of land were cleared (Brookins 1981:154) without the environmental impact assessments required by law.

The importance of cooperation between authorities and environmental management accountants is emphasised by McGinley (1992:267):

...unregulated coal mining in a free market economy can cause extremely serious environmental harm with attendant adverse social and economic impacts which cannot be effectively resolved without comprehensive and strict government regulation.

6.4.5 Summary and conclusion

Total quality environmental management in the mining industry in the USA is at a more
advanced level than in South Africa, although South Africa may apply more sophisticated systems in exceptionable situations. As in South Africa, both private and public rehabilitation policies must coincide with policies for repairing past contamination of the natural environment and for providing for rehabilitation as an ongoing function of the enterprise.

The functions of the management accountant of gathering, reporting and analysing cost data for decision-making purposes, and the interpretation and reporting of results (Rayburn 1986:12), are present at differing degrees in the USA in respect of environmental management accounting. Although illegal non-disclosures are found, there is a trend in the direction of accounting for the full cost of all natural resources used and consumed. These functions are encouraged by insurance companies in the USA which require precise cost frameworks for proposed rehabilitation projects as well as projections of total costs in respect of the mining companies themselves and comparable mining enterprises.

Various management accounting theories and models for determining the value and cost of natural resources have been developed and implemented. These models devise ways and means of assessing and determining both financial and non-financial effects of pollution management for introduction into the mining industry.

As the commitment to environmental protection in the USA has increased during the past decades, more nation-wide measures are now encouraged by means of legislation. The management accountants who are part of a team of experts, are informed about the latest legislative developments, about possible future promulgations by the authorities, and about the financial implications for the mining industry. To be deductible for taxation purposes, rehabilitation expenses should return the property to the state it was in before the commencement of mining operations, and should not make the property more valuable, usable, increase its capacity, enhance safety or efficiency, or extend its productive life.

An effort was made by the Department of Energy to consolidate environmental responsibilities under a single centralised national management system. Although consensus exists in South Africa that a similar centralised body should be formed, final comprehensive legislation has not yet been agreed upon. In the USA governmental and
industrial environmental groups are brought together as a result of increasing pressure to operate in a more cost-efficient manner. They now share information about their respective projects and the costs involved in this benchmarking process. This emphasises the importance of the management accountant being part of a managerial team undertaking rehabilitation management.

New prospects are, however, developing as the reclamation and rehabilitation of non-profitable mines due to be closed, are becoming prosperous projects. There is an awareness that contingency planning should be included as part of the strategic management system developed by the management accountant.

By researching the various rehabilitation approaches of the USA mining enterprises and the underlying reasons for success or failure, the South African management accountant could obtain non-financial benefits in the form of the diminishing of years which would have been allowed for the local evolvement of processes, as well as financial benefits.

6.5 SUMMARY AND CONCLUSION

6.5.1 Introduction

Rehabilitation management policies, together with the accompanying management accounting procedures for rehabilitation strategies in the mining industry, are investigated in this chapter. Canada, the United Kingdom and the United States of America which are among the developed regions of the world which have the highest ratings, were the target countries for this investigation. To assist management accountants to form a more complete picture of the origin and characteristics of rehabilitation costs and expenses, environmental and rehabilitation management systems were investigated, as were the measurement of and reporting on environmental rehabilitation efforts and the role of the relevant authorities. South African management accountants involved in environmental rehabilitation could benefit greatly by researching these aspects of rehabilitation costs in some of the most advanced developed countries in the world.

6.5.2 Environmental and rehabilitation management systems

More advanced environmental and rehabilitation management systems are found in the
mining industry in developed countries such as Canada, the United Kingdom and the United States of America than in the developing countries of most of Africa. The result is that it has been possible to develop environmental accounting and management accounting theories and models in these leading countries. This could be attributed to the fact that better information on rehabilitation and environmental costs inevitably leads to better decision making.

Developed countries tend to direct their financial, non-financial and natural resources towards the development of technology and productivity for the rehabilitation of the natural environment. Their major aim is to restore the environment to the same state or a better state than before the mines started operating, in accordance with the broad principles of total quality management. For this purpose the environmental performance scorecard of Epstein (1996:235) was developed to compare financial and non-financial efforts with matching results in the natural environment. In order to achieve this objective, the tendency in the developed countries is to allow people to work under conditions similar to those that apply with the third and fourth generations of management as defined by Joiner and Reynard (1994:9). In Africa, on the other hand, a top-down management system such as the first and second generations of management of Joiner and Reynard gives better results.

Various commendable aspects of environmental and rehabilitation management systems are found in these developed regions. Environmental rehabilitation policy issues that South African management accountants should increasingly include in their preparation of cost information strategies for decision making, are:

- the possible use of extended revegetation projects which might be more cost-beneficial than existing engineering programmes
- the influence of rewards for outstanding rehabilitation management operations to encourage disclosure of rehabilitation expenses
- international pressure to comply with ISO9000 and ISO14000 recommended international standards before sanctions are imposed on local industries
- the preparation of longer term planning schedules and budgets to make provision for rehabilitation and closure projects
- constant investments in environmental training and education for all people of all ranks involved in mining activities, varying from internal programmes to external
symposiums

- benchmarking between similar groups as well as with authorities in order to determine best practices
- recoveries from rehabilitation projects in terms of income from scrap metal and gold from dumps
- adequate provision for research and development programmes on rehabilitation issues which might reduce future costs
- emphasis on precautionary and preventive costs
- continuing after-closure expenses such as expenditure on water treatment facilities
- the involvement of multi-disciplinary teams of experts to enable better decisions to be made on the application of funds for rehabilitation purposes
- international tendencies to tighten environmental auditing standards

Canada, the United Kingdom and the USA have the necessary experience and resources to draw on. South Africa, on the other hand, has a leading role to play in Africa, and should also take care not to repeat the failures with environmental and rehabilitation management policies experienced in African countries.

6.5.3 The measurement of and reporting on environmental rehabilitation efforts

In both developed and developing countries environmental rehabilitation management projects in the mining industry are extremely costly in relation to the per capita income of the populations. It is therefore necessary for the management accountant to accurately determine the financial and non-financial implications of environmental rehabilitation operations, from both the cost and the benefit angles.

These developed countries formulated a large number of frameworks and models for assessing rehabilitation efforts. In Canada, for example, criteria have been laid down for dealing with future negative environmental effects; rehabilitation costs are calculated as between 3 and 20 percent of net income, and the whole process of calculating life cycle costs is included in assessments. CICA (The Canadian Institute of Chartered Accountants) plays a major part in working out these detailed frameworks. In the United Kingdom, for instance, models for accounting for natural assets have been developed.

In general, reporting on environmental rehabilitation expenditure is not adequate in either
developed or developing countries, although the developed countries are in the leading position. The following deductions could be made in respect of attitudes in these three countries:

- As there are no strict rules compelling mining companies to disclose rehabilitation activities, comparable information for different companies is not readily available.
- There is a realisation that the measurement of and reporting on rehabilitation efforts should include a wide spectrum of indicators and instruments.
- Financial as well as non-financial methods are increasingly applied in order to value environmental assets and liabilities and assess benefits.
- There is a growing awareness that adequate financial provision needs to be made for future contingencies and long-term rehabilitation and maintenance operations.
- People in developed countries are conscious of the fact that an ecobalance should be the aim of reported inflows and outflows of resources, materials, energy and waste (White & Wagner 1996:4). The amounts invested in rehabilitation are compared with the environmental results of these rehabilitation projects.
- Regular assessments of environmental and rehabilitation activities for reporting purposes encourage better environmental management policies.
- Provision in cash budgets for future rehabilitation and closure costs forms an integral part of strategic planning.

The South African management accountant could only benefit by being aware of developments in these countries regarding the measurement of and reporting on rehabilitation management efforts.

6.5.4 The role of the authorities

As in South Africa, management accountants and policy-makers in these countries have to rely on rehabilitation legislation measures which vary from Acts governing clean water, clean air and noise abatement to legislation on labour and health, apart from specific laws applicable to mines and abandoned mines. In developed countries such as Canada, the United Kingdom and the United States of America, more sophisticated systems of laws, taxation, regulations, guidelines and law-enforcement procedures are found than in most of developing Africa.
The following tendencies were noticed in these developed regions which might influence future decision making by local management accountants:

- The developed countries are still in the process of improving and consolidating their legislative measures concerning the rehabilitation of mining sites.
- In most instances public awareness and concern in these developed countries have a positive influence on the evolution of legislation, regulations and guidelines.
- Authorities are very much concerned about rehabilitation management, and more lenient deduction allowances in respect of taxation might be promulgated in the near future.

Since environmental management accountants in South Africa already know about the existing cost implications of the policies of local and national authorities, as well as of possible future attitudes, trends in developed countries should also be noted. Future pressure from these countries on South Africa concerning trade agreements with prescribed environmental and rehabilitation conditions similar to their own policies could then be avoided. In most instances it would be more beneficial to invest at an earlier stage in acceptable environmental protective projects than to postpone these investments until the mining industry is faced with boycott actions.

An awareness of the future implications of present mining practices for the world economy has been detected by leaders in the field of management. The total costs of the mining of metals and minerals to the environment and to society have not yet been determined, as "new" cost items constantly seem to appear on the horizon. As the low-cost but limited resources of copper and other scarce metals and minerals become exhausted over the next centuries, for example, the global economy might gradually become dependent on iron and aluminium only. This would cause a transition to the preindustrial standard of living of the New Iron Age (Gordon, Koopmans, Nordhaus & Skinner 1987:156), unless severe preventive measures are taken well in advance by authorities.

6.5.5 Conclusion

Although some of the most advanced of the developed countries such as Canada, the United Kingdom and the United States of America compare favourably to the developing
countries of Africa, their management accountants realise the importance of continuously improving the present systems of environmental and rehabilitation management, the measurement of and reporting on environmental rehabilitation efforts and the encouragement and expansion of the positive involvement of the authorities. These developed countries provide conditional financial and technical support for the rehabilitation of mine sites in the developing countries, but they do not adapt their traditional attitudes in the process. In principle the developed component of the South African community should also continue to improve on the existing environmental rehabilitation management policies without compensating for surrounding negative influences. More emphasis needs to be placed on the positive influence and experience of the developed countries.

South Africa could make a positive contribution towards Gore’s “Global Marshall Plan” ideology (1992:295) as applied in environmental rehabilitation management in the mining sector. Determining both the strong and the weak points of environmental rehabilitation policies in the rest of the world which are applicable to the local management accountants would make it possible to improve South African attitudes. The relatively advanced methods and approaches of the developed countries such as Canada, the United Kingdom and the United States of America could be adapted for the local situation and population groups. As South Africa has development stages coinciding with those of both the developed and the developing countries, and is situated in Africa, the relative successes of the continent as well as the failures should definitely not be ignored. It is therefore of the utmost importance that the South African management accountant should be part of a team of experts that could find the most suitable set of solutions for the rehabilitation management problems facing South Africa. This solution should accommodate all interested and affected groups, including the natural environment and future generations.

In this complex milieu of developed and developing forces, South African environmental management accountants should continue to perform the basic function of the provision of information for decision making (Maher et al 1994:4), taking the emerging aspects of total quality environmental management into account. Bearing all these management accounting elements in mind, they should be able to develop both general and unique strategies and models to accommodate the particular circumstances of each individual rehabilitation project.
CHAPTER 7

FACTORS THAT INFLUENCE A STRATEGY FOR TOTAL QUALITY REHABILITATION MANAGEMENT ACCOUNTING

7.1 INTRODUCTION

In previous chapters the situation pertaining to rehabilitation management in South Africa in the mining sector was investigated. In addition to the literature study, the opinions of rehabilitation and environmental managers were obtained on a wide spectrum of factors influencing management accounting strategies. Although high standards of rehabilitation management with the accompanying management accounting procedures are occasionally found, various aspects should still be addressed to a greater or lesser extent.

In an attempt to find alternative strategies to improve the present situation in this country, and in an endeavour to prevent failures, rehabilitation management approaches and policies in the most developed countries of the world as well as in Africa were researched. After investigating rehabilitation management policies in both South Africa and other countries, various factors were chosen for inclusion in a comprehensive management accounting strategy for rehabilitation management in the mining sector in South Africa.

This management accounting strategy includes major sub-strategy groups of factors which have an influence on and provide information for the decision-making process. These major sub-strategy influencing factors are internal as well as external background knowledge, a holistic approach in several respects, cost improvement policies, the role of authorities, a total quality environmental management approach, and research and development with the object of continuous improvement. These sub-strategy factors culminate in the strategy followed in terms of adequate management policies, evaluation of rehabilitation performances, reporting to interested and affected parties, and the final arrival at a balancing position between financial implications and the natural environment. The final stages of the management strategy follow in the next chapter.
The objectives of this chapter are to analyse these strategies and the factors which they comprise, and to advance reasons for including each one of them in the model.

7.2 TOTAL REHABILITATION MANAGEMENT

The major flowchart for the rehabilitation management accounting model is presented in Figure 7.1. The numbered blocks representing the various branches of the total strategy are discussed in the sections that follow. Each one of these substrategies has its own flowchart. Each one of these various branches of the comprehensive strategy forms an integral part of the central focus of total quality rehabilitation management.

- Waste to soil, air and water. One of the inevitable side effects of mining operations is the production of pollution products that damage the geosphere (soil), atmosphere (air) and hydrosphere (water). These pollutants are a major cause for concern and should be adequately managed in the comprehensive management accounting rehabilitation strategy. Basically, rehabilitation costs are incurred to prevent, minimise, assess, control and remediate damage resulting from mining activities.

- Background. Background information about local attitudes towards environmental and rehabilitation management eventually prevent costs from being allocated in an environmentally unacceptable manner. Applicable experience from both developed and developing countries could improve local rehabilitation practices. South African rehabilitation management teams, which include management accountants, could also benefit from knowledge about failures in these countries, especially in the African context. Further discussions on background information and influences follow in Paragraph 7.3.

- Holistic approach. A holistic approach should be followed in order to obtain maximum benefits from the various management accounting strategies incorporated in the comprehensive strategy. This approach includes aspects such as cost management from impact assessments to aftercare, flexibility regarding the needs of communities surrounding mining areas, the extended enterprise, and both financial and non-financial assessments. The holistic approach towards rehabilitation management is discussed in detail in Paragraph 7.4.
Figure 7.1  Total quality rehabilitation management

(Source: empirically developed)
Cost: improvement policies. Improvement policies are included in the aspect of continuous improvement inherent in quality management. Various and new procedures should continually be investigated and evaluated for the purposes of improving existing cost management policies. Feedback on both successful projects and failures forms an integral part of the improvement of cost management policies. More detailed analyses on cost improvement policies follow in Paragraph 7.5.

Authorities. Knowledge as to the role and attitudes of both local and central authorities regarding laws and regulations on rehabilitation issues should be available for overall decision-making purposes. Legal costs and fines, which are part of failure costs, should be kept to the minimum. The role of authorities in rehabilitation management accounting is discussed in greater detail in Paragraph 7.6.

Total quality environmental management (TQEM). TQEM occurs within a quality milieu. This means that rehabilitation management endeavours to reach maximum quality levels, commencing with the mission statement and finally including maintenance management. Quality management processes, including asset and cost management, are analysed in more detail in Paragraph 7.7.

Research and development. Both money and time should be set aside for research and development among other things to assist the management accountant to provide adequate information and advice on rehabilitation management issues. Investment in research and development includes crucial aspects such as education and training towards an increased awareness of environmental matters, and contingency planning for unplanned environmental accidents and disasters. The supporting role of research and development for the operation of the rehabilitation management strategy is discussed in Paragraph 7.8.

Ethics. The ethical views of people involved in mining activities largely determine the decisions taken and the outcomes of rehabilitation management policies. To what degree would each of the interested and affected parties allow the others to share in the gains from mining and rehabilitation operations? The influence of the ethical perspectives of the broad spectrum of rehabilitation managers on investment decisions is described in more detail in Paragraph 7.9.

Management. Strategic quality rehabilitation management forms the focal point of this model. Relevant information and influences emanating from the other sub-strategies, collectively culminate in rehabilitation management decisions. These
concerning factors are discussed in Paragraph 8.2.

- **Performance evaluations.** Financial and non-financial rehabilitation performance evaluations, by management accountants, among others, follow after rehabilitation management decisions have been carried out. These include assessments of rehabilitation and remediation results, forfeited claims, water quality and time management. Performance evaluations are analysed in Paragraph 8.3.

- **Reporting.** These measured financial and non-financial inputs and results are reported by the accountant internally to management as well as externally to interested and affected parties. The disclosure of this information is discussed in Paragraph 8.4.

- **Mining rehabilitation equilibrium.** These results are also weighed in terms of financial and non-financial inputs against the financial and non-financial benefits and losses. The degree to which the natural environment could benefit from all this previous rehabilitation efforts is compared with the long-term benefits to humans. The rehabilitation scales for determining this degree of balance are analysed in Paragraph 8.6.

- **Feedback.** Feedback on successes and failures is applied to improve overall rehabilitation strategies. Suggestions on improved rehabilitation policies are referred to management for evaluation and future decision-making purposes. Further discussions on feedback follow in Paragraph 8.5.

- **Equilibrium.** The objective of the whole strategy is to find an equilibrium position where the various interested and affected groups would be satisfied that each one has achieved the maximum benefit under the given set of circumstances. These groups vary from the owners of the mines to the surrounding communities, from the mineworkers to the surrounding natural environments.

### 7.3 THE ROLE OF BACKGROUND KNOWLEDGE

#### 7.3.1 Introduction

The role of relevant internal and external background influences on management decision making for rehabilitation management is illustrated in Figure 7.2. An appropriate knowledge of background influences would assist the rehabilitation and environmental management accountant in providing a higher quality of information and advice to management. Knowledge of rehabilitation management policies and technologies from
developed countries is combined with a knowledge of the influence of local heritage and cultures to form a comprehensive pool of background knowledge which can be utilised. This internal and external background information forms the basis for determining, among other things, the extent of the relationship between people and the natural environment. The development stage of management could then be decided on, on the basis of similar situations in other countries.

7.3.2 Local heritage and culture

Heritage and culture would dictate individual behaviour, organisational culture and creativity within a management team. Shared values, beliefs about reality and meanings would become the collective culture of the group. This culture might shape budgets according to a pattern of shared meanings, beliefs and values (Preston 1991:155). But it would also influence creativity and attitudes towards changed circumstances according to unstated rules which are continually produced and reproduced by participating individuals. Since creativity lies beyond acceptable current practice, only an evolving culture accepting new and innovative behaviour would allow new ideas to develop.

The majority of the responding environmental rehabilitation managers agree that local and internal attitudes towards rehabilitation management should be considered for decision-making purposes (Chapter 4, Statement 3.2.1:81,3%). Since these respondents also agree that cultural differences influence the process of rehabilitation management decision making (Statement 3.3.1:56,3%), it is evident that they are aware of the importance of various background behavioural impacts. Most of the respondents are of the opinion that positive behavioural attributes are indeed present in the management accounting systems that deal with rehabilitation management in South Africa (Diagram 4.10 and Diagram 4.11). The measuring of rehabilitation and environmental costs emphasises their existence and makes them visible. People would respond to these measures by positively changing their attitudes and behaviour, and therefore develop in terms of beliefs, values and mindsets.
Figure 7.2  Pool of background rehabilitation knowledge

Influence & information

Local heritage / culture

Internal sources

Background knowledge & information

Other countries: Canada UK USA

External sources

Relationship between people and natural environment

Generations of management

Management

(Source: Empirically developed)
The local South African background situation pertaining to rehabilitation management accounting is analysed in Chapter 2. Major factors that should influence the development of a comprehensive strategy are the following:

- Inherited ecological damage owing to mining operations in the past, as well as inadequate cleanup results, are reminders of mistakes in both financial and non-financial terms.
- A tendency is developing for more and more legislation to be promulgated to prevent and combat pollution in South Africa. These actions by authorities reflect the awareness of and increasingly positive attitude towards rehabilitation and environmental management. Since legal costs and the costs associated with failure to comply with laws and regulations could be prevented and avoided, this tendency should be noted.
- Visible efforts are being made to introduce international standards and accreditation for ISO14000 on rehabilitation management and for ISO9000 on total quality management.
- The importance of teams consisting of experts and consultants, as well as of contracting out and benchmarking, are being realised to some extent.
- There is a conflict of interests between the major interested and affected groups of money providers, labour and the natural environment.
- Although extensive environmental disclosure practices are not required by legislation, some major companies have already made a start with internal information disclosure and external reporting. Since this process of disclosing adequate information on rehabilitation and environmental input and gains will take many years, accounting and management accounting bodies should encourage organisations to take introductory steps at this stage.

Management accounting which tends towards full cost accounting with regard to rehabilitation and environmental management systems are in the initial stages of development in South Africa. Financial information and evaluations need to be supported by non-financial indicators in order to achieve total quality management by means of continuous improvement cycles.

Furthermore, the opinions of rehabilitation managers in the mining industry in South Africa were obtained and analysed in Chapters 3 and 4. Against the background of these
internal opinions (Chapter 4, Par. 4.7), the following important issues should, among others, be included in a strategy for rehabilitation management accounting:

- A long-term strategy ranging from impact assessment to aftercare should be encouraged. This would include benchmarking, feedback, ISO9000 and ISO14000, financial as well as non-financial provisions and factors such as quality, cost and time, together with a functional system of technology, behaviour and culture.
- People should become aware of the influence of a heritage of badly rehabilitated land and inadequately trained and educated people. There is agreement that expenses should be separated for rehabilitating inherited damaged land, and that money (as well as time) should be invested for improving education and training.
- Financial, environmental, leadership and implementation aspects should be considered in order to find a balancing position in respect of rehabilitation cost management.
- The experience of other countries should be taken into account.
- Background knowledge of local and national laws, regulations, fines and taxation conditions influences management accounting procedures, advice and decisions.
- Positive ethical views and awareness of responsibility will eventually support successful rehabilitation management as well as the accompanying management accounting policies.

Since South Africa is in a strategic position vis-à-vis the rest of Africa, the African heritage and influences form an integral part of the development of a comprehensive management accounting strategy. Influences from the rest of Africa add to both internal and external background information. The situation in respect of rehabilitation management and the accompanying management accounting procedures in Africa is analysed in Chapter 5. The following major background aspects pertaining to rehabilitation management accounting in the mining industry in Africa (Chapter 5, Par. 5) would have an influence on the development of local strategies:

- Rehabilitation management accounting practices in the rest of Africa are influenced by historically and culturally inadequate policies.
- A general lack of awareness exists regarding the objectives of rehabilitation management; that is, to provide a liveable natural environment for future generations.
Polluted air, water and soil are the result of unacceptable mining methods which are aggravated by small-scale mining activities, illegal mining operations, a lack of law-enforcement procedures, state-owned mines run by unstable governments, international pressure and limiting trade agreements, and a cultural heritage that excludes futuristic thinking.

Policies that aim to improve traditional practices and views are noticeable, however, and are encouraged by means of systems of awards and investments in education and training.

The presence of cultural influences in accounting and management accounting decision-making and activities relating to rehabilitation and environmental management should not be ignored. The broader spectrum of cultural influences dictates the management structures that are adopted, internal micro behaviour, the environment for accounting, as well as the cognitive functioning of people who are exposed to accounting procedures (Riahi-Belkaoui 1995:14). Working in tandem with the influence of cultural attitudes on accounting, this influence would also extend to the micro and macro economic spheres.

7.3.3 Other countries: Canada, the USA, the UK

The majority of the responding rehabilitation and environmental managers disagrees with the statement (3.1.4 in Chapter 4) that experience of other countries does not have a positive influence on local rehabilitation decisions. External background information from developed countries such as Canada, the United Kingdom and the United States of America would have a positive influence on the development of a local management accounting strategy for the rehabilitation of mining areas. Advanced forms of rehabilitation management which are found in these regions are analysed in Chapter 6. Various of these aspects (Chapter 6, Par. 5) which include these listed below, should form an integral part of local strategies.

- Precautionary and preventive costs are emphasised and included in long-term planning schedules and budgets.
- Multi-disciplinary teams of experts as well as benchmarking are utilised.
- The positive results of investments in both research and development, and in education and training, are recognised.
- Models have been designed for the assessment of rehabilitation inputs and gains,
as well as for accounting for natural assets.

- Although as yet there are no strict rules enforcing mining companies to disclose rehabilitation operations, an awareness is developing of the need to make provision for future contingencies and long-term rehabilitation and maintenance activities. The accountants are conscious that an eco-balance should be the eventual objective of reported inputs and gains in respect of natural resources, materials, energy and waste.

- More sophisticated systems of laws, taxation, regulations, guidelines and law-enforcement procedures are found than in most parts of the world. In addition, these developed countries are in a process of improving and consolidating these legislative systems.

- Concern by both the public and the authorities about environmental and rehabilitation management has a positive influence on the evolution of legislative issues.

7.3.4 Relationship between people and the natural environment

By combining the background information on and influences of rehabilitation management occurring in South Africa, African and developing countries, the local future relationship between people and the natural environment could be improved. The rehabilitation management team acts as a mediator between people and the natural environment from which mining commodities are extracted. In the process of mediation, people living around mines should be involved as well since they are mostly dependent on the natural environment (Chapter 4, Statement 3.3.2). About 74% of the environmental managers who responded to the questionnaire are in the age group between 31 and 50 (Table 4.4). In this age group people have sufficient maturity to realise the importance of an improved relationship between people and the natural environment.

There is a process of interaction between people and the natural environment, and an adjustment is achieved. People constantly act on their environment by means of positive or negative inputs, and then they alter these actions after responses by the environment. People and the environment reinforce each other by means of both positive and negative reactions. These boundaries of the relationship between people and the environment are not fixed and should be assessed by means of simulation on a continuous basis (Bonnicksen 1991:13). Owing to the high probability of uncertainty and the limited
information in this model, only short-term decisions based on human judgments could be formulated.

In this relationship between people and the natural environment, the rehabilitation management team, including the management accountant, need to develop a strategy where the following criteria (Guntram 1992:12) should simultaneously be satisfied:

- Effectiveness, by contributing to the improvement of the natural environment.
- Efficiency, by improving the natural environment at the minimum cost and expense.
- Equity, by being fair in the sharing of the financial and non-financial burdens among stakeholders.

Market forces alone cannot be allowed to determine the relationship between people and the natural environment. Failures and mistakes in respect of environmental problems would be exposed too slowly, while the market might demand rapid action (Kleiner 1991:38,47). Present economic gain should be compared with future quality of life in order to ensure economic growth and environmental quality. Part of the present improvement in quality of life should be transferred to the future in the form of investments in rehabilitation projects.

By including the natural environment as a stakeholder in an enterprise, we can arrive at a more realistic as well as a more complex perspective on the business milieu. In this regard Starrik (1995:216) expands the description of a stakeholder to include “any naturally occurring entity which affects or is affected by organisational performance”. This integration between nature and business would provide a more complete and strategic approach towards stakeholder management.

By allowing us to form a better idea of the existing and projected relationship between people and the natural environment, this background information and influences could lead to improved rehabilitation policies. Management in terms of decisions and functioning would then serve the interests of all stakeholders more impartially.
7.3.5 Generations of management

After determining the degree of inclusion of the natural environment in decisions on rehabilitation management, the generations of management in similar situations should be considered. A choice should be made among various approaches and combinations of approaches in order to find a management system that would best suit the circumstances of the particular rehabilitation management needs. Joiner and Reynard (1994:9) divide ways to get work done into the following categories:

- The first generation of management is management by doing the work yourself.
- The second generation of management is management by directing others to do the work.
- The third generation of management is management by results.
- The fourth generation of management realises that better results can only be obtained through fundamental improvements, which include quality management, a scientific approach and regarding all the interested and affected parties as part of one team.

The fourth generation of management, or bottom-up empowerment, is in a process of being applied in developed countries. But given the varying levels of training and education of South Africans, this kind of management could not be implemented locally without adaptations. Knowledge of the influence of different management systems forms an integral part of recommendations and investments with a view to obtaining maximum benefits for all interested and affected parties. Resource-conserving methods of management in South Africa should be linked to the chosen combination of generations of management.

7.3.6 To management

Background influences and information form an integral part of the set of information and advice that the management accountant has to prepare for management decision making. Monetary rehabilitation policies are formulated against the background of time, money and the environmental perspectives of local inhabitants, other people from Africa and the people in the most developed countries in the world.
7.4 HOLISTIC APPROACH

7.4.1 Introduction

Holism, developed by Smuts in 1926, could be described as the tendency of entities to function interdependently as well as independently (Olivier 1987:100). Each part of the strategy has an influence on the other parts in one way or another in the sense that each one has an influence on the whole. Each part functions according to its specific character within its own field as well as within the broader field. Since rehabilitation management is a complex situation, a number of influences should be analysed in the context of this holistic approach.

Not only should all interested and affected parties be taken into consideration, but all aspects of rehabilitation management should be included in a comprehensive strategy for the management accountant. This holistic approach is illustrated in Figure 7.3. The whole spectrum of relevant management issues should be considered, from impact assessments to aftercare maintenance. The value added to land as a result of rehabilitation policies, or the value destroyed as a result of inadequate policies, as well as the principles of an ecological equilibrium, should not be ignored. Existing paradigms should be reevaluated to include the extended enterprise as well. Communities adjacent to mining activities should be consulted as to their future needs regarding rehabilitated areas. All interested and affected parties should be included in the extended enterprise and value chain. This would determine, among others, the amounts to be invested in rehabilitation operations. Flexibility should be built into this holistic approach to make provision for future changes and new developments.
Figure 7.3  2 Holistic approach

From impact assessments to aftercare: life cycle

Rehabilitation cost in relation to wealth of community

Added value

Principles of ecology balance

Paradigms

Extended enterprise, value chain, stakeholders

Management

(Source: Empirically developed)
7.4.2 From impact assessment to aftercare

 Provision should be made in this holistic submodel for the accumulation of rehabilitation costs for activities that occur over the entire life cycle of the process for extracting commodities, from impact assessment to aftercare. The majority (95.8%) of the responding rehabilitation managers also agree with this (Chapter 4, Statement 2.1.1). Life-cycle costs are monetary figures for every effect of a product and they could include disposal costs, potential legal penalties, degradation of air quality and aspects of public health (Kleiner 1991:40). Rehabilitation management accountants have to consider the whole spectrum of rehabilitation costs and expenditure involved in the mining of commodities. Since a degree of uncertainty is attached to projections on full life-cycle costs, provision should also be made for future adjustments owing to changing circumstances.

 All costs associated with waste and rehabilitation should be adequately classified and recorded. The environment should not be treated as a free and common good that can be polluted with reducing rehabilitation costs to the enterprise (Bayou & Nachtman 1992:53). This would only result in transferring the burden to rehabilitate to other groups in society. Since environmental effects and costs are inclined to occur in the long term, costs to the successors of present managers should also be included in this category. This would eventually influence future rehabilitation performance evaluations.

 This approach of life-cycle oriented environmental management (Sharfman et al 1997:17) would reduce the negative impact of mining operations on the environment at all stages of mining operations. One of the most important aspects of this life cycle approach is impact assessments at the commencement of mining operations. The majority (91.5%) of the responding rehabilitation managers support this fact (Statement 3.2.3).

 This life cycle approach might be more costly in the short term, but as soon as sustainable development becomes the generally accepted norm, or becomes law, enterprises applying this strategy will be in a leading position.

7.4.3 Added value

 Just as profits are returns earned by shareholders, “value-added” refers to the returns
earned by workers, capital providers and authorities (Riahi-Belkaoui 1992:1). The concept of added value is a measure of performance, indicating wealth and profits at the micro economic level, created over a period of time (Enthoven 1985:14). This non-earnings accounting information could be utilised to predict future changes in earnings and the content of information (Riahi-Belkaoui 1996:73). The calculation of added value is therefore a measure of increasing wealth for an ongoing enterprise.

Increased awareness of the natural environment causes people to re-evaluate values concerning the natural environment. This value consciousness could be manifested in various forms as value could directly or indirectly be added to assets by means of rehabilitation processes. In this regard value-added information is used as a basis for evaluating socio-economic operations (Enthoven 1985:15), such as in environmental and rehabilitation projects, as well as in education and training in the pursuit of environmentally sound attitudes.

If a mining company could convince its interested and affected parties through its financial and non-financial disclosures of its positive results in respect of rehabilitation investments, its value would increase indirectly for these parties. These disclosures should indicate the distribution of value added by employees and authorities (Enthoven 1985:16). A company could turn the cost of remediation into an opportunity by becoming an environmental leader in a specialist area of rehabilitation management (Denton 1994:16). By designing and implementing techniques to eliminate or minimise waste products, or to save energy, corrective rehabilitation costs could be reduced and additional income could even be earned. In this process leadership adds value to the enterprise.

The supporting role of the management accountant should be recognised in this need to create value and to add value, especially in respect of rehabilitation projects. These expanded supporting roles include the provision of expert advice, leadership in cross-functional teams, design and management information systems, and management accountants also serve as teachers, guides, consultants and interpreters of complex situations (Barbera 1996:72). Management accounting should form an integral part of management and operations, and the management accountant should be promoted from a member of staff to a partner in business teams. The added value as a result of the expanded role of the management accountant should add to the value of existing rehabilitation management standards. This would add value to the land being remediated.
Investments on a continuous basis to rehabilitate abandoned mining areas would mean higher land values if the mine property were to change hands. The new owners would not need to invest in the rehabilitation of inherited damaged land and contaminated water. They would be willing to negotiate for a higher price in order to decrease future rehabilitation expenses and environmental liabilities. In view of the time factor, more value could be added with rehabilitation as an ongoing practice of the mining enterprise than when rehabilitation is carried out at the end of the productive life of a particular mine. A distinction should also be made between internal and external value-added and non-value-added environmental cost categories, according to the majority of respondents to the questionnaire (Statements 2.2.9 & 2.2.10). Projections of future benefits in the form of value to be added to rehabilitated assets should be included.

As part of the strategy to determine the value added to the enterprise, the results should be disclosed to interested and affected parties. One of the benefits of value-added reporting (Riahi-Belkaoui 1992:9) is that it provides a better measure of the size and value of an enterprise.

Care should, however, be taken with the interpretation and management of value-added information (Riahi-Belkaoui 1992:14). All the members of the team might not agree on the degree of co-operation between them. Positive added value might be disclosed while earnings might be on the decrease. In order to reflect a positive picture of rehabilitation activities, management and the accountant might concentrate only on the maximising of value-added disclosures.

### 7.4.4 Principles of ecological equilibrium

In order to achieve a holistic approach to the development of a comprehensive strategy for rehabilitation cost management, the principles of an ecological balance should be determined. Rehabilitation and environmental managers responding to the questionnaire agree that financial as well as non-financial aspects, such as the natural environment, leadership factors and implementation procedures, are actually included in long-term strategies to find a balancing position in respect of rehabilitation cost management (Statements 2.1.14 to 2.1.17; Diagram 4.3).

Competitiveness is encouraged, especially to gain a better position in terms of
international trading. In order to accomplish this goal, national institutions, social programmes and environmental protection are neglected (Poff 1994:444). Without these programmes to protect natural resources, promote social upliftment and expand infrastructure, no future international trading would be possible in any case after ten to twenty years. It is therefore necessary to strike a balance between ecological, social, national and overseas valuta interests. For each individual rehabilitation project a balancing or ideal position should be found between monetary human interests in the short term and the non-monetary long-term interests of nature. Before the commencement of excavations, during impact assessments and continuously during mining operations, the objective should be to cause minimum ultimate disturbances to the natural environment. At any given time this ecological equilibrium should be one of the major aims of management decision making. If it is not possible to reach this goal on a continuous basis, a projection should be made as to the point in time when this equilibrium is likely to be affected.

When determining inputs and gains in respect of rehabilitation policies, the management accounting team should also find a balancing ecological position in terms of varying time intervals. In the short term the negative impacts of mining operations on nature would be insignificant in comparison with positive economic growth tendencies (Meadows et al 1983:156). But the negative impacts on nature will dominate the positive growth results in the long term if the necessary precautionary steps are not implemented.

7.4.5 Rehabilitation cost in relation to the wealth of the community

There appear to be conflicting views on the subject of the rehabilitation costs that should be incurred in poorer and richer surrounding communities.

Quality management as well as ethical principles require best available techniques not entailing excessive costs (BATNEEC), without including such issues as wealth of people or their stage of development. This view is supported by rehabilitation and environmental managers in South Africa who responded to the questionnaire (Statement 3.3.3). People living in communities adjacent to mining areas have the right to clean air and water as well as to usable or productive land, irrespective of their social status. Adopting this option would entail incurring higher rehabilitation costs throughout the whole process of mining and aftercare.
According to the other view, people in poorer and less educated communities have lesser needs. They need land for agricultural purposes in a subsistence economic system. To take one instance, in the more developed communities rehabilitation projects should have to provide land stable enough for the building of highways. More people and animals would be exposed to the negative impacts of polluted air and water, and this would result in increasing claims and fines. Deciding on this option would mean both incurring lower rehabilitation costs in poorer and disadvantaged communities, and also relatively higher rehabilitation costs in more developed areas. This approach could be interpreted as espousing double standards, that is discriminating against people who cannot defend themselves, and should be introduced with great caution.

The rehabilitation management team has to decide to what extent they should combine these views when working out a strategy to suit their particular circumstances. Rehabilitation costs should preferably be managed as an integral part of strategic planning, and not with the aim of avoiding expenditure.

7.4.6 Paradigms

Since markets are undergoing fundamental paradigm shifts, the rehabilitation management sector is not likely to be excluded from this tendency. Paradigm shifts are observed from product-based to product-plus strategies (Chapman 1996:22) that focus on additional services such as the environmental impacts of goods and services. This would include more than merely closing opencast mines with a mixture of infertile soil. The achievement of these higher requirements for operational excellence places pressure on enterprises to minimise costs. This can only be achieved by means of improved operational planning.

As part of the holistic approach in the preparation of a rehabilitation management strategy, existing paradigms (or models or patterns: McLeod & Makins 1993:825) should be re-evaluated in the light of changed and changing criteria. The challenge to management accountants is to make the best choice among alternatives as a well-defined model would assist them in reaching decisions.

Various groups of paradigms for accounting and management accounting have been identified. One particular group, described by Riahi-Belkaoui (1996), consists of internal
and external patterns. The external behaviour is determined by market forces and individual user preferences. The internal component includes patterns from the past, the present true income interpretation, and a predictive model for the future. Previously Belkaoui (1980:80) identified models for stockholder wealth maximisation, managerial welfare, and social welfare.

The development of paradigms is described by Drury and McWatters (1998:38) as including the feedback framework, the adaptive framework, the strategic framework, the value chain framework and the kinetic framework. The comprehensive kinetic model combines the properties of the other models and also emphasises and accommodates the decision-making role of accountants and management accountants, which includes futuristic projections, to meet the needs of present organisations.

As part of the procedure for re-evaluating the rehabilitation paradigm which is currently being used, other systems should also be considered. In order to find the best alternative, management accountants should not confine themselves to a single paradigm. A combination of characteristics of various models could be included that best suit the particular limitations and circumstances of the mining enterprise. After the introduction of the chosen paradigm, further corrections and paradigm shifts might possibly be needed once feedback on successes and failures is received.

7.4.7 Extended enterprise, value chain, stakeholders

As part of the development of a strategy for rehabilitation management, the management accountant should define the boundaries of the extended enterprise. Most (87,2% to Statement 2.2.7) of the responding rehabilitation and environmental managers agree that the cost of the extended enterprise should be determined. This would allow accountants to come out of isolation, function in the broader environment and obtain a more holistic approach when compiling strategies.

According to Ansari et al (1997b:MMEC-20), the extended enterprise, or value chain, comprises all the customers, suppliers, dealers and recyclers who form an interdependent group together with the main enterprise. The costs of the extended enterprise in respect of rehabilitation management would therefore include expenditure on aftercare, consultants, research and development programmes, contractors, suppliers, security and
the natural environment. Not only are the own interests of the mining company taken into account, but so is expenditure in respect of accountability to society (Parker, Ferris & Otley 1989:169). Costs, time and risk assessments in respect of diminishing quality of life owing to pollution are difficult to determine. Both financial and non-financial impacts upon society, including the local community, environmental and national interests, should be determined.

After determining the boundaries of the extended enterprise, the accountant and management accountant should decide to what extent information on inputs and gains would be disclosed in respect of the value chain to these interested and affected parties. The people included in the extended enterprise would then have the opportunity to evaluate both the negative and the positive impacts of its performance.

7.4.8 To management

A holistic approach towards management accounting and rehabilitation management would support the factors of continuous improvement as well as of development and research. Various cost categories should be included in the management accounting model, which would include life-cycle costs from impact assessment to aftercare, value-added concepts, the costs involved in finding an ecological balance between humans and nature, rehabilitation costs in relation to the needs of the surrounding community, paradigm shifts for cost assessments, and the cost of the extended enterprise.

7.5 COST: IMPROVEMENT POLICIES

7.5.1 Introduction

All management accounting information is not necessarily useful and relevant for rehabilitation management planning and decision-making purposes. Within the organisational environment this information is often produced too late to reduce costs, it may not provide sufficient cost detail, and it may ignore long-term and future gains (Johnson & Kaplan 1987b:22). Environmental and rehabilitation costs are high and they are growing, they are scattered across a variety of activities, and they are not allocated equally to all products (Ranganathan & Ditz 1996:38). Outdated and inefficient accounting and management accounting techniques need to be recognised and updated,
or replaced, in accordance with the circumstances of particular rehabilitation projects. This fact is confirmed by the environmental managers responding to the questionnaire (Diagram 4.5 and Diagram 4.6). They agreed that environmental costs should be integrated routinely into management decision making (Statement 2.2.1:95.8%), and that monetary provision should be made for long-term rehabilitation management and aftercare (Statement 2.2.4:95.8%). These relatively high percentages indicate that policies to improve rehabilitation cost management could be implemented without resistance from the environmental and rehabilitation managers in the mining industry in South Africa.

In order to be able to improve existing rehabilitation cost management policies, the management accountant needs information on various costing systems, especially those that would reduce long-term environmental costs (Denton 1994:29). A better knowledge and understanding of rehabilitation costs could help management to increase profits, use materials more effectively and improve rehabilitation activities. These costing systems include life-cycle costing, the total cost approach, target costing and agency costing. Feedback on the effect of these changed and improved policies on profits and gains would lead to a chain reaction of improved policies regarding quality, cost and time. The component of cost improvement policies which forms an integral part of the comprehensive strategy aimed at rehabilitation management is illustrated in Figure 7.4.

Since rehabilitation and reclamation procedures are becoming highly complex and technical, cost calculations have to be a major consideration in the design and operation of a mine. Rehabilitation costs which form an integral part of the total operating costs of a mine should be methodically evaluated to determine whether they add value or reduce value.
Figure 7.4 3 Cost: improvement policies

(Source: Empirically developed)
7.5.2 Life-cycle costing

The principles of life cycle costing were briefly discussed in Paragraph 7.4.2 from the perspective of the holistic approach from impact assessment to aftercare. Effective life cycle cost management consists of the following components (Shields & Young 1991:39):

- Life cycle costing. 80-85% of life cycle costs are committed by decisions made early in the production life cycle. The implication for rehabilitation management would be that additional money spent during impact assessments could save up to eight times that amount on later rehabilitation activities and maintenance. This view on preventive costs is supported by the majority (85.4% to Statement 2.1.2) of the respondents to the questionnaire. The importance of the designing out of rehabilitation costs in the design phase was given a higher percentage (97.9% to Statement 2.2.2) by these respondents. Whole life cycle costs would also include the cost of maintenance after the closure of mines, or the rehabilitation cost of future owners with inherited damaged.

- Product life cycle management. This would involve costs incurred in the management and marketing during all the stages of the product or production process, including disposal costs, maintenance costs and health claims as a result of pollution.

- Organisational structure. Various forms could be considered, such as vertical and horizontally differentiated groups which would fragment activities during the life cycle. With multi functional teams each team would be responsible for better management through the whole life cycle.

- Responsible cost reduction methods. Reducing rehabilitation costs over the entire life cycle of the operational life of a mine would increase its competitive advantage. During periods of low market prices for commodities, this would ensure the survival of the mining enterprise.

Rehabilitation life cycle costing includes not only processing and maintenance costs, but also the life cycle costs of labour. The categories of employments cost, operational cost and work environment cost are distinguished (Dahlén & Bolmsjö 1996:460). For the purposes of a life cycle approach towards improved policies on rehabilitation costs, this life cycle of labour expenses should also be added.
When assessing the life cycle costs of a rehabilitation project, the stages of the life cycle (Hirsch 1988:398) should be distinguished. During the embryonic stage basic research and development are completed, whereas in the growth stage emphasis is placed on marketing or disclosure together with continuing research to improve technology. These are followed by the maturity stage of maintenance and control, and the aging stage when the rehabilitated land could be abandoned. Puri (1996:23) identifies the life-cycle stages as raw material acquisition, fabrication or processing, manufacturing, service, use, and waste management. Each stage has its own costs associated with the relevant operations.

In addition to the assessment of rehabilitation costs during the life cycle of excavating operations on an area of land, changes and potential changes in the life cycle or order of the life cycle (Czyzewski & Hull 1991:20) should also be budgeted for. For improved cost management the optimum sequence of events (Levitt 1965:93) in the life cycle should be determined in the planning stage. Complementary life cycles could also exist when rehabilitation projects are at different stages of their life (Hirsch 1988:399). These planning strategies would prevent the inefficient allocation of resources which might result in lower profits.

In order to improve cost management policies, management accounting systems should be developed that support the planning and control of life-cycle costs at all stages of the life cycle, especially in the early stages of the life cycle. The benefits and gains of rehabilitation should then be compared with all the costs incurred over the entire life cycle of mining activities from impact assessment to aftercare.

7.5.3 Total cost

Inputs of materials and energy yield outputs of products and harmful emissions during mining operations. The total cost of pollution and the accompanying rehabilitation costs involve aspects such as solid waste, recyclable materials, trade waste, hazardous waste, polluted water and air, heat, noise and radiation (Birkin 1996a:36). Both short-term and long-term rehabilitation costs should be included in total cost calculations to improve existing cost policies.

A distinction can also be made between various categories of environmental costs on the basis of the nature of these costs (Ansari et al 1997b:MMEC-4). We can distinguish
between legal costs, social costs and costs related to consumer matters. From these categories arise costs related to environmental activities, such as pollution prevention, assessments of sources of waste, control of produced waste elements, and failure costs for remediating accidental pollution (Lawrence & Butler 1995:104). According to the survey among rehabilitation managers, these cost categories of prevention, assessment, control and failure costs are indeed separated from other environmental cost categories. The responses, however, were not much in agreement with the relevant statements (2.2.11:45,8%; 2.2.12:50%; 2.2.13: 58,3% and 2.2.14:56,3%). In order to improve cost management policies, this separation of environmental cost categories would emphasise the contribution of each one to the total rehabilitation cost to the enterprise. From this analysis of total rehabilitation costs the deduction can be made that the extended enterprise, or groups involved in the value chain, could reduce total rehabilitation costs in a joint effort to improve cost policies.

Depending on the type of accounting and management accounting system being used as well as the tradition of the mining enterprise, various further smaller rehabilitation cost categories could be distinguished. They are costs associated with depreciable capital and operating costs in the receiving area, storage of materials, the processing area, solid and hazardous wastes, and controls over water and air emissions (Hamner & Stinson 1995:6). The supervision components of these rehabilitation costs are related to the departments of purchasing, engineering, processing, management, finance and accounting. Other sources of information on total rehabilitation costs (Ranganathan & Ditz 1996:40) would be permitting fees, fines and penalties, maintenance of equipment, emissions output, depreciation, monitoring, training and costs of outsourcing and contracting out.

It is necessary to correctly identify and allocate all relevant costs, and previously hidden costs, pertaining to rehabilitation for purposes of budgeting, recording and projections, and to determine cost relationships for management decision-making purposes.

7.5.4 Target costing

Target costing is closely linked to cost leadership and business planning from the onset of operations. It is an activity which is aimed at reducing the life cycle costs of products or operations, while ensuring quality, reliability and community satisfaction (Carr & Ng 1995:347; Kato 1993: 33). The purpose of target costing is to anticipate costs, to improve
processes, to consider community requirements, and to integrate all interested and affected parties with the ultimate aim of earning profits (Ansari et al. 1997d: TC-3).

Rehabilitation costs could largely be determined during the planning stage, and the benefits of cost reductions could be incorporated in the budget. In this regard the rehabilitation managers who responded to the questionnaire agree that designing costs out in respect of rehabilitation costs should form an integral part of strategic management (Statement 2.2.2: 97.9%). Possible methods of reducing costs are examined during all the phases from planning to research and development. In Japan target costing activities have reached a level where over 80% of all costs are determined before actual production commences. This allows Japanese companies to pay more attention to planning, design, and research and development (Carr & Ng 1995:347), which support target costing activities. Financial departments coordinate and set targets, for both internal and external parties (Carr & Ng 1995:363). A team approach is followed where experts ranging from designers to engineers and marketers together with the management accountant concentrate on developing processes that are in accordance with the required target costs. In order to reach the set targets, benchmarking activities take place under the leadership of accountants and management accountants.

The focus of target costing is to reduce rehabilitation costs, and not to control costs. It is a comprehensive programme for reducing costs even before there are any mining activities on a farm. In view of the new and more advanced techniques and processes that are developing, there should be continual improvement in target costing. Target costing is future-oriented and therefore provides a better basis for decision making.

Various types of cost data from management accounting systems are provided for purposes of target costing. These are life-cycle costing, value-chain costing, feature or function costing, design driven costing, operations costing and activity-based costing (Ansari et al. 1997d: TC-24). When targets for expenditure on rehabilitation projects are set, decision making is enhanced. The structure of target costing (Kato 1993:38) is based on the idea of

\[
\text{Target cost (allowed)} = \text{Expected sales price} - \text{Target profit}
\]

Each one of the variables in the equation is determined at the planning stage. Since the
expected sales of mining commodities are to a large extent determined by fluctuating national and international market forces, the accountant has to decide how much of the target profits should be forfeited for rehabilitation purposes at varying price levels.

Not only financial targets, but also non-financial targets in terms of time and people management could be incorporated into this approach of target costing for rehabilitation conditions. The waste elimination philosophy of just-in-time processing (Kato 1993:34), or rehabilitation during the extraction of commodities, could do a great deal to reduce both costs and production time.

The objectives of target costing could be incorporated into those of lean processing. Lean processing largely coincides with rehabilitation processes, where sophisticated technology, multi-skilled labour and a high capital outlay (Ansari et al 1997a:MALP-5) for long-term projects are found. Lean techniques involve constant elimination of waste from an operation and could be broken down into the following activities (Womack & Jones 1996:141):

- Determining the precise value in terms of the end product or result.
- Identifying the total value stream and eliminating waste.
- Effecting continuous flow between steps with no waiting time, downtime and waste.
- Designing and providing rehabilitation only to the extent that is required.
- Pursuing perfection by means of feedback, development and a virtuous circle.

A successful target costing system, like a lean costing system, must be based on sound long-term planning before commencement of activities. This would be supported by mechanisms for continuous improvement.

### 7.5.5 Agency cost

The agency theory is based on the relationship between principal and agent. The principal or superior delegates decision-making responsibilities to the agent or subordinate according to a mutually agreed contract. While the principal wants the maximum utility from both the contract and the information system as a whole, the agent only has to take action according to the contract (Drury 1996:853).
Managers as agents, acting in the interests of their stakeholders, the principals (Jensen & Meckling 1976:309), are faced with constraints in the markets for goods and services, for financing, control and managerial services (Parker et al 1989:174). Social accounting information, such as financial and non-financial inputs and gains from the rehabilitation of damaged mine areas, is now regarded as substitute positive information to principals to lessen the negative effect of constraints.

According to some authors the agency theory has the potential to provide a conceptual framework on which a comprehensive strategy for management accounting could be constructed (Scapens 1991:146). But this theory of agency costing is still in the process of developing, and has some limitations (Johnson & Kaplan 1987a:174; Drury 1996:854) that should be phased out. Inaccurate cost allocation schemes prescribed by the principal could lead to a chain reaction of inaccurate information and decision making (Wagenhofer 1996:380). Rehabilitation management accounting is far too complex to accommodate this simplified model. In rehabilitation management many interlinked contracts exist, such as those between stakeholders and a management team, each of which would have a hierarchical structure (Ashton 1991: 124). It would be virtually impossible for management accountants, who are responsible for the provision of information which would form the basis of these one-to-one contracts, to perform their duty.

But its development should be closely followed, since the theory might have some merit. Conflicts of interest between management and interested and affected parties, as well as the influence of accounting information on management and stakeholders, serve to shed fresh light on management accounting.

7.5.6 Feedback

After cost improvement policies have been considered and implemented, feedback adjustments should be made in response to both positive and negative influences and results. Feedback mechanisms have the ability to continuously respond to discrepancies between actual and ideal situations, and to adapt in the long term to fluctuations (Simon 1990:172). Feedback adjustments are made in response to changes, in whatever direction such changes may take, but they are in a responsive position and do not make projections for the future.
By comparing planned and actual outcomes, it is possible to detect rehabilitation activities that do not conform to the plans. In the process of self-renewal both successful and failed attempts are followed up (Pascale 1991:21). This applies to failures of new ideas as well, and these are often more easily abandoned. When actual operations yield better than planned results, the reasons behind these should also be investigated. Improved cost policies should be analysed and considered for application to alternative projects as well.

The importance to management of feedback on both successful and failed rehabilitation operations, is reflected in the responses of rehabilitation managers. They indicate that feedback on successes (2.1.9:100%) and failures (2.1.10:93,8%) is important for management decision-making purposes.

Feedback mechanisms can be used to gather information on changing activities as well as the changing circumstances in the working environment. Evaluations on feedback information should also include the appropriateness of the original plans (Drury 1996:12). Activities could then be modified to suit the plans or plans modified according to the activities. Feedback has dynamic characteristics as it creates feedback loops in an otherwise one-way policy illustration. The interdependencies between the various activities are emphasised and provision is made for regular reviews of existing cost policies.

7.5.7 To management (internal and external costs, effect on profits)

Policies to improve cost management would include measures to reduce costs, to shift costs and to take non-financial indicators into consideration. Life cycle costs, total costs and target costs in respect of rehabilitation management should be determined and adjusted during the planning stages, even before impact studies, which are required by law, have been conducted. Developments to cost systems such as agency costing should be followed in order to select aspects that could have a positive influence on existing rehabilitation management accounting procedures. A distinction between internal and external costs and gains would also reveal and emphasise possible problem areas that could be improved.

Management has to decide to what extent profits have to be forfeited in order to improve cost policies. The effect of existing rehabilitation approaches on profits has to be
determined before adjustments can be made. A distinction should be made between profits and an increase in wealth when these accounting figures are presented (Birkin 1996b:236). Profits should be compared with residual pollution to the air, water and soil after the completion of rehabilitation activities. These residual pollution effects would contribute directly and indirectly to a general degradation of the quality of life for all stakeholders. To increase efficiency in respect of these decisions, a system of feedback should be in place. Management could then be continuously informed about positive as well as negative influences of changes in rehabilitation cost management.

Management has the task of enquiring into both existing and developing cost improvement mechanisms in order to make a choice for the benefit of all affected and interested parties. As part of the rehabilitation management team, the management accountant has a crucial role in obtaining and providing adequate information which could be applied to improve existing cost policies.

7.6 THE ROLE OF AUTHORITIES

7.6.1 Introduction

Since the real costs of pollution and the control of pollution from mining activities cannot be avoided, someone has to bear the costs in the end. If the mining enterprise does not control pollution at the source of pollution, the environment or the taxpayer would have to bear the costs (Torrens 1982:27). It is the responsibility of the local and national authorities to determine and supervise the share of rehabilitation costs which should be paid by each interested and affected party. The principle of “the polluter pays” is widely accepted and applied in this regard.

It is therefore necessary that the management team involved in rehabilitation projects should have some knowledge of and access to expert advice on local regulations and national Acts in connection with pollution control. Trends in the influence interested and affected parties are likely to exert on future legislation as well as the taxation implications of rehabilitation expenditure should be noted. Figure 7.5 shows both the influence of and the information generated by authorities in rehabilitation decision making.
Figure 7.5  4 The role of authorities

(Source: Empirically developed)
7.6.2 Legal: regulations and laws

Traditionally environmental and rehabilitation costs have been relatively low and the cost of identifying them relatively high. In these circumstances it was possible to allocate these costs to general overheads (Hamner & Stinson 1995:5). Owing to the increased costs of compliance with the greater volume of environmental regulations that are now applicable, these traditional allocations have become inappropriate. New local and national pollution control regulations and laws compel rehabilitation management accountants to re-evaluate existing cost accounting systems.

In this regard the rehabilitation and environmental managers who responded to the questionnaire agree that a thorough knowledge of present local and national regulations, laws and fines applicable to rehabilitation issues is an attribute of good management policy (Statement 3.1.5:95.7%).

If companies are conversant with penalties and fines, pollution levels could be decreased and failure expenditure reduced or avoided. Fines, penalties, law suits and health claims could add up to large amounts for mining enterprises that do not comply with environmental laws and regulations. More accurate information on environmental and rehabilitation costs could be obtained by correctly identifying and allocating costs by means of cost drivers, for example, and cause-and effect relationships between budgeted and allocated costs (Hamner & Stinson 1995:10). Processes that might lead to pollution and future penalties, fines and lawsuits could be identified and adjusted. The possession of more accurate information on preventable as well as unavoidable environmental costs would lead in turn to more successful financing, better decisions on rehabilitation investments, and a competitive advantage.

7.6.3 Interaction with stakeholders

The influence of people on actions taken by authorities and the influence of authorities in compelling people to reduce waste production, should be considered when determining the role of authorities in rehabilitation cost management strategies. Both the public and the private sector have a variety of options when responding to new pollution rules. These options range from relatively simple to complex, and from relatively inexpensive to very expensive. Both groups should be aware of the impact of mining operations on the natural
environment as well as of the future financial and non-financial implications of adequate or inadequate rehabilitation policies.

The degree of positive reaction by authorities to requests by public groups, for example to improve the present situation by imposing higher fines on transgressors, should be investigated. Both financial and non-financial factors should be considered. Financial aspects would include more expensive rehabilitation equipment or processes, and non-financial aspects would be the time lag between draft documents and the enforcement of new laws and regulations. The effect of these new regulations, increased fines and penalties should be determined in terms of improved rehabilitation management policies and higher investments towards these goals.

In developing countries such as in South Africa, the management team should follow certain guidelines in the negotiation process for arriving at environmental and rehabilitation policies. Banks, donor organisations and authorities should act with responsibility by attaching conditions to the provision of credit facilities and technical assistance (Warhurst 1994:158). The following relevant issues should form the basis for these negotiations (Dias 1992:124):

- A balance should be found between confidentiality and the public’s right to know (public disclosure).
- Provision should be made for environmental costs in terms of long-term pollution and short-term remediation costs being met by mining companies, authorities and the community.
- Arrangements should be made for the monitoring and implementation of impact assessment guidelines.
- Conflicting national and global priorities should be reconciled in cases where national and local authorities are more concerned about exchange and revenue earnings and employment than about the rehabilitation of abandoned mines.
- Early participation by interested and affected groups would diminish problems arising from health and safety considerations and natural environmental problems.

The ideal situation would be a state of affairs where eventually both authorities and rehabilitation and public groups could work together towards quality environmental and rehabilitation management. The influence of politics of the day, the economic situation
in the mining industry, and the degree of dependency of rehabilitation management on these fluctuating external factors should be included in a rehabilitation management accounting strategy.

7.6.4 Preventive actions: Minerals Act of 1991

In order to prevent damage to the environment or human health from illegal discharge, failure to report such pollution, as well as repeated violations of pollution control regulations, authorities have to take action. One of the major objectives of the Minerals Act (50 of 1991, amended by 103 of 1993) is to prevent, by means of an extensive system of impact assessments, damaged land left in an unrehabilitated condition in future. According to the rehabilitation and environmental managers responding to the questionnaire, this Act significantly influenced rehabilitation management for land disturbed by mining (Statement 4.3:65,9%). A response of 34.1% in respect of uncertainty, however, indicates that they are not sure whether the effect of the Act could be determined at this early stage. The required funds now have to be available at the right times to accomplish rehabilitation activities (KPMG 1993:48). Large sums of money are involved in these preliminary investigations, but this expenditure could eventually lead to decreased damage and consequently lower remediation costs.

The Minerals Act (50/1991 as amended) is discussed in detail in Chapter 2, which deals with the situation in respect of rehabilitation management in South Africa.

7.6.5 Taxation

One of the major control mechanisms used by local and central authorities could be to manipulate taxes to encourage rehabilitation projects. Capital as well as current expenditure is involved. Expenditure of a capital nature is not deductible for purposes of income taxation, but current expenditure could be deducted from income before taxation liabilities are calculated.

The influence of income taxation on rehabilitation costs and expenditure, as well as recommendations for improving the existing taxation policies, could form the subject of a comprehensive study on its own. This section only touches on the importance of being informed about taxation policies as they affect rehabilitation management.
The following distinction (Smith 1997:22) could be made between various environmental taxes, and could serve as the basis for categorising taxation-related expenditure and decisions.

- Measured emission taxes. They are directly related to measured pollution effluent.
- Taxes to approximate a tax on emissions. Changes in indirect taxes such as value-added tax might be applied as an alternative to measured emission taxes. Goods and services associated with higher pollution effects (such as coal) would be taxed more heavily than products that might benefit the natural environment (such as lead-free fuel).
- Non-incentive taxes. They are collected for the purpose of procuring funds for particular public expenditures related to environmental protection and rehabilitation. These taxes are not imposed to provide incentives to reduce pollution emissions.

Responding environmental and rehabilitation managers in the mining industry indicated in their reply to the questionnaire (Statement 3.1.6: 80.4%) that a sound knowledge of present taxation policies supports decisions on rehabilitation costs and expenses. They also agreed (Statement 2.2.8:77,1%) that expenditure to rehabilitate on an ongoing basis as part of the operating process should be separated from expenditure to rehabilitate damage from the past. This would imply that expenditure to rehabilitate inherited damage from previous years should be considered for taxation reductions from income for those years. Rehabilitation expenditure incurred as part of the ongoing process during the current year should be compared with income of the current year for taxation purposes.

The influence on profits of current and future taxation policies imposed by authorities would determine the amounts and periods of expenditure on rehabilitation projects in the mining industry. It is therefore necessary for the management team to have a sound knowledge of taxation trends both in South Africa and in developed countries. Successful policies in other countries might be linked in future to put pressure on national authorities to introduce similar taxation in order to obtain foreign investments in the local mining sector.
7.6.6 To management

Management teams, including the management accountant, need to be informed about the attitudes of authorities when preparing a comprehensive strategy for rehabilitation management. A thorough knowledge of present local and national regulations, laws, fines and penalties regarding rehabilitation and pollution issues would contribute towards good management policy. Failure costs could be avoided or reduced. A distinction should be made between rehabilitation costs allocated to repairing the damage of previous years and to repairing the environmental damage of the current financial year.

The interaction of authorities with the private sector could lead to increased investments in improved rehabilitation equipment and processes. A more understanding attitude and support by authorities if complying mining companies should happen to suffer accidental spills or floods would reduce contingency or failure costs. Preventive actions by authorities such as the impact assessments required by law (Act 50/1991) are a means of compelling mining companies to provide funds for rehabilitation on an ongoing basis during excavations, as well as for closure costs.

The traditional role of the accountant and management accountant would have to be extended (Gray 1990:66) to include dealing with new taxation, taking new environmental regulations into consideration for investment appraisals, controlling costs under new pollution-reducing methods, estimating the impact of environmental consciousness, and changing responsibilities.

7.7 TOTAL QUALITY ENVIRONMENTAL AND REHABILITATION MANAGEMENT (TQEM)

7.7.1 Introduction

Total quality environmental management forms an integral part of the development of a comprehensive strategy for rehabilitation management accounting purposes. Although this management system is complex, it has inherent properties that can be utilised under constantly changing conditions. In order to survive under these changing circumstances, enterprises have to be both adaptable and willing to learn. The costs of poor quality which show up in the areas of scrap, repairs and warranties could be reduced (Blackiston
Companies introducing total quality management systems have certain characteristics (IIE Solutions 1996:13), such as using high-skills technology, being employee-oriented and competing on the basis of quality, service and variety. Other features frequently found are flexible jobs, problem-solving in team context, participation by employees, high levels of training and education, and employment continuity. One of the major objectives of total quality management is that organisations continue to find innovative ways to improve quality.

Total quality management could be described as complex, dynamic and nonlinear (Leach 1996:85). This management system is complex and adaptive in the sense that it demonstrates evolutionary behaviour. It is not exactly chaotic and does not feature rapid unpredicted changes without any pattern. This dynamic system changes with time, and is nonlinear because responses are not directly proportional to inputs.

The implementation of total quality environmental management procedures inevitably comes up against limitations. These obstacles could be bureaucratic or cultural (Blackiston 1996:17). The concepts of quality do not seem to be difficult to master, but they might take many years to put into practice. It is therefore important to be aware of these barriers before and during the implementation of total quality environmental management.

The sub strategy of total quality environmental management would include the consideration of the role of the mission and objective statements; the type of management structure; resource and maintenance management; total quality control; sustainability; the quality culture; international standards; strategic and value-based management, and futuristic views. This component influencing the comprehensive strategy towards environmental and rehabilitation management is illustrated in Figure 7.6.
Figure 7.6  5 TQEM STRATEGY

(Source: empirically developed)
7.7.2 Mission statement and objective statement

One of the initial steps of strategic management is to develop a mission statement for the organisation and for each section. From this mission statement objectives and goals are determined. Objectives are more general in nature; an example might be to rehabilitate damaged land in accordance with accepted international standards (SASOL 1997:4). Goals would be more specific (Hirsch 1988:408), a goal might be that wildlife would be introduced within five years of completion of rehabilitation operations. The basic mission statement, objectives and goals should be consistent with each other.

If a mission statement is to be effective in promoting quality management, it should include the vision of the top management, must be specific, must fit in with the organisational culture, has to be honest, and should contain input from personnel (Wright 1996:26). After the formulation of the mission statement, it should be communicated to all and should be conspicuously available. Objectives should be in keeping with the characteristics of the mining company, should be possible to achieve and should be motivational in nature (Hirsch 1988:408). In addition, they should also be clearly communicated and accepted by all participants in the rehabilitation process.

Rehabilitation management intentions would only contribute towards implementation policies if they are included in the mission, objective and goal statements of the mining enterprise. The environmental and rehabilitation managers who responded to the questionnaire confirmed that the mission statement and the objective statement have a positive influence on rehabilitation policies where they deal with environmental issues (Statement 3.2.2:83,3%).

As soon as the mission statement has been described and extended to the objective and goal statements, the management team should develop alternative strategies to meet these stated visions. Requirements for capital and human resources have to be assessed, as well as provision for risk and time, which involve both financial and non-financial factors. The mission, objective and goal statements are not static and have to be revised in accordance with changing circumstances. New approaches would be needed if the mining company were to change direction or in the case of mergers and technological developments.
7.7.3 Total quality control

The control stage of total quality management is part of the feedback loop. Rehabilitation results are evaluated and compared with budgeted standards, originating from the mission and objective statements. Actions are then taken to correct any unfavourable variances. These comparisons are made in terms of both financial and non-financial budgets, inputs and gains.

Since the natural environment is a public concern, rehabilitation management should constantly monitor the total quality of projects. Poor quality has its own hidden costs in the form of internal and external failure costs (Hughes & Willis 1995:15). Prevention and inspection costs which form part of total quality programs are incurred during the early stages to reduce from 70% to 80% of failure costs such as fines and penalties during later stages (Hughes & Willis 1995:16).

Various categories of quality (Riahi-Belkaoui 1993:5) could be identified as the basis for control analyses. They are the following:

- Performance and features quality categories refer to the operating attributes of rehabilitation management.
- Reliability, conformance, durability and serviceability quality categories determine future failure and maintenance costs.
- Aesthetics and perceived quality refer to how the external affected and interested parties experience the rehabilitation operations and final results, based on the amount of information that is available to them.

The management team has to decide which of, and to what extent, these categories of quality will be met, and what investments will be made in terms of the financial and non-financial expenditure on these objectives. All quality control costs and procedures in compliance with the reclamation strategy should be assessed, both for rehabilitation and for maintenance after vegetation. Projections should be made not only in terms of direct control expenditure, but also in terms of the periods involved for each control cost item and for inflation calculations (Bishoff 1984:169), especially under circumstances of significant fluctuations of price indices.
Part of total quality control is quality cost reporting. Quality cost reporting (Riahi-Belkaoui 1993:10) enables the management team to realise the extent of the quality-cost problems and shows them where the problems lie. It enables them to set and meet targets, to assess progress in respect of cost reduction policies, and it enables them to motivate departments to set targets and to assist these departments in achieving those goals.

Pollution control procedures and the associated costs should therefore be regarded as quality control measures to prevent water, air and soil pollution. These quality control costs would include expenditure to cover waste dumps, the establishment of vegetation, procedures to prevent injuries or loss of life from hazards at abandoned mine sites, shafts and boreholes, and methods to avoid fires (Bishoff 1984: 187), particularly at abandoned coal mines and coal discard dumps.

In order to supplement quality cost reporting which is based on historical figures, a feedforward control system (Riahi-Belkaoui 1993:98) for total quality control should be considered for implementation. This system is based on predictions, projections and simulations of the effects of future rehabilitation actions.

7.7.4 The bottom line; top-bottom management; bottom-top management

Changing public attitudes concerning environmental preservation and management are forcing management teams to reevaluate the traditional approach of an impressive balance sheet with high profits as the bottom line guideline. The bottom line is described (McLeod & Makins1993:126) as “the last line of a financial statement that shows the net profit or loss of a company or organisation”, and as “the conclusion or main point of a process or discussion”.

Accountability to workers, in the form of informed choices, is essential if the management system is to function adequately (Estes 1996:213). By concentrating not only on the achievement of higher profits, but also on the people in the workforce and on the natural environment, the purposes of total quality environmental management could be served. The key to effective rehabilitation management is to change the perspectives of the workforce towards support of the pollution management efforts, which would inevitably result in improved cost management and the prevention of contamination. They should regard the natural environment and rehabilitation management as a potential opportunity
and not as a liability. Although top-bottom management systems would be the only means of delegating under certain circumstances in South Africa, bottom-up management should constantly be considered and developed as a means of getting all levels of the workforce involved in improved quality management.

A bottom-up approach could add significantly to the quality of rehabilitation projects. Quality would be better served if everyone in the workforce understood the purposes behind the goals (Juran 1989:294). Since the workforce is interested in management, they should be informed about developments. Their suggestions for improvements to the tasks they are performing and any creative proposals they can offer on financial and non-financial issues should be included in the main flow of feedback to the rehabilitation management team. Employee involvement in quality issues should include teamwork, encouragement to solve problems, willingness to experiment with new ideas, and a commitment to do the best possible job (Ciampa 1991:181). The basis of quality work would be to do it right the first time and to yield real and valuable benefits (Hollington 1997:33) in both financial and non-financial terms.

One of the major assets of an enterprise is the power of people, including the workforce, managers, suppliers, customers (Johnson 1992:103) and the surrounding community, which could remove limitations that impede flexibility in a total quality approach. The workforce is no longer merely a source of energy and cost which is obliged to follow orders in a top-down system and is motivated merely to maximise profits. Included in the features of total quality management is the emphasis on the empowerment of employees. Employees can only be empowered when they are involved in strategic planning, can be trained to improve the way in which they perform their tasks, and can be trusted by management (Raiborn & Payne 1996:964). Senior managers should allow workers to participate in quality-related environmental decisions and to accept more responsibility for quality output in an atmosphere of flexibility.

### 7.7.5 Sustainability

The system of total quality environmental management has as one of its major aims sustainable development (Stead & Stead 1993:19). Companies need to respond to growing numbers of environmentally conscious stakeholders in the marketplace who champion the cause of the natural environment by including sustainable development in strategic
management programmes. Sustainability or sustainable development could be described (Bebbington & Tan 1996:75) as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. It means “preserving the ecosystem as well as maintaining the ability to provide humans with the goods and services necessary for a good life, complete with fulfilling work and economic justice” (Banks 1993:23, quoting Stead & Stead). An effort is made to find a balance between economic growth on the one hand and environmental preservation on the other, based on the limit that could be reached in population numbers whose needs could be met by finite resources (Todaro 1994:327). Sustainability therefore integrates the social, economic and ecological values (Milne 1996:137) of present and future generations in a multi-disciplinary focus, including future generations as a stakeholder.

In accounting and management accounting terms this would mean (Bebbington & Tan 1996:75) that a mining company leaves the natural environment no worse off at the end of the accounting period than the extent to which the company falls short of its target, by calculating the additional annual costs which would be borne by the company if it were to remedy any environmental damage it created during the course of the year. As part of the management team of trained professionals involved in sustainable rehabilitation strategies, the management accountant has the task of evaluating the costs of the pollution and developing preventive approaches (Ullwe et al 1996:140). When the available resources are reduced for the present and future generations as a result of the failure to conserve, remediate and recycle, these generations are confronted with threats (Banks 1993:23), while conservation and remediation would give them opportunities. The essence of sustainable development is to benefit from natural resources while contributing to and improving them (Schmidheiny 1992:179).

In order to achieve sustainability, sufficient resources need to be committed to the effort as well as to making employees accountable for their actions. Sufficient capital should be allocated, appropriate equipment should be purchased, and the right personnel should be employed and trained to fulfil the commitment to sustainability (Banks 1993:25). Employees should be encouraged to strive for and rewarded for environmentally sound actions.

Various positions in respect of sustainability could be identified. The gaps between these positions would be components of full environmental cost accounting, while the gap
between the worst and best situation would form the basis for the calculation of sustainable costs. The following positions are identified (Bebbington & Tan 1996:76; Banks 1993:25):

- The present unsustainable position where costs are not calculated for externalities arising from activities.
- A more sustainable position where the cost of environmentally sound output is estimated. Since some environmental externalities have been internalised, output would cost more.
- A position where the environmental impacts of present activities are estimated. Additional costs to inputs are incurred to prevent adverse environmental impacts. Costs are required to remediate negative environmental impacts of output from activities.
- A fully sustainable position where the cost of environmental impacts for both present and past activities are included.

The gaps between the first and second positions, between the second and third positions, and between the third and fourth positions are the components of full environmental cost accounting. The gap between the first and the third positions forms the basis for sustainable cost calculations.

Various limitations to the introduction of sustainability would, however, be encountered (Banks 1993:24). Physical barriers include technical limitations such as the lack of substitutes for natural products at reasonable prices, processing methods producing significant levels of waste, and inadequate conservation methods. Social limitations to sustainable developments are found where different levels of development and commitment to environmental sustainability exist. Organisational barriers would include a culture that poorly understands the concept and prefers the familiar.

Provision should be made in the strategic programme for overcoming these limitations. These strategies would include drafting environmental policy statements as well as budgeting for improved training and education to employees, and for research and development to improve technical aspects. The complementary and interdependent parts of the strategy for sustainable development such as the protection of the natural environment, trade expansion, and economic growth and development (Schmidheiny
Although South Africans do not always understand the concept of sustainability, their opinions on sustainable development are substantially in agreement with those of other countries (Shotter & Vorster 1996: 196). This would imply that local environmental and rehabilitation managers are not totally unfamiliar with this concept, and would be able to incorporate sustainability costs in their rehabilitation strategies.

The concept of sustainability should be regarded as a long-term policy, and should be constantly reviewed and re-evaluated (Bebbington & Gray 1996: 137). Methods of assessing sustainability costs are being developed and include the involvement of companies and communities, as well as transparency and accountability. Additional mechanisms are required to capture the wider non-market impacts of mining operations in order to enable management accounting to include the externalities of sustainability. Sustainability is one of the most important components of full environmental cost accounting, which is in the first stages of evolution.

### 7.7.6 Quality culture

Traditionally and in the bureaucratic system the minority would do the thinking and give orders. The majority receive orders and do what they are told under close supervision (Wright 1996: 19). Standards for quality are set from above and inspection, testing and performance control are top-down functions. Workers are not encouraged to make suggestions or to question.

If total quality environmental management is to succeed, every one in the mining company has to be involved and interested in quality environmental and rehabilitation policies. Each member of the organisation should be determined to reduce and eliminate any costs that do not add value to the remediation and rehabilitation process. Total quality management requires a culture where everyone believes that a contribution should be made towards the improvement of the quality of the processes or projects. In South Africa, most environmental managers are positively disposed towards quality management approaches in rehabilitation policies in mining enterprises (Diagram 4.2 and Diagram 4.4).
In order to develop this total quality management culture, changes in empowerment are necessary. Managers must be prepared to allow others to take decisions and trust others, and workers have to be prepared to accept responsibilities (Wright 1996:27). A new approach should develop with the focus on “doing things right the first time” (Russell 1990:22). This process of change in the culture towards quality would involve both learning and unlearning. All changes should be negotiated and flexibility should be built into these plans so that there can be a change towards a quality culture or where a quality culture already exists it can be improved. A quality culture would lead to improved productivity, less waste, increased profitability and a better and pleasanter working environment (Russell 1990:23). The combination of people and quality is the link which leads to a successful total quality management future.

7.7.7 International standards: ISO9000 and ISO14000

International standards such as ISO9000 on quality management and ISO14000 on environmental management, issued by the International Standards Organisation (ISO), form an integral part of total quality environmental management. This view is supported by the environmental and rehabilitation managers who responded to the questionnaire. They agreed that the application of ISO9000 (Statement 3.1.1:76,6%) and ISO14000 (Statement 3.1.2: 89,1%) should be encouraged (Diagram 4.8). The introduction of ISO9000 and ISO14000 fulfils the need for a comprehensive international set of standards on quality and environmental management.

As South African companies start to compete with international companies in the global economy, more attention is being focused on their environmental management systems. A company wishing to promote new investments needs to ensure that it is implementing environmental and rehabilitation management systems and procedures that comply with international standards.

The series of ISO9000 standards consists (Webster 1997:19; Rothery 1993:30) of ISO9001 for the design and development of products, ISO9002 for installation and manufacturing according to design specifications, ISO9003 for the ability to inspect and test output, and ISO9004 for standards on services. The ISO9000 series of international quality standards ensures quality in goods and services manifested in increased productivity, lower overheads and less waste, and would stimulate creativity and
teamwork (Taormina 1996:44). Affected and interested parties can assess the quality system and check the ability to function satisfactorily (Sadgrove 1994:32). ISO9000 certification provides a competitive advantage for the measurement of gains and assists in the improvement of existing processes.

During the ISO9000 registration process (Webster 1997:21) all employees are trained on the quality policy of the company and of the audit procedures. Before a company can pass the registration audit, ISO9000 requires that all procedures should be written down in detail. This quality manual develops into a document control system which is the foundation of a quality system. The corrective action of internal audits provides feedback on problems, and their causes can be identified and resolved in a process of continuous improvement. Previously hidden cost constraints could be revealed by this process of registration and could then be reduced. The costs of the initial assessment and certification, surveillance costs, the costs of extra meetings and planning, and of additional control measures, should be budgeted for (Sadgrove 1994:35). These costs could, however, be largely offset by efficiencies and savings on costs which could be achieved by the introduced standards. ISO9000 also provides opportunities (Vloebergs & Bellens 1996:48) and creates an orderly organisation. The input of human resources, employee cooperation and involvement will eventually determine the degree of success of the quality management system.

Although the ISO9000 series was issued in 1987 and revised in 1994, a variety of interpretations of these standards (Ridley 1997:52) indicates that ISO9000 is not yet fully developed. But ISO9000 registration should not be applied only as a marketing instrument, thereby defeating the purpose of the quality standard. Other limitations (Vloebergs & Bellens 1996:48) are the failure to include leadership characteristics and cooperation at various levels, and the failure to make allowances for the fact that improvements do not occur automatically. Previously lenders relied only on the World Bank Environmental Guidelines to assess environmental pollution risks regarding international investment projects. This practice is in the process of being extended to include voluntary international environmental standards such as ISO14000. The World Bank Guidelines provide a useful first screen for evaluating environmental risk, but more comprehensive criteria are needed. Lenders do not want to be associated with projects abroad that contaminate the natural environment. Since South Africa is dependent on overseas investments to a large extent, registration of these international environmental
standards might in future be the key to obtaining funds and surviving economically.

ISO14000, which developed from ISO9000 (Begley 1996:50), attempts to provide a framework to prevent and detect violation of environmental laws and regulations in all the countries involved. Companies have to identify and evaluate all the environmental effects of its activities, products and services. In order to obtain registration the company has to “establish, implement and maintain an ongoing comprehensive system of policies, procedures and practices to identify and comply with its environmental requirements” (Henderson 1995:50). The ISO14000 standard requires that a company should define an environmental policy that includes the following (Henderson 1995:51):

- nature, scale and environmental effects of activities
- a commitment to continuous improvement
- a commitment to compliance with environmental laws
- a framework for setting and reviewing environmental objectives and goals
- documentation of policies
- training of employees on the importance of environmental policies
- emergency planning and response
- procedures for controlling all documents related to environmental conditions
- potential consequences of noncompliance with these procedures

The ISO14000 series consists of ISO14001 on the minimum requirements and of ISO14004, which provides the framework. Both have already been accepted. Other standards that are being developed (Alexander 1996:15), are standards on environmental auditing, environmental labelling, environmental performance evaluation, life-cycle analyses, environmental aspects of product standards, and standard terms and definitions.

The advantages of ISO14000 registration and implementation would be that a mining company would be able to identify and correct environmental damage and unsafe working and living conditions. Cost control would be improved, while environmental legislation would be adhered to. Ensuring more effective ways of complying with environmental norms would increase the possibility of obtaining funds from lending countries. In addition to the long-term beneficial effects on the environment and international trade, ISO14000 will also benefit the people involved (Alexander 1996:18). The ISO 14000 framework provides the minimum standards for an effective environmental compliance
programme.

It is possible to a large extent to integrate ISO9000 and ISO14000. If ISO9000 has already been implemented, it is not necessary to change all the systems being implemented for ISO9000 in order to introduce ISO14000 (Van Rooy 1998). The successful implementation of these standards depends on commitment from all levels and from the people who perform all activities, especially from top management. Policies to include these standards go through the stages of planning, implementation, operation, corrective action, management reviews and continuous improvement (Department of Environmental Affairs & Tourism 1998).

International trends are directed towards standards for establishing general environmental guidelines relating to the various stages of the mining process, and of different types of environmental impacts of mining on the health and safety of employees and the communities (Dias 1992: 112). In this regard accountants and management accountants involved in rehabilitation decision-making processes should be prepared to make provision for these developments. Adherence to these voluntary standards would assist mining companies and the community to reduce long-term damage and to increase sustainability.

7.7.8 Resource management

The task of the resource manager should be included in the overall task of the environmental and rehabilitation management team. The resource manager acts as mediator between society and the natural environment from which resources are derived (Bonnicksen 1991:11). A framework is established to organise relationships and interactions between people in industry and their natural environment with the aim of achieving sustainability. This function forms an integral part of total quality environmental management.

Resource management would therefore include life-cycle assessments from impact assessments to closure provisions. These would entail the development of pollution risk profiles, the preparation of strategic plans, regular progress measurements and reviewing and modification of plans. These actions would emphasise the commitment of the mining company towards the maintenance and improvement of the natural environment, the
protection of the health of the people involved, and the ensuring of sustainable development. Mining companies that work with hazardous waste materials have to consider the potential impact of these substances on natural resources. A natural resource damage liability regards the natural environment as an asset and realises that the services provided by the natural environment to outside markets are highly valued by society (Smith 1994:16). For each type of natural resource a set of property rights for the community is defined in terms of this approach.

Resource management would include the assessment of pollution of the natural environment and of the effect of pollution on the community. In Colorado, for example, damage to natural resources from releases into a river system was determined by studying (Smith 1994:30) the utilisation of water resources by the outside community, and how pollution would influence their quality of life.

Constant changes and developments regarding mining and processing techniques, laws and regulations, and the interests of the stakeholders necessitate regular feedback and update procedures. Environmental assessment and auditing of resource and asset management are useful especially for transfers and acquisitions of mining properties.

Resource management is an indication of the commitment of the mining company towards maintaining and improving the quality of the natural environment. This policy would protect human health and would ensure sustainable development. In compliance with international standards, constant financial and non-financial assessments, audits, evaluations and feedback would demonstrate continuous improvement and the integrity of the company would be maintained.

7.7.9 Future cost policies

The formulation of future cost policies forms an integral part of total quality environmental management. Since total quality management is still in the process of being introduced and developed, future developments within the total quality framework should be provided for in financial and non-financial terms. Compilers and users of accounting and management accounting information need to recognise and accommodate changes in cost structures. New approaches to calculating and presenting financial and non-financial information in a meaningful way should be developed.
In order to assess future investments, the particular stage of development on various aspects towards total quality management should be determined. Traditional operations management and total quality management should therefore be compared (Prasad & Sprague 1996:73). Where the focus on quality is part of inspection after the completion of a task in the traditional system, it is incorporated into the process together with total quality management. In the first-mentioned system defects are defined, while the latter system would not tolerate defects. Under total quality management continuous improvement originates from the technical and human sides, whereas technological breakthroughs are the only means of improvement under the traditional system. Problem solving is undertaken by small groups or teams under total quality management, whereas the other system has only an individual manager or specialist to solve problems. More emphasis is placed on customer satisfaction under the total quality management approach than under the traditional system. Responsibility is spread throughout the organisation under total quality management where only one department is involved with the traditional approach.

To enable companies to provide for future costs in respect of total quality rehabilitation management procedures, causes of failure of total quality management should be taken into account. It is important that these barriers should be understood and avoided before and during the implementation and development of total quality management procedures. The following are some of the causes of failure of total quality management that have been identified (Masters 1996: 54):

- lack of management commitment in the form of support and interest, and improper planning which does not provide for dialogue, a time frame, flexibility and for a reward system
- inadequate knowledge and understanding of total quality management, a lack of continuous training and education for all, and inability to create a learning culture that provides for continuous improvement
- inability to change the organisational culture owing to a fear of change, and poor relations
- ineffective assessment procedures, unreliable data, a lack of access to results and short-term focus on preventing immediate pollution
- insufficient attention to the expectations of internal and external stakeholders
An awareness of these causes of failure should be emphasised. Plans could be made to overcome these potential problem areas by understanding them and being prepared to counter them. The traditional role of management accountants as watchdogs would be replaced by a new role as suppliers of information and part of decision-making teams (Bromwich & Bhimani 1989:5). Management accountants should in future be able to recognise opportunities and challenges since accounting will become more decision-driven.

Certain social trends are evolving which will require the restructuring of existing accountancy approaches in future. Although these trends are noticeable in the USA, they are also present in South Africa, where they are at an earlier stage of development. Some of these directions, which have implications for management accounting as well as for a total quality approach, are the move towards an information society, the trend from national to international economics, a move from short-term to long-term strategies, and a shift from hierarchial structures to information networks (Enthoven 1985:6). The information measurement system will link companies, authorities and national accounts and provide more relevant and projected information. Efficiency and effective measurements will be required which are supported by legal and statutory guidelines, professional and institutional accounting infrastructures, research, education and training, and socioeconomic structures. A greater need for utilisation and measurement of assets at their service value is developing as well as a need to evaluate in terms of alternatives (Enthoven 1985:27). These integrated, multidisciplinary trends and concepts should be evaluated and included in strategic management planning models.

Each company has its own version of total quality management and this results in a complex situation for purposes of comparison. Continuous improvement in quality rehabilitation is based on the technical and human attributes of the mining company. Diverse total quality management strategies are integrated with existing traditional strategies, cultures and systems (Prasad & Sprague 1996:82). Although a company might be utilising total quality management procedures, it would only be fit under its own particular circumstances. A total quality management strategy is necessary to achieve efficiency, but is not sufficiently developed to be effective in all respects. The existing transition process towards total quality environmental management still needs to be refined in order to be regarded as a global model. It might even be necessary to accept new paradigms in the process of development.
As part of the futuristic view of and expectations for total quality environmental management, provision should also be made for management systems after total quality management has been achieved. In the stages that follow after total quality management, the approach towards invisible quality is likely to emerge (Maromonte 1996:14). Performance improvement at reduced operating expenses would be achieved in an infrastructure originating from total quality management.

7.7.10 Strategic management

Since escalating environmental costs and long-term pollution prevention are serious concerns, rehabilitation management policies should be built into the comprehensive strategic management plan of a mining company. A strategic management plan is the “course of action leading to the allocation of scarce resources over time to reach identified goals” (Pascale 1991:42).

Extensive environmental damage and the accompanying expenditure could be avoided through better long-term management practices and policies. All aspects of environmental and rehabilitation management varying from preventive costs to clean-up costs should be incorporated into strategic management programmes. The accounting and management accounting functions of financial analysis, planning and control (CIMA Stage 4 Paper 14 1996:77) should not be independent of the central total quality strategy, but should be complementary to it. Issues such as high quality on a timely basis together with low costs (Hiromoto 1988:26) should also be valid for management accounting members of management teams who are preparing strategic plans. Strategic management and quality management with the objectives of achieving efficient methods of functioning that produce less pollution should therefore be integrated into strategic quality management.

In order to determine effectiveness and efficiency as well as to evaluate performance, the management team has to refer back to an overall or strategic plan. In this regard Hirsch (1998:397) defines a strategic plan as

an organizing statement of what a company wants to accomplish and how they will achieve their basic mission. Measures of success must relate to this plan to have ongoing future-orientated meaning.
Kabat (1983:10) sees in long-term planning on a global, national and corporate level the solution to the survival of society. Strategic planning would enable its users to anticipate problems and opportunities, to assign priorities to them, and to manage diminishing resources. This is in accordance with the quality master plan which defines quality objectives and formulates goals. Basic goals that would support the quality objective (Russell 1990:18) are to integrate and promote quality management, to consider the needs of stakeholders, to provide value to them, and to achieve continuous improvement. Continuous forward planning and adequate information would form the bases for these goals.

Internal as well as external factors should be taken into account when preparing a strategic plan (Hirsch 1988:398; Pearce & Robinson 1994:17). Internal capabilities include past strategies, the availability of capital, capacity and human resources. External realities such as economic projections, the milieu of operations, the availability of labour, technological developments, regulations, and overseas experience have to be taken into account. The gradual or immediate implementation of the strategic plan, the involvement of individuals and teams, as well as the monitoring of actions would also be documented in detail in the plan.

Strategic management accounting has to support the strategic objectives concerned with quality, cost and time (Ansari et al 1997c:SMA-6). These functions would include short-term and long-term operations as well as the positive involvement of the extended enterprise in pursuit of the achievement of the strategic objectives. The objective of strategic management accounting is not only to collect data, but also to turn raw data into strategically relevant financial information (Ward 1992:304), allowing for a degree of flexibility. Strategic cost analysis for information purposes would consist of the following actions (Wilson 1991:95):

- Identify the value chain and assign costs and assets.
- Find the cost drivers of each value activity and determine their interactions.
- Benchmark with similar mining companies.
- Develop a cost strategy for lower cost by changing cost drivers or the order of the value chain.
- Ensure that cost reductions do not negatively affect sustainability.
The link between strategic management and management accounting is to be found in the shared characteristics of both functions, namely analysis, planning and control (Ward 1992:9). Strategic management accounting has to ensure that adequate funding can be made available for rehabilitation purposes as required by the strategic movements of the company. It provides the financial and non-financial values which would form the basis for decision making (Kabat 1983:102) and which would influence the processing of the attributes of the strategic plan.

Strategic rehabilitation management accounting is concerned with life cycle costs, and in particular with the quality of land, water and soil, from impact assessments to aftercare and maintenance. Other concerns are related to the types of financial risk involved with the source of funding, and a combination of life cycle costs and cash flows in the Boston Matrix (Ward 1992:40).

Formal strategic control practices could negatively influence performance when they are focused on rigid plans, objectives, targets and the collection of information. Flexible and more creative strategic reactions under certain circumstances should, however, be allowed in quality strategic planning (Ittner & Larcker 1997:310). The strategic quality management process requires continual reassessment and updating. Although the basic strategic management model is unlikely to change, the branch strategies have to be adapted to changed circumstances.

7.7.11 Maintenance management

Maintenance management in this study concerns asset care after closure and the rehabilitation of abandoned mines. A proactive approach towards the maintenance of abandoned land would require forward thinking in order to develop the best practices by means of mixing and matching systems and methodologies (Lane 1996:20). A team of experts would participate in an effort to meet the specific needs of a particular site. Efficient maintenance practices would contribute to the lessening of the financial burden associated with reclamation activities.

Maintenance management should be integrated with other applications such as human resources, financial applications, workflow and electronic documentation. Expenditure in connection with contracting out against in-house maintenance management options
should be realistically compared by the management accountant. Asset care through maintenance management would add value to existing abandoned mine sites.

Expenditure associated with maintenance management includes assessment costs during the initial stages, operating costs, control costs, and fines and penalties. To enable companies to become more proactive, costs should be incurred in respect of continuous staff training and the establishment of standards (Rahman 1996:19). A balance should be found between preventive and maintenance costs. Non-financial factors such as the needs of the surrounding communities of these sites, and the period for which maintenance would be required, have to be included in the total quality environmental management programme.

With this information available, operational and overhead costs could be controlled in accordance with the strategic plan (Rahman 1996:21) and without forfeiting basic ethical standards. Effective assessment and monitoring of the long-term plan would provide feedback that would make it possible to achieve total quality service. This would encourage continuous improvement of the maintenance management strategy.

7.7.12 Value-based management

Value-based management is an approach, a framework and a set of financial instruments for building maximum long-term shareholder value (Bannister & Jesuthasan 1997:15). A series of analyses are included in the value-based audit, which is the evaluation of the culture for decentralised decision making, performance measurement, financial information system, and incentive design (Bannister & Jesuthasan 1997:12).

An increased awareness on a global level of environmental values and attitudes would cause people to rethink values within their management strategies. The interested and affected parties for which the financial statements are produced would expect their suppliers to integrate sustainable development into their strategic planning in order to demonstrate their accountability (Allen 1994:53). Environmentally responsible companies would choose to avoid investing in enterprises that give rise to a great deal of pollution or in countries where higher levels of pollution are tolerated. Other companies would prefer to invest or locate in parts of the world where pollution control would permit higher profits. In the short term only, the profits of the first-mentioned company would
decrease in relation to those of the latter company.

The long-term benefits for a company with an environmentally responsible strategy would be visible in a decrease in the cost of activities, increased profits, decreased cost of capital and a decrease in the risks associated with laws and regulations. The following are some of the benefits identified in respect of an environmentally responsible strategy which would add value to companies applying this strategy (Allen 1994:70):

- Less sick leave as a result of fewer health problems would result in higher morale and the possibility of attracting higher quality workers. Reduced insurance premiums related to disabilities and medical claims would be possible in the long term. Lower employee turnover would reduce expenditure related to recruiting and training.
- Management would have more time available to improve quality management in the absence of lawsuits requiring secondary time.
- Better relationships with the community and activist groups owing to environmentally responsible strategies would lower public relations costs.
- In some countries mining companies could benefit from tax incentives for pollution abatement equipment.
- Both suppliers and buyers from the same country and from other countries would evaluate the environmental standards of the company and decide on the discontinuation or maintenance of business relationships. Risk premiums could be attached to dealings with environmentally irresponsible companies.
- Input costs could be reduced by the consciousness of minimising waste, as well as by the reduced costs of waste disposal.
- The environmentally responsible company would be able to market itself better, and might even receive support from environmental groups. This would enable the company to attract more eminent members to its board of directors, which would enhance its image and profitability.
- Overseas lending companies carefully audit the environmental records and risks of companies before investing. If future laws and regulations were to require compliance with additional pollution standards, preference would always be given to an environmentally responsible company that strives to exceed standards in order to prevent huge adaptations at a later stage.
Strategies to improve the value of a company are based on the elimination of wasteful expenditure and the management of costs. Inappropriate cost management and management structures impose high overheads which might negatively affect the company in its markets. The cutting of costs would only be free of risks if the management team are purposely aiming at the adding of value. The economic benefits in terms of added value for being an environmentally responsible mining company could indeed exceed the costs of environmental and rehabilitation operations. By achieving new levels of excellence and quality through improved planning and technology, companies have the means to add real value for their stakeholders, which include future generations.

Total quality environmental management can be enhanced by incorporating aspects of value-based management. The concepts of value and improving value could support the continuous improvement objective of total quality management. Both quality (fitness for use) and value would enhance the total quality paradigm.

7.7.13 Feedback: gain or loss: to management

Total quality environmental management encourages a company to develop, evolve and grow, and improves the chances of long-term prosperity. Part of the total quality approach is the development and maintenance of comprehensive feedback cycles. The introduction of changes should be geared to provide rapid feedback and adaptation (Leach 1996:90). Both internal feedback from employees and external feedback from the community at large should be obtained in order to improve existing quality management strategies.

Total quality environmental management could also be introduced in smaller mining companies in view of their uniqueness. Although resources are often severely limited, adaptations could be made to accomplish more with less (Bonvillian 1996:35). A greater sense of teamwork among employees, a basic approach of minimising waste, and more comprehensive expertise from leaders would support feedback in a quality management culture.

The commitment to quality environmental management commences with the mission statement and of the objective. Management has to decide what management structure would yield the best quality rehabilitation output and how much input would be allowed from bottom to top management. A policy on asset and resource management in
combination with value-based management should be determined, as well as maintenance policies after the closure of mines. Decisions should be made on the degree of total control over quality, costs and non-financial inputs and gains. Transparency on the sustainability views of the management team as well as the implementation and maintenance of a quality culture should be included in the comprehensive rehabilitation management strategy. Since international standards such as ISO9000 and ISO14000 will be required in the near future by international companies dealing with South Africa, provision should be made for their registration. A comprehensive strategic management plan for the long-term, including management of rehabilitation projects and future investments, should be formulated as the basis for the total quality environmental management programme.

Since total quality environmental management is a complex strategy, the management team, which includes the accountant and the management accountant, should be prepared to constantly acquaint themselves with alternative methods for achieving continuous improvement.

7.8 RESEARCH AND DEVELOPMENT

7.8.1 Introduction

In order to achieve continuous improvement according to the total quality management plan, research should be conducted and adequate training provided to develop the capabilities of employees, and update existing rehabilitation management policies. The leading role of industries such as the mining sector should not be underestimated. Traditionally “order and good government...among inhabitants of the country who had before lived almost in a continual state of war with their neighbours” were introduced by the development of industries (Adam Smith 1920, written in 1776:363).

Since research and development programmes in respect of rehabilitation management in various mining companies vary considerably, performance measurements should be designed for the particular needs (Maromonte 1996:108) of the company. The research and development budget for rehabilitation projects should be applied as a basis for comparing the actual performance assessments. An indication must be given of what progress has been made towards achieving the stated goals.
Technological developments would not only increase output at lower cost, but would also support rehabilitation management policies. New methodologies would decrease pollution as well as expenditure on clean-up operations. The rate of resource depletion could be reduced (Meadows et al 1983:1977), with the result that the value of land would not be decreased.

Expenditure on research could be classified into basic and general research, and applied research for particular projects (Van der Schroeff & Groeneveld 1984:260). Simultaneously with technological and processing research and development programmes for rehabilitation management, improved accounting and management accounting concepts should also be investigated and attempted.

Research and development form an integral part of the development of a comprehensive rehabilitation management strategy for the mining sector in South Africa. Research and development programmes would include the education and training of employees and employers, team approaches involving consultants and experts, benchmarking, contingency planning for emergencies, the investigation of experience from other countries, and award systems. These components of the research and development programmes are illustrated in Figure 7.7.

7.8.2 Education and training

A culture should be established in which people know what rehabilitation entails and where it is going. In a state of chaos with poor supervision, inadequate management practices and limited statistical control, it is impossible for anyone in the company to develop their potential to perform quality tasks (Deming 1982:194). This might lead to unsatisfactorily rehabilitated land where projects would have to be initiated to rectify mistakes from the past at huge expense to future generations. According to a study by the HSRC (Daily Dispatch 1997) companies in South Africa do not yet realise the financial and non-financial benefits that could be derived from employing environmentally trained people who would reduce waste and maximise production.
Figure 7.7  6 Research & Development Perspectives

(Source: Empirically developed)
The environmental managers, however, who responded to the questionnaire, confirm that positive changes in behaviour towards rehabilitation and environmental management are attained by means of education and training (Statement 3.2.6:83,3%). This attitude is supported by the view that monetary investments (Statement 2.2.3:64,6%) and investments of time (Statement 2.3.2:70,2%) in education and training of the whole workforce in environmental preservation would improve strategic management policies.

As part of the management team the management accountant has to plan and budget for training and education for all employees and employers. The entire management team should be included, together with all functions and all levels (Juran 1989:323). Provision should be made for money and time in this plan, as well as for decisions on voluntary or mandatory training, sequence of training procedures, subject matter and the practical aspects of training.

By being more aware, and better informed, qualified and able to understand changes in respect of rehabilitation management policies and the accompanying cost aspects, both employees and employers would be able to make contributions of a considerably higher quality. Higher productivity and earnings would eventually follow.

In this regard the developed skills and knowledge applicable to specific tasks could be referred to as human capital (Meyer & Thibadoux 1996:539; Enthoven 1985:19). The provision of education and training to employees for improving skills and decision-making, results in people who are more valuable and productive both in the company and in the community. Better education makes it possible to adopt more sustainable practices, particularly in respect of environmental and rehabilitation issues. Qualified and trained employees are not easily replaced and an atmosphere of job security should be achieved. This leads to less expenditure on recruitment and training.

Modern methods of training on the job form an integral part of management strategy (Deming 1982:31). This should be supported with a vigorous and continuous programme of education and retraining in new knowledge and new skills (Deming 1982:47). Better educated and trained employees would adjust more easily to new responsibilities, fewer inspections would be needed, and the quality of inspections would improve. Education increases an awareness of a subject and this would support the forming and development of personal values. Everybody should be exposed to education and training programmes.
in the section of rehabilitation management pertaining to their field of specialisation.

7.8.3 Team of consultants and experts

The management accountant should function with the support of cross-functional teams and experts through all the phases from design to disposition during rehabilitation activities. This is the opinion of 78.7% (Statement 2.1.5) of the environmental and rehabilitation managers who responded to the questionnaire. These teams of experts could include any combination of botanists, chemical engineers, actuaries, geologists, civil engineers, hydrologists and community leaders. Strategies should be developed that ensure full utilisation of their technical skills, experiences and expertise (Diagram 4.9). The rehabilitation managers who responded to the questionnaire do not represent management accountants (Table 4.2(a) and Table 4.2(b)). The current rehabilitation managers in South Africa do not have as one of their qualifications extensive management accounting training. A need for people with this qualification in the team therefore exists.

Each one of the members of the management team must be given an opportunity to create, innovate, learn, inspire and advance their careers as a result of team experience (Milas 1996:37). Provision should be made for necessary external consultation and relationships with other teams. These teams have to function within predetermined financial budgets and commitments, and have limited resources available to them.

Accountants and management accountants should be involved in the strategic process from the design phase right up to maintenance after closure of mines. Their role is changing from that of record-keeper to that of joint planning manager (De Villiers 1998:3). Through involvement in the comprehensive rehabilitation management programme, a positive contribution could be made in terms of the design of better accounting and management accounting systems designed right from the start. Accountants and management accountants have to determine exactly what skills are required and how to acquire them (Lowry & Yap 1997:50). In addition to traditional skills, other proficiencies would be required such as proficiency in written and verbal communication, computer training and staff management.
7.8.4 Benchmarking

An important instrument towards research and development is the process of benchmarking. Benchmarking consists in the investigating and identifying of best practices and utilising them as standards to improve processes and activities (Ansari et al. 1997c: SMA-17). Benchmarking is “a systematic search for the best practices, from whatever source, to be used in improving a company’s practices” (Schonberger & Knod 1994:38).

Therefore, benchmarking is a technique for achieving continuous improvement. The company’s services, products and activities are measured against those of top performing, world-class companies, and against practices either internal or external to the company (Drury 1996:24). The objective of benchmarking is to find how rehabilitation processes and activities could be improved. The latest developments, best practices and methods could then be incorporated, directly or with adaptations, within various sectors of the company.

Benchmarking as a means of searching for information comprises of a systematic set of steps (Schonberger & Knod 1994:39). The benchmarking team begins the procedure with planning and organisation. Team members and the rehabilitation management process are selected. The management accountant should be part of the benchmarking team in order to obtain the maximum benefit in terms of total quality environmental management. The team then benchmarks their own process in terms of measurements in numbers, and practices in each step of the process. In the following step information is obtained on whom to benchmark and what information to ask for. The necessary approvals are gained and plans finalised for exchange visits. At the benchmarking company’s site parallel information in terms of measurements and practices is sought. Finally the benchmarking team analyses the data, develops plans, proposes changes and follows through with activities.

The importance of benchmarking was emphasised by the environmental and rehabilitation managers who responded to the survey (Diagram 4.1). All respondents emphasised that there should be an awareness of the continued need to keep striving to improve processes and activities (Statement 2.1.8). They agree that benchmarking should be used by management in the same mining sector and/or region (Statement 2.1.6:91.7%).
7.8.5 Local and overseas experience

Research and development programmes would not be complete without the inclusion and analysis of local and overseas experience of similar mining companies regarding rehabilitation management. Benchmarking only concentrates on the best practices of other companies, and does not include analyses of failures of seemingly good practices. Local and overseas experience regarding rehabilitation management policies and management accounting practices should be investigated in terms of both successful and failed operations. By not repeating or not developing potential unsuccessful operations, unnecessary expenditure could be avoided or diminished. Costs of developing existing procedures would be higher than the cost of utilising them directly or indirectly in an adapted form.

Experience of local and overseas approaches to rehabilitation management is discussed in the paragraph (7.3), which deals with the inclusion of background information as part of the development of a comprehensive strategy.

7.8.6 Contingency planning

Contingency planning for unexpected events and emergencies forms an integral part of research and development programmes, because rehabilitation management in the mining industry is involved with hazardous materials and enormous earth moving projects. A contingency is a possible future event which planners do not expect to happen, and which is not provided for in the major strategic programme. Contingency plans should be prepared in advance in the event of known possible contingencies, such as the flooding of silt dams.

These crisis management plans should provide for action immediately after they have been prepared but before the contingency situation arises, and for action in the contingency situation itself (Kabat 1983:204). Since there is no certainty as to what actions would be needed if a contingency were to arise, provision must be made for flexible plans and special arrangements that are capable of being changed from the original strategies. An interdisciplinary approach should be followed where all major types of crises are included in contingency plans, both in the short term and in long-term strategies.
Environmental and rehabilitation managers in the mining sector who responded to the questionnaire confirm that contingency planning should exist for unforeseen disasters (Statement 3.1.3: 81.3%). They agree that monetary provision should be made for contingencies such as flooding (Statement 2.2.5: 66.7%). Investments in the development of contingency planning would eventually reduce risks and the accompanying expenditure on remediation and cleaning up after accidents and disasters caused by natural forces.

Contingency planning forms part of the total quality environmental programme and should be prepared according to the following schedule (Comfort & Pitts 1996: 2124):

- Identify problems and their probable causes in the planning stage by analysing the performance of the company in respect of technical, organisational and cultural design.
- Devise a means of diminishing and preventing errors and improving quality when transforming these plans into action.
- Provide for control, evaluation and feedback to improve the learning process within the company and within the surrounding community.
- Redesign contingency policies to improve its individual actions in order to reduce risks.

Research and development aimed at effective contingency planning would eventually reduce the costs associated with losses of personnel, materials, energy and time. Social and economic projects within the surrounding community would not be interrupted at high cost, and there would be less damage to the natural environment both in financial and non-financial terms in the long term.

7.8.7 Awards

In the process of benchmarking best practices should be identified and adapted. In order to find the companies with best practices, a starting point would be to find companies which received awards for rehabilitation management, environmental reporting and for total quality management. These companies might be using good practices that are worth analysing.

Rewards to excellent rehabilitation management and management accounting teams
would further encourage improved rehabilitation approaches in the mining industry. In order to achieve these improvements, further research and development programmes should be allowed. Environmental and rehabilitation managers in the mining sector who responded to the questionnaire confirm that awards to encourage improved and successful rehabilitation management policies are important (similar to awards for safety hours) (Statement 4.1: 77.1%). They also support the statement that awards for green reporting enhance the awareness of cost management for rehabilitation purposes (Statement 4.2: 70.8%).

When considering internal award systems to encourage and improve rehabilitation awareness, care should be taken to ensure that awards should be aimed at people for outstanding group efforts, and not just at results (Johnson 1992:171). In the process of continuous improvement this attitude would lead to the long-term quality performance of the group.

7.8.8 To management

Research and development programmes pertaining to rehabilitation management should be encouraged because of the financial and non-financial benefits that could be obtained in the long term. Furthermore, research (Maher 1995:36) indicates that companies that are innovative in manufacturing and processing practices are also innovative in managerial accounting. The development and introduction of improved management accounting procedures would lead in the long term to improved decision making and higher financial and non-financial gains for companies.

Research and development programmes form an integral part of the development of a comprehensive strategy for rehabilitation management and management accounting. Investments to improve existing practices would result in the long term in improved financial and non-financial benefits to mining companies. Components of these programmes would include education and training for all employees in their particular areas of specialisation. A relatively small team of experts, which includes the management accountant, would cooperate to provide information for management decision making. Benchmarking should be encouraged in order to find the best available practices in similar rehabilitation situations for the assessment of inputs and gains. Contingency plans for emergency and unforeseen circumstances should be researched and
developed. A system of awards for rehabilitation management and reporting would encourage further research and development programmes to improve existing policies and approaches. Experience of other mining companies in similar situations should be researched, and successful procedures and processes should be implemented directly or in an adapted form.

7.9 ETHICS

7.9.1 Introduction

For the purposes of the strategy pertaining to environmental and rehabilitation management and management accounting, ethics is regarded as "a code of behaviour considered correct, especially that of a particular group, profession, or individual" as well as "the moral fitness of a decision, or course of action" (McLeod & Makins 1993:382).

True and fair approaches should be regarded as a list of permissible interpretations instead of a single point. It is important to determine "who exactly is accountable to whom for what" (Gambling 1978:31). Moral progress is a way of assessing progress in terms of intentions and the capability to respond to the needs of all mankind in the present and the future (Simon 1990:184). It is the task of the accountant and management accountant as part of the management team to adapt profitability to satisfy an increasingly environment conscious world. In a society with rapidly changing values, the business sector will be held responsible for its negative impact on the environment.

In order to extend existing codes of ethics between professionals and between professional and client, a social contract on ethical grounds should be entered into between business and society which would include accounting disclosures on natural environmental issues. But an extension of financial and non-financial reporting is not exactly the same as ethical and moral behaviour. Ethical behaviour has to be developed in terms of other factors as well, such as a broader educational basis for professionals and the setting of appropriate standards for decision making by the management team (Mathews 1995:670). In order to match the scientific, technological and economic revolution, a moral, intellectual and spiritual revolution is needed (Gourley 1997:23) to which education should make a significant contribution.
The influence of the ethical views of the management team in respect of environmental and rehabilitation management forms an integral part of the development of a comprehensive strategy. These ethical issues regarding the natural environment should be compared with total quality management, profits and values, the accountability of the involved parties, and the welfare of the community as a whole.

7.9.2 Total quality management

Total quality management techniques are designed to improve performance by empowering employees, minimising waste, changing processes and behaviour, and increasing the integrity of people, services and products with the emphasis on stakeholder satisfaction (Raiborn & Payne 1996:963). This means that total quality management is ethics put into practice. In terms of a total quality approach, present costs and benefits in respect of rehabilitation management should be regarded in the context of costs and benefits to the "ongoing chain of generations extending ... into the future" (Nürnberg 1996:55). Human costs and benefits should similarly be regarded in the context of costs and benefits to the natural environment. This means that financial instruments which are applied to analyse for decision-making purposes have to be supplemented by other instruments based on ethics.

7.9.3 Ethics and profits and value

By implementing improved internal cost accounting procedures, a greater awareness could be developed of the true costs of pollution and of the true benefits of environmentally conscious methods and procedures (Parker 1996:52). When ethical issues are included in profit calculations, the objective of the maximisation of profits would change to the optimisation of profits (De Vries 1993:6). With activity-based costing techniques as a basis, for example, methods could be developed to collect, separate and assign cost data for environmental accounting.

In the process of ascribing values to the functions of nature, decisions have to be made on "whether and how far value intrinsic in nature enables humans to come to own these values" (Rolston 1988:3). The kinds of value which are distinguished by Rolston, are applicable in the areas of life-support, economics, recreation, science, aesthetics, genetic diversity, history, cultural symbolisation, character building, diversity unity, stability and
spontaneity, dialectics (study of reasoning), life and religion. Irreversible changes in the natural order with the loss of species or the natural society might lead to hidden and unknown risks of serious financial and non-financial damage to humans and their civilisations (Ehrenfeld 1978:188). With these functions and values of nature in mind, management teams should develop rehabilitation policies that do not disturb these values, or that cause minimum disruption. Investments in the preservation of natural diversity would lead to the long-term survival of civilisations.

Putting a value on the utilisation of natural resources involves human interests and the possibility of ownership. In this regard Rolston (1988:32) argues

If value is always and only a matter of satisfying our human preferences, the morality that issues from value preservation is _ipso facto_, constrained to a class self-interest.

Daly and Cobb (1989:104) confirm this view of a broader valuation of nature by stating that

The goodness of the world in general cannot be understood simply as its value for human beings.

It is therefore important for the development of successful long-term rehabilitation strategies to consider the future implications of the strategies on ethical grounds, as well as from the perspective of the non-financial value of nature.

7.9.4 Accountability

The accountability aspect of an ethical approach towards the development of a comprehensive rehabilitation management strategy means that the management team should be “responsible to someone or for some action” (McLeod & Makins 1993:8). In order to discharge this responsibility, the principles of ecology (Gray 1992:406) should be understood. These are

- Every separate entity is connected to the rest.
- Everything goes somewhere.
- One cannot get anything for nothing from the natural environment.
In the accountability context the focus is on the supplier of the accounting and management accounting information and the user of this information within or outside the mining company. The accountant and the management accountant should realise that interested and affected parties want more funds to be channelled into rehabilitation and pollution abatement projects, even if this means a cut in dividends (Epstein & Pava 1992:32).

Traditionally accounting information needs to be relevant, useful and give a faithful representation of realities (Ijiri 1983:78). Ethical issues are not visibly part of these information frameworks. According to the opinions of the environmental and rehabilitation managers who responded to the questionnaire, mine managers would not operate according to an ethic of responsibility to preserve the natural environment if there were no laws, regulations and inspections (Statement 3.2.5). This means that ethical and accountability principles would only be applied when enforced by external means.

In order to include the ethical responsibility towards nature and future civilisations, this framework needs to be adapted. Management teams should add to and implement environmentally responsible policies by being aware of ethical issues and developing structures for dealing with these crises (Epstein & Prava 1992:33). Incentives to promote ethical, environmental and socially responsible behaviour should be encouraged as part of the development of accountability.

7.9.5 Welfare

The accountability function of the management accountant in respect of rehabilitation management extends to the welfare of the community, which means their “health, happiness, prosperity, and wellbeing in general” (McLeod & Makins 1993:1349). It is important not only to consider how profits are generated and money made, but also how this money is spent. The principle of welfare economics should be valid for the management team involved in decisions on rehabilitation management policies. This principle is that one economic situation could be preferred above another only on the condition that no-one would lose and that at least one person would gain (Van den Bogaerde 1974:421). This principle is also referred to as the Pareto optimum position. It
is defined (Blaug 1985:588) as

a position from which it is impossible to improve anyone’s welfare, in the sense of moving him to a position that he prefers, by transforming goods and services through production or exchange without impairing someone else’s welfare

Pareto improvement is similar to some gaining with none losing (Perman et al. 1996:85). This means that the management team involved in rehabilitation decision-making processes should adopt the ethical view of not merely gaining from mining activities, without considering the influence of rehabilitation projects on future and stakeholder financial and non-financial interests. This responsibility would include all stakeholders, of which the natural environment is one of the most important representatives. In this regard environmental and rehabilitation managers responding to the questionnaire agree that true profits are only recognised when none of the stakeholders incur losses from the process of profit generation (Statement 3.2.7:64,4%). In the calculation of economic welfare, damage due to pollution and other environmental damage should be deducted (Daly & Cobb 1989:410). Projections of long-term environmental rehabilitation of damage should be added to these calculations of welfare.

7.9.6 To management

By utilising ethical norms in considerations affecting the natural environment, environmental and rehabilitation management could reach a stage of development where treating the environmental challenge as an opportunity would result in reduced costs in the long term. Balances could be found which benefit both society and the environment. Within the framework of total quality management, present rehabilitation expenditure extends into the future with the accompanying financial and non-financial implications. Profits and values intrinsic to nature as well as their future values should be included when preparing a strategy for rehabilitation management. The accountability of the management team involved with rehabilitation projects would allow them to support and implement environmentally responsible policies. This responsibility would extend to the welfare of the affected and interested parties, in the sense that some might gain without anyone losing. Not only gain, but also considerations of the influence of environmental and rehabilitation projects on future financial and non-financial interests should form the basis of present management decision making.
7.10 SUMMARY

The implementation and maintenance of a strategy for total quality rehabilitation management requires a team approach that would include a variety of multidisciplinary expertise. The functions of the management accountant and the accountant form an integral part of the development and functioning of the various systems encompassed in and influencing the major long-term strategy. As a designer of management accounting information systems, the management and cost accountant has the responsibility for developing a better understanding of the information requirements of specific tasks so that he or she is able to provide more relevant and useful information, taking into account the varying needs of varying rehabilitation situations. The following contributions, briefly, are made by management accountants, or should be included in their contribution:

- An appropriate knowledge of the background influences of time, money and environmental perspectives would enable the environmental management accountant to provide a better quality information and advice to management. These influences have their origins in local heritage and culture from within and from outside the company, but also from South Africa, Africa and other countries such as Canada, the USA and the UK. The relationship between people and the natural environment requires financial and non-financial burdens to be fairly shared among stakeholders. The influence of different management systems based on the generations of management determine the amounts and nature of investments and recommendations. (Paragraph 7.3.).

- A holistic view of the interdependency and independency of relevant aspects of rehabilitation programmes. This view supports continuous improvement as well as research and development. The effects of life-cycle costs from impact assessment to aftercare maintenance are included as well as value-added principles, the cost of finding an ecological balance for sustainability, rehabilitation costs in relation to the needs of the community, paradigm shifts and flexibility for changed circumstances, and the cost of the extended and future enterprise. (Paragraph 7.4.)

- Policies and information for improving cost management. These would include advice on updating and adapting cost policies to changed circumstances, reducing long-term environmental costs, introducing and developing life-cycle costing, target costing, total and full cost accounting, and utilising the feedback
mechanism. Improvements in cost management would also include the consideration of non-financial indicators, the shifting of costs, and the adjustment of rehabilitation costs during the planning stages. Distinctions and analyses of internal and external costs, as well as of profits and increases in the value of natural capital and wealth, indicate possible problem areas. (Paragraph 7.5.)

- Dealing with the influence of legal aspects of local and central authorities. These would include a thorough knowledge of present and anticipated environmental taxation policies and regulations to be considered for investment decisions. Controlling and failure costs could eventually be limited. (Paragraph 7.6.)

- The introduction and development of total quality environmental management. This system is complex, dynamic and non-linear, and includes cost management aspects arising from the mission and objective statements as well as from the long-term rehabilitation strategy; the management structure, resource and maintenance management, total quality control, sustainability, the quality nature, international standards (ISO14000, ISO9000), strategic and value-based management and futuristic views. (Paragraph 7.7.)

- The encouragement of investments of time and money for rehabilitation research and development programmes would lead to financial and non-financial benefits. These would include components such as education and training for all employees in their specialised areas, the involvement of teams of experts, benchmarking to find the best available practices both locally and internationally, contingency provisions for emergencies, and internal and external awards for supporting improvement efforts. (Paragraph 7.8.)

- The adaptation of profitability on ethical grounds is needed to satisfy an increasingly environmentally conscious world which wants to know who exactly is accountable to whom for what. These ethical approaches regarding the natural environment should be seen in comparison with total quality management, profits and values based on the natural environment, the accountability of responsible persons, as well as the welfare of the community. Traditional financial cost management instruments need to be supplemented by instruments based on ethics to provide for future interests. (Paragraph 7.9.)

These sub-strategy groups of factors that influence a strategy for total quality rehabilitation management accounting culminate in the final stages of the management accounting strategy which follow in the next chapter.
CHAPTER 8

STRATEGY FOR TOTAL QUALITY REHABILITATION MANAGEMENT ACCOUNTING

8.1 INTRODUCTION

In the previous chapter major sub-strategy groups of factors which have an influence on and provide information for decision-making purposes are discussed. These influencing factors are internal and external background knowledge, a holistic approach in several respects, cost improvement policies, the role of authorities, a total quality environmental management approach, and research and development with the object of continuous improvement. These factors culminate in the final stages of a strategy for total quality rehabilitation management accounting. The position of management in the overall strategy is illustrated in Figure 7.1 (Chapter 7).

The next series of sub-strategy factors includes a strategy followed in terms of adequate management policies, evaluation of rehabilitation performances, reporting to interested and affected groups, and the arrival at a balancing position between financial implications and the natural environment. The objectives of this chapter are to analyse these strategies and the factors which they comprise, and to advance reasons for including each one of them in the final model.

8.2 THE ROLE OF MANAGEMENT

8.2.1 Introduction

The role and function of the management team in the development of a comprehensive strategy on total quality rehabilitation management is illustrated in Figure 8.1. The input to this model in Figure 8.1 consists of information and the influence of various factors which are considered for management decision making. These factors are a background knowledge of local and overseas practices, the influence of the attitude of authorities, total quality environmental management approaches, research and development, a holistic approach, ethical issues and cost improvement policies.
Increased awareness by society of environmental problems is leading to pressure on industries from governments, customers, competitors and employees (Winsemius and Guntram 1992:12). Local pollution problems easily become regional and global problems. Polluted water in rivers eventually becomes polluted oceans. This consciousness of pollution effects has led society to realise that the present generation can destroy its very existence. Traditionally information was used for control purposes only, but lately complex and ambiguous information of no immediate value has also been considered (Wheatley 1994:91). This information originating from uncertain circumstances is likely to drive change and improvement in decision making.

In order to process such information and influences, their relevance in a changed approach by the accountant and management accountant towards environmental and rehabilitation management should be determined. Various strategies are encapsulated in the major strategy of the management team. These strategies are to consider paradigm shifts and reengineering whenever necessary, to build in flexibility to adapt to changing circumstances and developments, and to improve measurement criteria. After the strategy has been formulated and implemented, performances are measured and improved policies are introduced by means of feedback mechanisms in a continuous cycle of improvement. The objective of the strategy is eventually to reach a balancing position where all affected and interested parties would be satisfied.

8.2.2 Relevance

The importance of relevant information on environmental and rehabilitation expenditure is stressed by the fact that these costs are increasing in proportion to profits and are now running into huge sums. The quality and distribution of relevant information would determine the degree of performance improvement of companies (Johnson 1992:202). Information should be judged by accountants and management accountants against new megatrends when they have to decide whether it is relevant for decision making, and existing directions should be restructured and redirected where appropriate.
Figure 8.1 7 Management

(Source: Empirically developed)
Some of these trends which reach into the near and distant future are the following (Enthoven 1985:5):

- The industrial society is changing into an information economy where information is created and distributed instantaneously and where short-term planning is changing into long-term strategies.
- Local management is becoming part of global management, industrial cities are being left behind and there are movements to new sites.
- Results are achieved from the bottom up, from centralisation to decentralisation, from economies of scale to small, efficient plants, and the utilisation of outsourcing and institutional aid is being replaced with self-reliance and entrepreneurial activities, and a movement away from limited choices to a multi-option society can be detected.

Relevant information for future development should therefore consist of multidimensional and multidisciplinary actions concentrating on people, information and systems to bring people and information together in a meaningful way. Management information is needed to enable companies to capitalise their resources of people and time (Johnson 1992:11). Accounting information will have to be more socioeconomically acceptable, useful and relevant, and should include social responsibility aspects such as contributions towards environmental and rehabilitation policies. Efficiency and effectiveness assessments would be required in terms of both financial and non-financial values. Accounting and management accounting approaches should also become more homogeneous in an environment made up of perspectives. The shift from short-term to long-term planning, assessments and reporting requires information to be more future-oriented for the purposes of relevant decision making. Alternative solutions to management problems should be provided in a multiple-option society. To prepare themselves to provide suitable information in an economy subject to these megatrends, accountants and management accountants should utilise systems such as networks (Johnson & Kaplan 1987a:262), the latest information technology, and decentralised structures.

Other new developing practices (Johnson & Kaplan 1987a:210) that should be taken into account when preparing relevant information for decision making are total quality control, just-in-time, computer-integration, life cycles and future deregulation of governmental interference in markets. A tendency is also developing to outsource rehabilitation projects
to companies specialising in the remediation of abandoned mine sites, such as Fraser Alexander.

Relevant accounting and management accounting information would place less emphasis on quantitative financial aspects and would also include qualitative (Roslender 1995:55) and non-financial aspects of organisation and management. In this regard the accountant and management accountant have to provide information on the expenditures involved at various purity levels of water released in nature. This information would allow management to perform the functions of strategic planning, as well as control resources and operations (Johnson & Kaplan 1987a:168).

8.2.3 Paradigm shifts

In order to coincide with the megatrends in the economy and make it possible to direct relevant management decisions, paradigm shifts should be considered. “A paradigm is a set of rules and regulations, written or unwritten, that establishes or defines boundaries and tells you how to behave inside the boundaries in order to be successful” (King 1996:23). Traditional and existing models and patterns should be analysed and adapted, improved or replaced to meet changed needs. They could also be replaced by improved or new ways of thinking.

Traditional management accounting information was based on financial reporting which was too late, too aggregated and too distorted to be relevant to management teams for purposes of planning and decision making (Johnson & Kaplan 1987a:194; Roslender 1996:534). Profits were the ultimate measure of performance. Management often does not have detailed information on environmental costs, since these costs are hidden as overheads (Greyling 1997:11). A paradigm shift towards more fragmented financial and non-financial environmental information in a broader context would enable management to determine the contribution of environmental and rehabilitation costs to profits. Costs relevant to particular decisions would be available to support management in their tasks. Such knowledge would also lead to more efficient applications of materials, less waste, and to the general improvement of environmental and rehabilitation activities.

Paradigm shifts from short-term decision making to long-term strategies should be encouraged. Long-term expenditure on research and development, quality improvement,
engineering, education and training of human resources, and rehabilitation should not be rearranged (Johnson & Kaplan 1987a:201) under short-term expenses for taxation purposes, or reduced only to show higher immediate profits. Paradigm shifts are to a large extent based on continuous performance improvement. Strategic positioning and repositioning (Roslender 1996:536) develop from paradigm shifts due to changed situations and circumstances.

A further paradigm shift should be introduced away from accounting results only, towards processes and people (Johnson 1992:30). Processes should be aimed at the reduction of waste products as well as at more effective rehabilitation techniques. The interests of all people categorised as interested and affected parties should be considered when preparing and interpreting management accounting information for decision-making purposes.

Accounting and management accounting paradigms should be changed to accommodate changed patterns in management (Kaplan 1985:225; Drury & McWatters 1998:38) such as rehabilitation policies. Measurement and control systems should be chosen that simultaneously and explicitly support the corporate and long-term strategy of the company. Paradigm shifts towards the more holistic approach of rehabilitation management and the related accounting function, are discussed in Paragraph 7.4.6.

8.2.4 Reengineering

Following the fundamental changes in approach of paradigm shifts, reengineering is reconstruction and experimentation in the sense of fundamental new organisation and radical redesign of business processes and procedures to bring about dramatic improvements in performance (Yeo 1996:322). Since adaptability and organisational learning become key issues for survival, reengineering supports total quality management and the implementation of continuous improvement cycles. Reengineering also allows rapid radical experimentation (Yeo 1996:321), other than the more gradual forms of change inherent in total quality management.

Together with the reengineering of rehabilitation management approaches, accounting and finance functions as well as their supporting information systems should also be considered for reengineering. Reengineering is associated with productivity, timeliness and usefulness. The results of these outcomes would reduce the number of transactions,
and would place responsibility for the costing activities of the accounting department on the personnel directly involved (Vollmers 1997:64) with these rehabilitation projects. To be more cost effective and to utilise external expertise, it might be necessary to outsource certain rehabilitation activities or entire projects (CIMA S4 P16 1996:202). Internal reengineering should be compared with the cost savings of outsourcing.

Out of necessity, reengineering might create a new management format that is rigid, unadaptable and chaotic. Timeliness, positive feedback and a basis of continuous improvement would to a certain extent prevent such a complex result of reengineering. With rapid unpredictable patterns of change such as might be required as a result of fluctuations in financial markets and thunderstorms over slimes dams, reengineering can easily approach the verge of chaos. This is a region between chaotic and stable behaviour with a constant battle between stagnation and anergy (Leach 1996:87). While management systems that are too stable would cease to exist, those on the edge of chaos could evolve towards survival.

Reengineering concerns changes in phases from investigation to planning to implementation (Vollmers 1997:64). Investigation includes the study of procedures for improvement, existing cost structures, and comparisons by means of benchmarking. Planning involves the development of a scheme for producing results, time schedules and transitional arrangements. Implementation is the delegating of responsibilities, the financial and non-financial assessment of results, feedback, and the maintenance of the new reengineered process. Unsuccessful actions should be investigated and improved, changed or replaced as part of the feedback and continuous improvement process.

In a system of reengineering managerial accountability is transferred to teams that become increasingly self-managed, whereas middle management has to redefine their traditional management activities (King 1996:24). Middle management would be responsible for effective project strategies for success. People who are more directly involved with the pollution effects of mining activities, would have the authority and responsibility to take preventative actions in both financial and non-financial terms. Visibility of rehabilitation efforts would then be provided throughout the company and to all interested and affected parties.
Optimal solutions could be found by means of reengineering within different and conflicting constraints. Financial economic issues, such as the availability of input funds and their projected monetary gains, and the application of economic principles are needed for restructuring, pricing and risk management. Constraints such as present and future budgets, tax policies and accounting rules would influence the design of various alternative options for new strategies.

8.2.5 Rehabilitation flexibility structures

Provision should be made for flexibility in the rehabilitation strategy. Flexibility means being able to act or react to changes when providing information for decision making (Koornhof 1998:272). Flexibility in the redesign of processes and procedures would reduce the effects of constraints such as organisational structures, changeover time and the links between people and work. Improvement in flexibility should be incorporated in all management functions, especially those associated with control and evaluation (Johnson 1992:52). Since flexibility is a complex management instrument, its benefits are not often fully utilised.

The importance of managerial flexibility is supported by the respondents to the questionnaire on environmental and rehabilitation management. Most of the rehabilitation managers reacted favourably by agreeing that maximum results would be obtained when there is flexibility between the strategic dimensions of quality, cost and time, and the technical, behavioural and cultural attributes of a good rehabilitation management accounting system (Statement 4.6; 76.6%).

The improvement of skills by approaching rehabilitation management procedures including management accounting, in exactly the same way as twenty years ago, would not allow for new ideas such as under flexibility conditions. In the past companies concentrated on the speed at which work was done, whereas flexible companies focus on the total time, including lead time, required to get the work done (Johnson 1992:68). Lead times are influenced by non-financial indicators such as delays, excess work and too many variations in processes.

In the rehabilitation management accounting context this would mean that funding and rehabilitation operations should not be delayed until the closing down of mines, or put
off for future generations, but that rehabilitation should be incorporated as part of the excavation process. Better deals could be negotiated with subcontractors at the time than would be possible at a future date, under threat of legal action. Since accounting and management accounting are information-oriented disciplines, responsiveness and flexibility would assist companies to adopt improvement changes in management strategies. Flexibility would enable management accountants to adapt information to changing circumstances, both efficiently and without delay. For these purposes projections and futuristic views should be added to the existing historically based reports in order to support the ability to continue to absorb change and disturbances.

Organisational structures should be developed to make them self-renewing systems which could accommodate external and internal change in a flexible manner. These structures should also be equipped to change in response to changed needs, and to utilise expertise, teams, tasks and projects to fulfil these needs (Wheatley 1994: 91). Constantly changing information and new information, most of which would be supplied by the accountant and management accountant, should be applied when formulating alternative courses of action.

In order to implement the concept of flexibility, with its accompanying demand for new thinking, employee relations should be sound. Employees should be valued as a resource and as a source of ideas, and not regarded as a source of energy and cost (Johnson 1992:94, 103). The power of people to remove constraints on flexibility is the most important asset of a company. A workforce allowed and empowered to innovate and learn would form the basis for the introduction of flexibility that would decrease constraints. Responsibility and control are therefore placed in the hands of the people who do the work so that they can improve processes. This attitude would replace the traditional manipulation in order to achieve accounting results.

8.2.6 Improved measurement criteria

The improvement of measurement criteria forms an integral part of the comprehensive management strategy towards rehabilitation management. (Performance measurement is discussed in detail in Paragraph 8.3.) The purpose of assessing, measuring and reporting on environmental costs is to provide management with information to enable them to manage these costs (Ansari et al 1997b:MMEC-11). The improvement of measurement
and assessment bases links up with the overall strategy of total quality management and with the cycle of feedback and continuous improvement. Within the management accounting setting and its dynamic work environment, the gathering of relevant data should be achieved. Performance measurement should therefore be regarded as a dynamic process which should be maintained. This management instrument for improving measurement criteria has the potential to enhance company performance in respect of rehabilitation strategies.

Performance measurement programmes should not just determine performance, but should also actively encourage improvements in volume and quality with the aim of reducing costs and increasing profits. In order to improve measurement criteria the following guidelines should be considered (Ricciardi 1996:67; Odiorne 1993:2):

- The measurement programme should give equal weight to quality and productivity.
- With a good programme everyone and every segment are measured in the same manner, obtaining comparable results.
- Incentive and participation in the measurement programme should be provided, in combination with reward and continuous training systems.
- Reviewing and updating of measurement standards should be incorporated in the measurement programme, especially after a technology change, making it adaptive to change.
- Measured data should be reviewed on a regular basis.
- Adequate action should follow soon after reading reports compiled as a result of these measurement programmes.
- Pitfalls in the measurement system should be quickly identified and resolved.

From these guidelines it may be deduced that a performance measurement programme should be able to transform itself into a continuous improvement programme.

But when a perfect measurement programme does not yet exist, it does not mean that the impact and full implications of environmental and rehabilitation projects, as well as delays in these projects, should be ignored. Even if the assessments are somewhat imprecise, the measurement of environmental costs should continue (Ansari et al 1997b:MMEC-14). Long-term financial and non-financial environmental damage could
lead to serious financial consequences for mining companies. This attitude of not avoiding costs would allow the management team to operate within a strategic framework, and to improve measurement criteria on a continuous basis.

Benefits that could be determined with a continuous improvement of measurement criteria would include benefits to the macro economy, cost reductions, and increases in output and utility (Freeman 1982:176). More cost-effective rehabilitation strategies would result in a lower financial burden to authorities and taxpayers, as well as increased profits. Improved measurement criteria for the present and future utilisation of resources would allow the management team to formulate policies to reduce costs and to contribute towards the macro economy.

8.2.7 Towards implementation, performance measurement, feedback and equilibrium

The collections of strategies discussed in the preceding paragraphs would be included in the overall management strategy for rehabilitation management that the management team would consider. Relevant information should be selected and presented, paradigm shifts which change value systems should be considered, reengineering should be implemented to a lesser or greater extent, flexibility should be incorporated and measurement criteria should be continuously improved.

The management accountant as part of the management team should be involved in the selection of relevant information for decision-making purposes. This information should be socio-economically acceptable, should be useful and should include relevant financial, non-financial and qualitative data. Information should form a sound basis for decisions on total quality management, just-in-time and life-cycle cost calculations. Provision should be made for projections and futuristic views in addition to historically-orientated information. Relevant information should be provided which would enable management to weigh alternative options.

Reengineering involves the reconstruction and redesign of processes and procedures based on increased productivity, timeliness and usefulness. Radical and rapid changes could be affected through reengineering, both on the mining sites and in the offices of the management accounting team. Financial and non-financial benefits of internal
reengineering should be compared with those of outsourcing. Accountants and management accountants accompany the investigation, planning and implementation of reengineering projects, from the rehabilitation sites right up to the financial reports.

Flexibility in decisions and policies is a complex management instrument. Information provided by the accountant and management accountant should provide for alternative options to be considered under varying circumstances. Provision should be made for flexibility between quality, cost and time on the one hand, and the technical, behavioural and cultural attributes on the other hand, of a good management and management accounting system. Projections, trends and futuristic views should be added to the traditional historical information to enable improved flexible decisions to be made. Flexibility is to a large degree people-oriented and emphasis should be placed on the importance of adequate education and training of decision-makers of all ranks.

Measurement criteria should be improved on a continuous basis in order to provide quality information for decision making. These criteria include financial and non-financial measurement instruments as well as criteria to assess volume and quality, such as in surface and underground water quality. The accountant and management accountant should link both financial and non-financial measures in improved and more meaningful ways. Improved measurement criteria would have an escalating effect, from improved profits to more accurate macroeconomic figures. Cost-effectiveness would be improved, output could increase, resources would be better utilised, and the financial burden on authorities and the taxpayer could be lessened.

The management functions of performance measurement, reporting and the comparison with a balanced situation, form part of the overall comprehensive strategy, which is illustrated in Figure 7.1.

8.3 PERFORMANCE EVALUATION

8.3.1 Introduction

Since organisations are interested in finding out how they are doing in terms of environmental and rehabilitation operations, performance measurement and evaluation should become inherent in the culture and should be included in the initial stages of
strategic planning schedules.

Performance measurement is "the process of quantifying the efficiency and effectiveness of action" (Neely, Mills, Platts, Gregory & Richards 1996:424). The measurement process is the "assignment of numbers to objects in such a way that the relation among objects can be determined from the relation among numbers" (Ijiri 1967:22). Performance evaluation programmes should, in addition to calculations and reports, also include dynamic procedures that would actively encourage improvement in quality rehabilitation schemes and decreases in waste volumes and so reduce operating rehabilitation costs and increase profits (Ricciardi 1996:66). Quality measurements serve as an analytical instrument to determine when, where and how quality money has to be spent. The functions of evaluation reports (Tatikonda & Tatikonda 1996:7) are to provide information, and to motivate, communicate, coordinate, prioritise and evaluate performance. The progress of quality projects and their contribution to profits is monitored. In the evaluation process performance indicators are established and interpreted in order to follow progress of activities towards the set objectives. Potential further improvements are identified and the cycle of evaluation continues, beginning with the initial stage of the monitoring of the effectiveness of operations (Smith 1995:146).

Environmental performance measurement and evaluation form an integral part of the comprehensive management accounting strategy for rehabilitation management (Eckel et al 1992:16) for the following reasons:

- Mining activities have an impact on the ecology, on society and on the economy.
- Companies are increasingly being held liable for environmental remediation costs, as may be deduced from regulations and penalties.
- Environmental management often results in improvements to the "bottom line" as a result of cost reductions and increases in goodwill. Allocation of scarce corporate resources towards environmental policies requires evidence in the form of adequately measured information.
- Lower levels of management are empowered and need more and better information for decision making and monitoring.

The alignment of performance measurement with total quality management would eventually lead to effectiveness of decision making. The flowchart of performance
evaluation is illustrated in Figure 8.2. Since most of these evaluation criteria have already been discussed throughout the text, a brief discussion will follow. Performance evaluation has traditionally been based to a large extent on financial values only. Other criteria such as non-financial values and time standards are often ignored, or not linked in a meaningful way to financial results.

### Figure 8.2 8 Performance evaluation

![Diagram](Source: Empirically developed)

#### 8.3.2 Financial values

Financial analysis of rehabilitation activities indicates the current position as well as comparisons with previous years and with benchmarking competitors. Financial planning strategies and budgets are compared with current financial information in order to facilitate decision making by means of feedback mechanisms.

Financial values to be included in performance evaluations consist of the traditional and existing approaches to the measurement and reporting of activities in monetary terms. Trends are developing to identify and classify quality costs, such as prevention costs, appraisal costs and failure costs (Tatikonda & Tatikonda 1996:2). Prevention costs are incurred to minimise, reuse and recycle waste products, while appraisal costs are associated with assessments of the quality attained. Internal failure costs are incurred to correct failed efforts to rehabilitate, and external failure costs are incurred for correction and service of damage to the external environment.
Although most of the environmental and rehabilitation managers who responded to the questionnaire indicated agreement with the actual separation of the various cost categories of prevention costs, assessment costs, control costs and failure costs (Statements 2.2.11 to 2.2.15), it seems that they do not really care whether they are separated or kept together under overheads. A relatively high response was obtained in respect of the uncertainty option. The principle should be further developed that by using more fragmented cost categories in respect of rehabilitation policies, the management accountant could provide quality information for improved decision making.

With the application of financial value analyses, realistic financial estimates of the individual activities of the strategic programme could be obtained. The value created or destroyed could be measured by adjusting this programme (Bannister & Jesuthasan 1997:14). Supporting financial information is needed for decision making and activities, and should indicate how financial returns will change (CIMA Stage 4 Paper 4 1996:82; Parker et al 1989:84). Relevant financial information is therefore required, such as information on avoidable and incremental costs.

8.3.3 Non-financial values

The impact of investments in rehabilitation technology and procedures should also be assessed in non-financial and non-quantitative terms which could not be immediately translated into numbers or which are not easily identifiable. Environmental pollution is not normally a measured variable as it could not readily be translated into profitability and efficiency (Evans 1996:48). Other non-financial evaluations would include toxicology as well as assessment of the health and safety of occupational and local residents (Shimell 1991:16). Environmental damage should be assessed in terms of the levels of water and air pollution, solid and hazardous waste substances, soil degradation and the loss of biodiversity (Todaro 1994:331). Environmental performance in terms of rehabilitation successes, for example, should be measured for water pollution readings relative to the permissible standards set by authorities. Similarly the existence and potential of environmental liabilities (Cormier & Magnan 1997:235) in respect of closed sections of mining sites should be calculated and disclosed.

Non-quantitative factors could be shown on a scale with a total equal to 10 or 100 points indicating flexibility, simplicity of operations, timeliness and company image (Carter
1992:61). Other factors in this category would include safety, ethical attitude of decision-makers, morale, awareness and skills (Smith M 1995:181). A spider diagram (Quest Quality 1997:32) could be applied to illustrate these situations.

Traditional financial evaluations of performance should be complemented with non-financial measurement instruments. Pollution and pollution control, especially regarding contaminated soil, are not easily quantifiable in terms of gains and costs, making assessments and comparability difficult. Owing to uncertainty regarding the application possibilities of non-financial indicators and the limited recognition of their function, they are not used for reporting purposes (Cormier & Magnan 1997:236). But developments in information technology continuously provide improved measurement systems for the generation, analysis and storage of information in order to facilitate decision making on more levels. Although non-financial results are not reported and disclosed regularly in South Africa, they are indeed measured according to the response of environmental managers to the questionnaire (Statement 2.1.12: 74,5%). The compilation of the optimum set of non-financial indicators to evaluate rehabilitation performance is furthermore linked to the goals of the mining company.

Non-financial indicators of performance would be more relevant (CIMA Stage 4 Paper 16 1996:210) to rehabilitation processes under certain circumstances and also more useful in determining the strategic priorities of modern enterprises. Non-financial indicators such as quality, time and flexibility measures could be distinguished. In environmental and rehabilitation strategies especially, longer corporate time horizons are needed since future quality of life should not be sacrificed for present economic gain (Kleiner 1991:38-47).

Responses of environmental and rehabilitation managers indicate that the non-financial indicator of time is actually a factor in management accounting policies in rehabilitation management (Diagram 4.7). They agree that a heritage of badly rehabilitated land is an important factor for strategic management (Statement 2.3.1:83,3%). Time in terms of years is needed to remediate the neglected damage of previous years. It is also the time factor that causes the escalation of repair and recovery costs due to inflation. These respondents also agree that investments of time in education and training of the whole workforce in environmental preservation contribute towards better management results (Statement 2.3.2:70.2%). They realise that non-financial input in terms of time would yield quality non-financial output in terms of environmental and ecological attributes.
Non-financial indicators could be determined according to the nature and size of mining companies, and would vary according to the needs of each individual situation. Non-financial indicators could be defined for each one of the categories of input, performance, products and services, markets, employees and customers (Smith M 1995:180). Examples of time factors would be time on repeat work, on backlog tasks, on repairs and overtime. Other non-financial indicators would be the number of failures, such as instances of clean water mixing with polluted runoff water from waste dumps. Percentages could be calculated such as the percentage of unplanned tasks in relation to planned tasks, preventive maintenance to total maintenance, and research and development on rehabilitation schemes to total budgeted research and development allowances. Indices could be compiled for educational attainment, rehabilitation success, community involvement and satisfaction regarding environmental management, employee contributions, leadership and the utilisation of benchmarking opportunities.

For the successful implementation of non-financial indicators the human factor forms the basis regarding data accuracy, manipulation opportunities (Smith 1990:26) and the ability to be continually innovative (Hiromoto 1988:26). The effectiveness of the utilisation of non-financial indicators would therefore depend largely on the historical background, culture and management style (Eccles 1991:137) of the mining company and its people.

Conventional management accounting has to adapt a selection of non-financial indicators to take into account environmental and rehabilitation performance. The integration of non-monetary outcomes with traditional financial information would enable the compilation of a structured approach towards decision making (Fitzgerald 1997:26). Legislative support and incentives to assist rehabilitation policies set by authorities would further encourage the introduction and development of non-financial indicators. To enable the management team to take a strategic view, both financial and non-financial information should be provided by the management accountant for decision-making purposes. Long-term strategies would more easily include the environmental consequences of present decisions and assessments of waste and the rehabilitation of mining waste sites. The utilisation of non-financial evaluation instruments should be regarded as an ongoing and evolving process for obtaining future rewards.
8.3.4 Performance measurement

A performance measure as “a metric used to quantify the efficiency and/or effectiveness of action” (Neely et al 1996:424). Since performance measurement is an empowerment instrument which forms the basis of good management practice, the utilisation of appropriate measures should generate an improvement orientation. The rehabilitation managers who responded to the questionnaire agree in this regard that measurable is tantamount to manageable in rehabilitation management (Statement 2.1.18: 76.1%). In a tradition of quality management, including continuous improvement, a new era of performance measurement is evolving. Qualitative and non-financial measures are often more difficult to determine, but the management accountant has to find means to assess these figures for a comprehensive strategy towards rehabilitation management. A new attitude has taken shape which states that something is difficult to measure because it has not been clearly enough defined (CIMA Stage 4 Paper 16 1996:214). Galileo said much the same thing (Stainer & Heap 1996:11):

Count what is countable, measure what is measurable and what is not measurable, make measurable.

A performance measurement system has the different levels of individual performance measures, the performance measurement system itself, and the performance measurement system operating within its environment. When, as part of their function as providers of information, management accountants design and assess a performance measurement procedure, measures should be clearly defined, purposeful, practical, self-controlling and effective at the individual level. At the performance measurement system level these measures should be integrated to include functions and hierarchy, should provide information on past and budgeted future performances, and should aim to provide and reflect a balanced picture of activities. Within its operating environment the performance measurement system should match the culture of the company, emphasise its strategies, should be in compliance with the reward system, and should provide information for comparison with external data. (Neely et al 1996:425.)

Performance measurement provides information for the management accountant as well as to management to enable them to assess and compare the performance of the company with that of its peers. By investigating and analysing this information, strengths and
weaknesses could be identified, as well as areas for improvement. With the analysis of strengths, weaknesses, opportunities and threats (SWOT-analysis) financial needs are identified that pertain to profitability, gearing, liquidity and working capital (Smith M 1995:21). As a result of SWOT analyses, improvements can be effected in respect of quality, processes, information and technology, communication and management information systems (Smith M 1995:49).

It is fairly easy for companies to achieve 25% improvement (Kleiner 1991:47) in environmental strategies by means of better internal operations as a result of more detailed measurement systems and technologies, but it is much more difficult to continue with this trend. After the initial success environmentalism should be incorporated in a comprehensive strategy which includes flexibility, creativity and the maintenance of a higher standard than is required by relevant existing legislation.

The introduction and evolution of non-financial indicators, as with the utilisation of traditional financial measurement criteria, is dependent on the human factor for accuracy, manipulation and interpretation purposes. Results could be compared and communicated to all interested and affected groups, and could motivate both employers and employees towards the development of an optimum measurement system (Smith 1990:26) in order to achieve the rehabilitation objectives.

Management has to decide what measurement instruments should be utilised and how those chosen criteria should be used in a meaningful way. Environmental performance evaluation measures are developed as part of other activities in the dynamic planning and control structure. Although measurement in itself does not cause improvement, relevant performance yardsticks would encourage analyses and a movement towards progress. In this evaluation process (Russell 1996:40) the objectives of the company regarding rehabilitation strategies should initially be determined and quantified in both financial and non-financial terms. Existing measurement instruments should be reviewed and strong and weak attributes identified. Limitations and gaps should be detected and resolved by means of retraining or the acquisition of better equipment. New measurement instruments should be established to replace inadequate ones, especially after technology changes, and to upgrade the general measurement system. The measurement system should be designed to report and disclose the processing of data and the distribution of relevant information to interested and affected parties, and to provide for flexibility. The
collection of data and the evaluation of performances should be supported by the actions of management and employees. In the end positive communication of information resulting from performance measurements would determine the degree of the successful future direction of the company.

In order to improve the communication of information to staff, provision should be made for an understanding of the effect of their actions, for feedback, for the encouragement of teamwork, for early reaction to evaluation indicators, for flexibility and simplifying evaluation systems (Grady 1991:53). In the process of identifying relevant environmental indicators for evaluation purposes, environmental audits should be conducted and stakeholders consulted (Eckel et al 1992:18). A diversity of assessment criteria should therefore be found that would support the rehabilitation strategies of the company in a balanced way that would include financial, non-financial and human factors.

A comprehensive and balanced performance measurement system which also encourages quality and good communication should include the following attributes (Stainer & Heap 1996:10; Eckel et al 1992:17; Kravchuk & Schack 1996:350; Van Schalkwyk 1998:10; Price Waterhouse 1995:183; Thor 1993:2-6.1):

- The system should be in accordance with the objectives of quality evaluation, for both internal and external comparisons. Changes to the system should be introduced at the beginning of a business cycle. All key elements of performance should be assessed, such as productivity, quality, timeliness, creativity and the use of natural capital resources.
- The measurement criteria should be reliable and easily understandable in order to create confidence in the long term at all levels.
- The measurement criteria should link up with operational activities, frequently utilising existing data where possible to evaluate performance, and should change with changing rehabilitation strategies.
- Only those financial and non-financial factors which could be controlled by individuals or teams should be included in the major measurement system, omitting factors such as water pollution resulting from excessive thunderstorms over discard dumps since such factors require separate appraisals. The control function of the measurement system should not be applied in order to ascribe blame, but to determine what people do well and for the purposes of training and
education in the event of mistakes.

- Lower levels of performance measurement should contribute to the achievement of higher levels in a hierarchical structure. A balanced set of performance measures should be found which would include financial, non-financial, internal, external and qualitative instruments.

- The period of measurement should be consistent with the project and the strategic plan, especially with rehabilitation management where actual positive or negative results of remediation actions could only be observed after decades.

Benchmarking for best practices would provide information to set goals for evaluation purposes. The actual situation should be compared with these goals by applying gap analysis (Grady 1991:52). Both financial and non-financial information is included in this comparative model. Stability of soil, water quality, input costs to achieve certain remediation levels, and maintenance inputs and results after closure could be included in these gap models on an evaluation scale of 1 to 10.

Once these measurement criteria have been established by the management team, which includes the management accountant, a comprehensive strategy for implementation should be determined. The initial stage would be to develop a prototype measurement system in order to refine the evaluation system (Eckel et al 1992:23). A successful implementation strategy for performance measurement should have the following major characteristics (Daly 1996:66):

- Disciplined adherence to the integrated program should be encouraged. Strategic objectives and performance measures, as well as employee behaviour, should be continuously aligned.

- Provision is made for both radical and continuous improvement to the evaluation system. Information on the achievement of environmental objectives is combined with information on changing political, legal, economic and social attitudes in order to reevaluate environmental policies and objectives.

The various attributes and actions mentioned above could be combined in the Perkin-Elmer analytical model of environmental performance appraisal (Daly 1996:66). The following actions are included in this model:
An environmental team is formed and an environmental measurement strategy is developed.

Each division has to select a smaller set of baseline measurement indicators, and a baseline year for comparison with present performance. The impact of recent progress together with future initiatives is determined.

Key quantitative results are formulated, such as energy and water consumption, and the regulation of hazardous and non-hazardous waste. A decision is taken on how or whether to index data according to some single normalising variable measure.

Unexpected and unusual circumstances are accommodated, providing for comments to reports, such as on the diminution of toxic waste, causing a higher volume of non-hazardous waste.

A simple system is developed for the collection, documentation, processing and reporting of data.

Provision is made for qualitative performance measurements, such as for cross-functional teams, air quality, energy and water consumption, waste water, safety and soil stability.

The degree of compliance with this evaluation model could be compared with the stages in the development of environmental responsibility, which vary from ignorance and doing nothing to sustainable development (Eckel et al 1992:19). Responsiveness might range from reactive approaches to regulatory compliance, to proactive responses to going beyond legal requirements.

8.3.5 Towards reporting and comparison with an equilibrium situation

Performance evaluation primarily includes financial and non-financial values aimed at the provision of information for decision-making purposes. Supporting financial information needed for management decisions should indicate financial returns and the results of decisions based on changed situations. The utilisation of non-financial evaluation instruments should be regarded as an evolving process that is ultimately aimed at future successes. Management accountants as circulators of management information have the opportunity to be more involved with the integration and coordination of financial and non-financial data resulting from rehabilitation activities (Fitzgerald, Johnston, Brignall, Silvestro & Voss 1993:124). For the successful implementation of
these evaluation techniques, the human factor should also be considered, since accuracy, manipulation and interpretation would determine the eventual quality of decisions.

The potential functions of management accountants would include the tabulation of environmental costs under separate headings (Fitzgerald 1997:28), such as prevention costs and failure costs. In addition, environmental accounting standards could be introduced and followed by compulsory inclusion in evaluations and disclosures. Multi-disciplinary teams consisting of banks, insurers and the accountancy profession should develop acceptable methods for utilisation measurement instruments for environmental and rehabilitation purposes. Accountants should become more involved in the development and application of non-financial assessment instruments, and should continually monitor new methods and systems in environmental accounting. Performance evaluation and measurement form the basis for reporting and disclosure of information, both for internal decision-making purposes and for external stakeholders.

A complex combination of quantitative and qualitative indices and information is needed for a balanced assessment (Parker 1979:319) of divisional and total performance regarding financial, non-financial, employee, social and ecological operations (Price Waterhouse 1995:173). The future focus might change to the reporting of quantitative and qualitative information including environmental accounting and accounting for time (Barbera 1996:73). These evaluations and reported figures in respect of rehabilitation programmes would provide further information to determine the degree of balance between profit-generating initiatives and the long-term ecological wellbeing of all interested and affected parties. Performance evaluations and assessments would eventually influence the value of assets such as abandoned mine properties and environmental capital.

8.4 REPORTING AND DISCLOSURES

8.4.1 Introduction (from performance evaluation)

Environmental reports are internal as well as public disclosures and they are reports provided and published by companies with the object of communicating with stakeholders on relevant rehabilitation and environmental issues (Bartolomeo & Ranghieri 1996:70). The objectives of environmental performance reporting (CICA 1994:6) is to
share responsibility for the state of the natural environment, to report on performance, to 
obtain approval for environmental policies, to demonstrate compliance with regulations, 
and to differentiate the company from its competitors.

The reporting and disclosure of environmental and ecological inputs and gains is a much 
discussed topic owing to various in-depth national and international research projects, and 
need not to be analysed in detail in this study. The disclosure of the results of 
rehabilitation policies, however, forms an integral and very important part of the 
comprehensive management accounting strategy for rehabilitation management.

Rehabilitation and environmental reporting and disclosures are increasingly needed in the 
South African society for the following reasons (Erasmus 1998:10; De Villiers 1996a:50):

- Companies have to indicate their social responsibility in view of the demands by 
  employees and stakeholders for the right to a safe and healthy natural environment 
  for themselves and for future generations.
- Reports on the environmental successes of companies would enhance public trust 
  from bankers, creditors, insurers, ethical investors and environmental groups.
- In the capital markets investors realise that the effective management of both 
  economic and environmental scarce resources would give them a competitive 
  advantage as a result of long-term cost savings, advantages and profitability. A 
  reduction in waste and the accompanying total quality management principles 
  would support this movement of continuous improvement.
- Other companies that report rehabilitation and environmental information set the 
  standards in a competitive market. Customers want the reassurance that they are 
  supporting companies that do not intend harming the community and natural 
  resources. Disclosed concern for the natural environment could place the company 
  in a better position.
- Companies have to demonstrate that they have adequate environmental 
  management systems at work in compliance with the latest legislation, or even 
  before legislation is enacted.

Despite the fact that the number of companies reporting environmental information has 
increased significantly in Europe during the past few years, the quality of reporting in 
general is very low (De Koning-Martens & Van der Ende 1996:22). Since South Africa
is following in the footsteps of developed countries, these tendencies are also likely to be detected in local environmental disclosure practices.

The disclosure and reporting of information derived from performance evaluations forms an integral part of and basis for management decision making. In this regard rehabilitation and environmental managers who responded to the questionnaire agree that measurable is tantamount to manageable in rehabilitation management (Statement 2.1.18:76,1%).

Environmental reporting goes through various evolutionary stages and actual reporting should be judged against the particular stage of evolvement. The following stages were identified (Ulhøi et al 1996:133):

- no reporting
- minimal reporting by exception
- internal reporting only
- mostly internal reporting with some external reporting
- both internal and external reporting
- full public sustainability performance reporting

Performance measurements and evaluations are disclosed and reported by accountants and management accountants to management groups for decision-making purposes, as well as for external stakeholders. Financial as well as non-financial inputs and gains are combined into these reports. Costs incurred during the recent financial period as well as provision for future costs in combination with gains obtained from these inputs, are weighed to determine profits, losses and variations in profits and losses of previous periods. These disclosures of information on financial and non-financial activities that influence profits are made in the annual statements, through advertising campaigns and by means of web pages on the Internet. These activities surrounding the reporting and disclosure of rehabilitation operations should in the long term lead to a balance between the interests of stakeholders in short-term profits only, and the long-term sustainability of the natural environment.

This sequence of events relating to reporting and disclosure of rehabilitation activities is illustrated in Figure 8.3.
Figure 8.3 9 Internal and external disclosure and reporting

Performance evaluation

- Financial input and gains
- Non-financial input and gains
- Public and internal disclosure of rehabilitation activities
- Costs incurred
- Provision for future costs

Communication & Public relations

- Marketing Advertising
- Financial & non-financial Statements
- Web

Equilibrium

(Source: Empirically developed)
8.4.2 Reporting financial input and gains

Traditionally disclosure and reporting of annual activities were reflected without any clear indications of rehabilitation and environmental performance. Developments in environmental accounting paved the way for the inclusion of environmental projects in financial terms.

The financial environmental reporting system would be expected to provide information on a regular basis according to external requirements, which include the following (Eckel et al 1992:16):

- disclosure of rehabilitation and environmental obligations and contingencies
- disclosure of financial and environmental risks internally to the company and externally to the community
- separate disclosure of environmental expenditure in the form of both capital acquired and expenses. Environmental expenditure would include environmental costs and the cost of lawsuits.

Although financial information traditionally forms the basis of the information used for reporting purposes, and is continuously being complemented with non-financial and qualitative information needs, financial issues still form an integral part of the procedure of finding a balancing position in respect of environmental cost management. This view is confirmed by the rehabilitation and environmental managers who responded to the questionnaire (Statement 2.1.14: 89,6%). In addition to this view, the rehabilitation and environmental managers who responded agree that monetary rehabilitation inputs are indeed disclosed to stakeholders (Statement 3.2.4: 64,6%).

Rehabilitation and environmental costs which are built into the price of coal and other commodities delivered to users should be disclosed in annual reports. The removal of impurities in coal for example, would lower the ash content and would increase the heat content (Torrens 1982:23). Environmental costs results in a better quality product for customers, and they should be informed of this fact in statements issued by companies.
8.4.3 Reporting non-financial input and gains

Since the reporting of non-financial rehabilitation and environmental input and gains is not regularly included in annual reports, Gray (1992:410) suggests that current accounting practices should be retained, but that attempts should be made to change them, either directly or indirectly by means of education and agendas, or to subvert some current actions. The reporting of non-financial measured rehabilitation and environmental performances must be integrated with and might rely on financial accounting and reporting practices. It would however, function differently and might not conform with the requirements of general accounting practice in terms of objectivity, quantifiability and the assignment of monetary values (Eckel et al 1992:16). It is not an easy task to reconstruct the world in terms of historical information based on financial accounting alone. Non-financial information is therefore needed to supplement existing financial accounting information systems.

Non-financial gains in the form of awards encourage management initiatives towards improved rehabilitation policies. This view is supported by the rehabilitation and environmental managers who responded to the questionnaire, since they agree that awards for green reporting enhance the awareness of cost management for rehabilitation purposes (Statement 4.2:70,8%).

Non-financial information that should be disclosed includes elements found in all activities and performances throughout the company. The following major areas are to be included and disclosed in environmental and information systems (Gray 1992:411; Gray, Bebbington & Walters 1993:233; Bartolomeo & Ranghieri 1996:71):

- audits on compliance and ethics to monitor whether legal requirements and the company’s own code of conduct are being met, and audits on waste and energy to determine whether the company is making the best use of its input in terms of environmental policy on the conservation of natural resources
- environmental management systems such as environmental budgets that set targets as part of performance evaluation, as well as risk and emission management
- techniques such as environmental impact assessments (EIA), environmental hurdle rates, best practicable environmental option (BPEO), best available technique not entailing excessive cost (BATNEEC) and environmental risk assessments
environmental reporting, as part of social reporting, to reinforce the accountability of the company and increase transparency (Elements in these reports would be, for instance, the rehabilitation and environmental policy, environmental contingencies, disclosure of critical, natural and man-made assets, transfers between these assets, environmental consumption, the emission statement and voluntary regulations not yet required by authorities.)

- non-priced environmental performance indicators of critical and natural capital, which should be captured in environmental asset accounting and maintenance, such as biodiversity and the assessment of the extent to which a mining company is destroying natural capital to create man-made capital (These indicators should be compared with information from previous periods.)

Other categories of non-financial reporting would be changes in the nature of natural resources such as in the landscape, water and rivers, soil and air. The flow of natural resources into the excavating processes should be compared with the outflow, including losses, waste, stability of land and pollution. These non-financial items which should be reported and disclosed should be measured against the criteria of eco-efficiency and eco-justice. Eco-efficiency concerns reduced input of resources in a business-centred approach with the objective of increasing or maintaining output, and eco-justice is environment-centred and might even require reduction or termination of production in order to prevent environmental degradation (Owen 1996:24). Decision makers have to decide to what degree either one or both of these criteria should be met.

Although non-financial evaluations and reporting are not widely applied, rehabilitation and environmental managers have already introduced these management instruments. According to their response on the questionnaire, non-financial rehabilitation results are indeed measured (Statement 2.1.2:74,5%), and non-financial rehabilitation inputs and gains are disclosed to stakeholders (Statement 2.1.13:67,4%).

Reporting on qualitative matters should be included in non-financial environmental disclosures. Examples of qualitative environmental reporting (Ing 1992:288) are trends, attitudes, opinions, policy statements and data on pollution levels. Pollution should be indicated in parts per thousand and compared with the legal requirements that embody safe norms. Risks to the environment would be expressed in terms of attendance days at dams and fishing downstream, and compared with information of previous years and
similar river systems. Private and public actions of a mining company aimed at the protection of the environment, the decrease of negative environmental impacts, and the reclamation of the landscape form an integral part of qualitative information that should be disclosed.

Impossible non-financial objectives like 100% pure run-off water should be avoided in reports since they could be regarded as misleading and would result in a considerable negative impact for the company. External experts whose honesty could not be questioned should be brought in to provide confirmation that qualitative information has been identified and correctly disclosed. Exceptional incidents, such as flooding and tremors, should be disclosed as well as the cost and the result of these remediation actions. Accountants and management accountants are therefore challenged to develop, utilise and disclose non-financial indicators (Koornhof 1997:115) pertaining to rehabilitation and environmental management results.

Sustainable management forms an integral part of an environmental management system from the initial planning stages up to the reporting and feedback stages. Sustainable development reporting requires that mining companies assess their performance in terms of both the natural environment and the economy with the objective of creating quality of life today and for future generations (Schmidheiny 1992:94). Elements of sustainable management within the system of rehabilitation and environmental reporting to be disclosed include (Gray et al 1993:235) the identification of natural and man-made capital, transfers between these two categories, estimates of sustainable activities and forfeitures to return the natural environment to the same position as before excavating activities commenced for the benefit of future generations.

8.4.4 Reporting and disclosure of environmental costs incurred

The major categories of rehabilitation costs incurred during the financial period should be disclosed to interested and affected parties. Information on the results of these incurred costs should be matched with the financial and non-financial inputs in a direct or indirect way in financial, non-financial and narrative terms.

Environmental costs in reports could be grouped in various ways such as direct, indirect, hidden and contingent liability costs (Kite 1995:13). Other categories could be identified,
such as prevention, assessment, control and failure costs (Ansari et al 1997b:MMEC-5). White and Savage (1995:50) distinguish about twenty-eight different environmental cost categories that should be considered in financial analysis, ranging from health issues to staff training to energy consumption and waste treatment and disposal. On the other hand Gray (1992:415) defines the primary environmental information groups as input data, processing data and output data.

Although reported information on rehabilitation expenditure would not be accurate in most instances, this fact does not imply that these costs should not be disclosed. Since environmental costs are often uncertain, less tangible, difficult to quantify and influenced by human judgment, estimates of 3% to 20% of operational costs might be substantially understated (White & Savage 1995:54).

According to the survey among rehabilitation and environmental managers in the mining industry, environmental costs such as prevention costs (Statement 2.2.11:45,8% against 37,5%), assessment costs (Statement 2.2.12:50% against 41,7%), control costs (Statement 2.2.13:58,3% against 35,4%) and failure costs (Statement 2.2.14:56,3% against 27,1%) are separated from other environmental cost categories. These major groups of rehabilitation costs which are incurred are also disclosed to stakeholders (Statement 2.2.15:77,1%).

Various parameters which could influence decisions on the environmental costs incurred should also be disclosed. These factors would include downward or upward fluctuations in interest rates, amortisation time for plant and equipment (Torrens 1982:24), as well as time for the transport and installation of rehabilitation machinery.

8.4.5 Provision for future costs

Escalation in rehabilitation and environmental costs is a serious concern for mining companies. Penalties and fines for the violation of environmental regulations, as well as compulsory clean-up costs for rehabilitation actions required by authorities, could be substantial (up to R200 000 according to the draft National Water Bill of 1998 (Visser 1998:14)). It is therefore necessary that management and interested and affected parties should be informed by means of disclosures in reports about these future environmental liabilities. Potential and actual rehabilitation and environmental hazards with regard to
health and safety as well as projected expenditure should be publicly disclosed.

Provision is made for future costs and liabilities in respect of rehabilitation projects in both capital and expenses budgets. The stages of environmental capital budgeting (Kite 1995:12) are the development of environmental awareness, the identification of projects that support and encourage company objectives, the selection of the project, and the ongoing assessment of the progress of the project. These facts on environmental budgeting schemes together with a statement of the progress made should be disclosed to stakeholders.

Environmental liabilities are commitments to incur future expenditure to prevent, reduce or repair environmental damage (Visser 1998:14). This expenditure might be in connection with past or existing waste disposal. Rehabilitation and environmental liabilities should be disclosed separately in reports indicating the monetary values of liabilities, contingent liabilities and reserves for future rehabilitation projects. When monetary values cannot be assigned to these future costs, the fact of future environmental liabilities should be stated as well as the time factors associated with expected losses due to environmental damage.

The disclosure of future rehabilitation and environmental expenditures forms an integral part of strategic management planning. In this regard rehabilitation and environmental managers in the mining sector in South Africa agree that strategic planning for long-term rehabilitation management and aftercare is necessary (Statement 2.1.4:97,9%). Since there is a general absence of funds earmarked for environmental projects (White & Savage 1995:49), the reporting and disclosure of future rehabilitation and environmental expenditure should be the result of an integrated environmental accounting system.

8.4.6 Communication by means of statements, advertising and the web

The quality of rehabilitation and environmental management accounting could eventually be reflected in the disclosed reports communicated through the medium of published statements, advertising, webpages on Internet, press releases, speeches, and news reports and publications in scientific and technical journals.
These disclosures could be measured against the following requirements (Baker 1996:46):

- Relevant information should be provided to assist management in planning, controlling, decision making and performance evaluations as part of the feedback function. The costs of pollution and rehabilitation need to be evaluated and preventive managerial strategies developed.
- The disclosed information should be future-oriented and should also reflect environmental realities. The environmental management accountant should be aware of the consequences of the information provided, keeping in mind the objectives of the company.
- Environmental management accounting statements should be in accordance with acceptable standards, and provision should be made for continuously improving these existing accounting practices.

It may be technically difficult for the accountant to compile a complex environmental reporting structure that provides significant information and to compare such systems over years when provision is made for continuous improvement. In addition, every effort has to be made to ensure that the information is correct.

By means of environmental accounting procedures management accountants give meaning to activities in enterprises and this information is communicated to users through effective disclosures. Environmental issues as seen by those inside as well as those outside the company need to be understood. Within the African context where there are traditional perspectives of an abundance of natural resources with no need to provide for future generations, environmental accounting practices (Gouws 1996:117) as well as methods of communicating environmental policies should be adequate for the needs of the users. In order to fully utilise the potential of these presentations and disclosures, information should be communicated in such a way as to be user friendly, useful and of value (Gouws 1997:78) to interested and affected groups. There is a particular interest in information on earnings, projections and management, which would include rehabilitation and environmental policies (Parker et al 1989:110). Both internal and external users of these environmental reports should be able to respond quickly to changed circumstances.
8.4.7 Towards an equilibrium position

The reporting of rehabilitation and environmental evaluations and information should be helpful in reaching the objective of finding a balance between financial, economic and environmental cost issues on the one hand, and on the other hand the gains in the form of protected natural environments and benefits derived from these inputs. Rehabilitation and environmental reports contain important figures in financial and non-financial terms, as well as qualitative information regarding the relationship between the mining company and the natural environment. They provide information on a regular basis to interested and affected groups of a mining company. This information includes environmental obligations, contingencies, risks, expenditure and acquired capital.

Non-financial input and gains to be disclosed in reports are found in all performances throughout the company. These would include issues on rehabilitation policy, levels of waste and pollution, budgets for waste and pollution standards, rehabilitation and reclamation techniques, and the rate of transformation of natural assets into man-made assets. Qualitative rehabilitation and environmental reporting would reflect trends, attitudes, culture, opinions and information on pollution levels. Sustainable management reporting would present information on sustainable activities and forfeitures for returning the natural environment to the same position as before mining operations commenced.

Rehabilitation and environmental reporting could be classified into various categories, and should be compared with similar information for previous years. Upward as well as downward fluctuations should be noticeable. Provisions for future rehabilitation and environmental expenditure and liabilities should be disclosed as part of the long-term management strategy of the mining company. These commitments might be in connection with past, present or future rehabilitation schemes. Information contained in the reports should be communicated in such a way as to be accessible to the users and should assist management in the feedback function. The environmental management accountant should be aware of the consequences of the information, in view of the objectives of the mining company.

Information disclosed in these reports forms the basis for the feedback mechanism to enable management to continuously improve on policies. Feedback is provided in various forms by the users of this information.
8.5 FEEDBACK AND THE IMPROVEMENT OF STRATEGIES

Accounting and management functions require continuous improvement, based on the feedback mechanism, for the provision of adequate information for decision making. Failure to react timeously to negative trends was traditionally ascribed to obsolete and restrictive management accounting and accounting procedures (Turney & Anderson 1989:37). But the relevance of accounting information was also lost through the improper use of accounting and management accounting information with the emphasis on the control of operations (Johnson 1992:31). The role of the feedback function (Paragraph 7.5.6) as well as the continuous improvement cycle were incorporated throughout the text, since feedback and continuous improvement form an integral part of the comprehensive rehabilitation management accounting strategy.

Feedback is information about actual results and achievements, coming from within the company on matters such as rehabilitation expenditure and rehabilitation standards reached, with the purpose of assisting in control decisions. By continually responding to differences between the management accounting system's actual and desired states, feedback mechanisms adapt the system to long-term fluctuations without forecasting (Simon 1990:172). However, feedback adjustments follow these discrepancies after a certain time lag. The difference between planned and actual performances is measured, and subsequent actions are modified in order to achieve improved performance (CIMA Stage 4 Paper 16 1996:49). The management team has to follow up on feedback, whether or not the rehabilitation project was a success or a failure, especially in cases of experimentation and the initial introduction of new ideas (Pascale 1991:21). Negative feedback is information indicating that activities are deviating from the planned strategy, and that adjustments and even a change of course are necessary to reach objectives. In this regard rehabilitation and environmental managers who responded to the questionnaire agree that feedback on failures in rehabilitation management is necessary for management decision-making purposes (Statement 2.1.10: 93,8%).

Positive feedback informs interested and affected groups that targets have been exceeded, and that the actions causing the deviation could possibly be maintained. Rehabilitation and environmental managers responding to the questionnaire agree that feedback to management on successful rehabilitation operations is important for management decision-making purposes (Statement 2.1.9:100%).
Continuous improvement could be described as the relentless pursuit of improvement in the delivery of value, or the reduction of waste and the production of wasteland, by means of ongoing attention to excellence in production, engineering and marketing (Turney & Anderson 1989:38). Improvement is the organised creation of beneficial change and the attainment of unprecedented performance levels (Juran 1989:78).

To make it possible for top management to improve quality and productivity, Deming (1982:16,18) identified 14 points to be followed in the long term. The first of these points is to constantly create a target for improvement. Improvements should be aimed at present problems as well as problems of the future. Continuous improvements to day-to-day problems would be aimed at immediate reactions such as putting in more plant material than the previous week with the same number of employers and equipment. Long-term problems require constancy of purpose and dedication to improvement. This means

- allocating scarce natural resources in an innovative way for long-term strategies
- allocating financial and non-financial resources to research and education
- constantly improving designs in order to improve efficiency in accordance with established quality goals
- allocating financial and non-financial resources to the maintenance of existing equipment and new technology, including the consideration of possibly contracting out of some rehabilitation activities

Other methods of effecting change towards continuous improvement would be to find a new managerial team; adopt a new accounting philosophy with accounting joining production, engineering and public relations; to build trust for new approaches; and to manage excess capacity and employee turnover (Turney & Anderson 1989:40). Juran (1989:80) adds the reviewing of progress, revised rewards systems, and improved employee relationships. A change in the role of the management accountant from watchdog to change facilitator is needed in order to focus information on continuous improvement in order to develop and design new financial and non-financial criteria for performance evaluations.

Part of the research and development component of continuous improvement would include the removal and replacement of obsolete rehabilitation systems. In the improved working environment better systems could be implemented (Turney & Anderson 1989:42)
for the continuous flow of activities and materials, for people involvement in the form of teamwork, continuous processing improvements, the elimination or reduction of waste, the elimination of excess inventory, the replacement of sudden changes with more even change-overs, and visual control to detect imbalances immediately. This view is supported by the rehabilitation and environmental managers who responded to the questionnaire. They agree that there should be an awareness of the continuous search for best practices in order to improve processes and activities (Statement 2.1.8: 100%).

The implementation or expansion of continuous improvement activities and cycles could, however, constitute a barrier to long-term improvement strategy. One example would be the increase in overheads as a result of expanded engineering activities to replace escalating labour costs. These overheads could result in expenditures which far exceed the corresponding labour costs (Turney & Anderson 1989:44). Accounting procedures which are segmented over various sections of the total rehabilitation process would record individually low labour costs in accordance with the policy of reducing labour, without comparing labour decreases with total increases in overheads. Continuous improvement should therefore be assessed and measured by means of both financial and non-financial indicators of efficiency, quality and improvement trends.

Continuous improvement and optimisation in rehabilitation strategies support continuous quality improvement. These would eventually lead to the attainment of the objective of remediating the natural environment into a sustainable position similar to its capabilities before the commencement of mining excavations. Feedback and continuous improvement functions are powerful instruments for management to apply in order to progress in the direction of a balancing position between the needs of human and non-human stakeholders in connection with the rehabilitation of mining land. Improvement teams should consist of cross-functional experts so that they are able to operate this complex system of rehabilitation and environmental functions.

Where South Africa is endeavouring to expand trade relations with developed countries, improvements in pollution management and standards would be part of the conditions of trade. A similar situation was found in Mexico when Canada and the United States threatened restrictions on trade unless antipollution standards were upgraded (Schonberger & Knod 1994:618). The need to include continuous improvement cycles in rehabilitation management accounting strategies is further emphasised by the fact that
South Africa is regarded as the leading nation in Africa south of the Sahara.

8.6 OPTIMISING EQUILIBRIUM

8.6.1 Introduction

In the previous stages of the comprehensive management accounting strategy for rehabilitation and environmental management, performances were evaluated and measured with the aid of financial and non-financial indicators. These sets of data should be communicated by means of reports and disclosures to interested and affected parties in a way that is easily understood by them all. Since no single-dimensional set of data could clearly reflect performances, management require balanced presentations of both financial and operational assessments. There is therefore a need to bring together dissimilar issues, to indicate how results are obtained and what the effect would be on the environment, similar to the “balanced scorecard” of Kaplan & Norton (1992:72) for manufacturing and marketing purposes.

In that regard the South African rehabilitation and environmental managers in the mining industry agree that the strategic management accounting dimensions of quality, cost and time should be combined for general rehabilitation management purposes (Statement 4.4: 72,9%), and are indeed combined in the interests of rehabilitation management in their mines (Statement 4.7:56,3%). The rehabilitation managers also agree that the attributes of a successful management accounting system of technology, behaviour and culture should be combined for the benefit of rehabilitation management (Statement 4.5:79,2%), and that these attributes are indeed combined to a certain extent in their mines (Statement 4.8:47,9%).

The data on rehabilitation and environmental strategies that have been gathered should be compared in checklists in order to determine what degree of equilibrium and balance has been achieved in the management of these issues. Equilibrium is the “unchanging state of a system ... resulting from the balance of the influences to which it is subjected” (McLeod & Makins 1993:377). Balance represents “harmony in the parts of a whole” (McLeod & Makins 1993:79). Equilibrium and balance are not necessarily associated with total stability, but would also include elements of instability to make provision for continuous improvement in an effort to achieve an optimum equilibrium position.
This performance matrix provides numerical information on the mining company’s progress towards the achievement of its vision, mission and objectives regarding the long-term strategy for the preservation of the natural environment. The results of these checklists should be compared with the results of previous periods as well as with set goals and standards. An ideal situation would be to reach an optimum equilibrium position in terms of environmental rehabilitation implementation, environmental leadership, financial and non-financial input and gains, and the natural environment. This view is supported by the rehabilitation and environmental managers in South Africa who responded to the questionnaire. They agree that a balancing matrix should be developed to determine the degree of environmental equilibrium (Statement 2.1.3: 86.5% agree; 13.5% uncertain, 0% disagreement).

Most of the elements of these sets of actions would have an influence on decisions in the same set as well as in other sections. The interaction between environmental rehabilitation implementation, environmental leadership, financial and non-financial implications, and the state of the natural environment is illustrated in Figure 8.4.

8.6.2 Financial and non-financial implications

Both financial and non-financial implications of rehabilitation management accounting could be evaluated against a checklist on a scale of zero to five, or zero to ten, depending on the degree of accuracy required. On a scale of zero to five a score of zero would indicate that no satisfaction with the issue is experienced, while a score of five would indicate that full satisfaction with the policy pertaining to that item is experienced. An example of financial and non-financial items to be included in such an assessment scheme is illustrated in Table 8.1. These financial and non-financial indicators have been discussed in the text. Financial and non-financial inputs and gains or results of rehabilitation inputs are disclosed to stakeholders according to the rehabilitation and environmental managers who responded to the questionnaire (Statement 2.1.11: 79.2%; Statement 2.1.13: 67.4%). They also agree that financial issues form an integral part of the procedure to find a balancing position in respect of environmental cost management (Statement 2.1.14: 89.6%).
Figure 8.4 Finding a mining rehabilitation equilibrium

Items on such a scale should be selected in accordance with the particular rehabilitation and environmental policy of the mining company as well as of the commodity mined. Surface coal mines for example would have different needs from deep gold mines, geological composition might differ substantially, and weather conditions such as rainfall and prevailing winds on discard dumps would be different in various regions.
Table 8.1  Environmental financial and non-financial checklist

<table>
<thead>
<tr>
<th>Item</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
<tr>
<td>Total costs of rehabilitation</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Costs of the extended enterprise (aftercare, consultations, environment)</td>
<td></td>
</tr>
<tr>
<td>Designing out of rehabilitation costs during planning</td>
<td></td>
</tr>
<tr>
<td>Costs of pollution prevention, minimising</td>
<td></td>
</tr>
<tr>
<td>Separation of internal, external, capital and operating costs</td>
<td></td>
</tr>
<tr>
<td>Separation of prevention, assessment, control and failure costs</td>
<td></td>
</tr>
<tr>
<td>Separation of rehabilitation costs as part of present process</td>
<td></td>
</tr>
<tr>
<td>and costs on damage from the past</td>
<td></td>
</tr>
<tr>
<td>Integration of rehabilitation expenditure into decision making</td>
<td></td>
</tr>
<tr>
<td>Life cycle costs</td>
<td></td>
</tr>
<tr>
<td>Time: monetary provision for long-term rehabilitation</td>
<td></td>
</tr>
<tr>
<td>and aftercare</td>
<td></td>
</tr>
<tr>
<td>Extended capital, expenses budgets to include rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Utilising expertise</td>
<td></td>
</tr>
<tr>
<td>Timing of rehabilitation operations</td>
<td></td>
</tr>
<tr>
<td>Investments of time and funding for education and training</td>
<td></td>
</tr>
<tr>
<td>Financial and non-financial (permits) provision for contingencies</td>
<td></td>
</tr>
<tr>
<td>Future costs: legal, remediation, prevention, failure, control</td>
<td></td>
</tr>
<tr>
<td>Benchmarking, consulting with the surrounding community</td>
<td></td>
</tr>
</tbody>
</table>
**Results:**

Financial gains: capital and operating
Return on investment; costs to benefits
Performance improvement
Value of property
Internal and external value added
Decrease in pollution, ecological risks
Increase in water quality
Aesthetic value, impact
Health of workers, community
Productivity, flexibility, efficiency, quality improvement
Quality of recreation in nature
Time: short-term, long-term losses/gains
Employee development towards rehabilitation policies
Involvement of accounting personnel
Marketability
Awards, leadership
Comparison with international standards

(Source: Empirically developed)

These financial and non-financial implications of rehabilitation and environmental programmes would determine the degree of implementation of a system of full cost accounting. Both external and internal environmental cost accounting approaches are incorporated in order to provide a more complete assessment of environmental risks and impacts (Heymann 1997:7). Each individual mining company would be in a separate stage of development regarding the differentiation and disclosure of rehabilitation and environmental inputs and gains.

### 8.6.3 Rehabilitation and environmental implementation

Issues pertaining to the implementation of environmental rehabilitation form an integral part of the procedure to find equilibrium in respect of environmental cost management. This view is supported by the rehabilitation and environmental managers who responded
to the questionnaire (Statement 2.1.17:81.3%). The degree of implementation of rehabilitation and environmental policies could also be evaluated by means of a checklist, such as the one illustrated in Table 8.2. Since the needs and circumstances of each individual mining company and mine might vary, each one has to prepare its own checklist.

Table 8.2 Rehabilitation and environmental implementation checklist

<table>
<thead>
<tr>
<th>Item</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolvement stage of comprehensive strategy</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Implementation of this strategy</td>
<td></td>
</tr>
<tr>
<td>From a reactive to a planning approach</td>
<td></td>
</tr>
<tr>
<td>Initial impact assessments</td>
<td></td>
</tr>
<tr>
<td>Separate budgets for rehabilitation programmes</td>
<td></td>
</tr>
<tr>
<td>Integration of rehabilitation policies into major schemes</td>
<td></td>
</tr>
<tr>
<td>Implementation of BATNEEC (best available techniques not exceeding excessive costs)</td>
<td></td>
</tr>
<tr>
<td>Flexibility, redesign in respect of changing circumstances</td>
<td></td>
</tr>
<tr>
<td>Contingency planning for floods, accidents</td>
<td></td>
</tr>
<tr>
<td>Development stage of environmental information gathering and disclosure</td>
<td></td>
</tr>
<tr>
<td>System of waste and rehabilitation accounting</td>
<td></td>
</tr>
<tr>
<td>Internal and external environmental auditing</td>
<td></td>
</tr>
<tr>
<td>Co-operation and relationship with authorities</td>
<td></td>
</tr>
<tr>
<td>Importance of feedback and continuous improvement</td>
<td></td>
</tr>
<tr>
<td>Stage of sustainable development support</td>
<td></td>
</tr>
<tr>
<td>Maintenance after closure</td>
<td></td>
</tr>
</tbody>
</table>

(Source: Empirically developed)

The rehabilitation and environmental implementation checklist makes provision for the assessment of the degree of full cost accounting being implemented in the rehabilitation management accounting system. Future rehabilitation costs are considered and allocated for present pricing purposes.
8.6.4 Environmental rehabilitation leadership

Rehabilitation and environmental implementation are closely linked to environmental rehabilitation leadership. Although a mining company would have compiled a comprehensive strategy on rehabilitation management including issues on financial and non-financial policies, would have a programme on the implementation of these policies, and could detect some positive effects on the natural environment, these would not be successful without strong environmental rehabilitation leadership and integrity on the part of top management. This view is supported by the rehabilitation and environmental managers who responded to the questionnaire. They agree that leadership factors form an integral part of the procedure to find a balancing position regarding environmental cost management (Statement 2.1.16: 83%).

An example of a checklist for the evaluation of environmental rehabilitation leadership is illustrated in Table 8.3. These items should be adjusted according to the needs of each individual mining company, since some companies have more difficult environmental problems to solve because of a heritage of badly rehabilitated land or of no rehabilitation at all.
<table>
<thead>
<tr>
<th>Item</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing from a compliance to a strategic planning approach, with</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>mission and objectives</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation integration into existing programmes</td>
<td></td>
</tr>
<tr>
<td>Elimination of hidden environmental costs in various overhead accounts</td>
<td></td>
</tr>
<tr>
<td>Integration of awareness of environmental impacts throughout all activities</td>
<td></td>
</tr>
<tr>
<td>Benchmarking in industry, communicating with community</td>
<td></td>
</tr>
<tr>
<td>Involvement of internal and external expertise</td>
<td></td>
</tr>
<tr>
<td>Encouragement of employees to improve rehabilitation performance</td>
<td></td>
</tr>
<tr>
<td>by means of prevention</td>
<td></td>
</tr>
<tr>
<td>Ethical, cultural attitudes; sensitivity to natural environment; accountability</td>
<td></td>
</tr>
<tr>
<td>Responsibility towards interested and affected parties</td>
<td></td>
</tr>
<tr>
<td>Utilisation of rehabilitation technology in various divisions</td>
<td></td>
</tr>
<tr>
<td>Provision for training and education in rehabilitation issues at various levels</td>
<td></td>
</tr>
<tr>
<td>Encouraging continuous improvement by means of research and development</td>
<td></td>
</tr>
<tr>
<td>Incorporating total quality management, ISO9000, overseas experience</td>
<td></td>
</tr>
<tr>
<td>Utilisation of available financial and non-financial management instruments</td>
<td></td>
</tr>
<tr>
<td>Emphasis on the role of feedback information</td>
<td></td>
</tr>
<tr>
<td>Development of environmental performance evaluation and information</td>
<td></td>
</tr>
<tr>
<td>systems, including flexibility</td>
<td></td>
</tr>
<tr>
<td>Quality and timely reporting, disclosure of rehabilitation investments,</td>
<td></td>
</tr>
<tr>
<td>operations, results</td>
<td></td>
</tr>
<tr>
<td>Distinguishing between immediate and gradual reaction to data</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation standards in line with international standards (eg ISO14000)</td>
<td></td>
</tr>
<tr>
<td>Implementation of environmental audits which are continuously being improved</td>
<td></td>
</tr>
<tr>
<td>Accounting approaches from historical to future-oriented emphasis</td>
<td></td>
</tr>
<tr>
<td>Recognition of environmental liabilities for reporting, decision making</td>
<td></td>
</tr>
</tbody>
</table>
Following a team approach that will include accounting, legal and other managers
Life-cycle evaluations of present and future rehabilitation policies
Following total approach from impact assessment to aftercare
Providing for future, long-term changes in regulations, technology, cost structures
Encouraging sustainable development

(Source: Empirically developed)

The indicators on the environmental rehabilitation leadership checklist would assess the degree of linkage of environmental information systems with the management accounting systems of control and reporting, as well as with existing cost management and capital investment decision-making systems. Management for quality could therefore be determined in terms of quality environmental planning, quality control and quality rehabilitation and environmental improvement (Juran 1989:26). These indicators would measure the properties of environmental leadership, and would also indicate that these leaders would be successful in other management areas as well, such as planning, anticipation of and provision for change, self-control in establishing clear criteria as well as making use of feedback (Juran 1989:174), and functioning within legal limits.

Progress with these leadership indicators is determined in terms of improvements when comparing these scores with the scores of previous periods and with set standards. Unsatisfactory long-term improvements of the total balance of the four elements of the equilibrium could be ascribed to inadequate management and leadership, rather than to the inadequate performance of employees. Improvements in leadership properties are closely linked to the degree of bottom-up empowerment of employees to recommend opportunities for performance improvement, as opposed to the traditional top-down control approach (Johnson 1992:156). This system for the assessment of an optimum equilibrium position therefore forms an important management instrument for the evaluation of leadership properties.

8.6.5 Effect on the natural environment

The implications of financial and non-financial actions and results, the implementation
procedure of rehabilitation and environmental programmes and the strength of the environmental rehabilitation leadership form an integral part of the finding and optimising of an equilibrium position. But the positive or negative effects of all these actions are eventually found in the present and future state of the natural environment. This view is confirmed by the rehabilitation and environmental managers who responded to the questionnaire. They agree that issues on the natural environment form an integral part of the procedure for finding a balancing position regarding environmental cost management (Statement 2.1.15: 82.6%). In order to arrive at a more complete reflection of the equilibrium situation, the effect of the comprehensive management accounting strategy should be followed through, and the effects on and reactions of the natural environment should be evaluated.

Since it is difficult to be precise in these evaluations, a degree of subjectivity should be allowed and more than one opinion obtained. A proposed checklist for the evaluation of the natural environment during and after rehabilitation programmes is illustrated in Table 8.4.
Table 8.4 Checklist for effect on the natural environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Added value to land, water, air</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Added years for agricultural land, food supplies</td>
<td></td>
</tr>
<tr>
<td>Prolonged useful life of land, property</td>
<td></td>
</tr>
<tr>
<td>Maintenance, supervision after closure</td>
<td></td>
</tr>
<tr>
<td>Reduced waiting period from excavation to remediation</td>
<td></td>
</tr>
<tr>
<td>Reduced pollution of soil, water, air</td>
<td></td>
</tr>
<tr>
<td>Revegetation, reintroduction of former plants, animals</td>
<td></td>
</tr>
<tr>
<td>Water safe for human and animal consumption</td>
<td></td>
</tr>
<tr>
<td>Stability of land for building purposes, sinking of boreholes</td>
<td></td>
</tr>
<tr>
<td>Surrounding communities could survive as previously</td>
<td></td>
</tr>
<tr>
<td>Keeping land, property in ordinarily efficient condition</td>
<td></td>
</tr>
<tr>
<td>Matching quality, cost, time with technology, behaviour, culture</td>
<td></td>
</tr>
<tr>
<td>Public opinion/satisfaction with rehabilitation, preservation of nature</td>
<td></td>
</tr>
<tr>
<td>Sustainability for future generations, life</td>
<td></td>
</tr>
<tr>
<td>Biodiversity remediation, preservation</td>
<td></td>
</tr>
<tr>
<td>Preservation of a number of species</td>
<td></td>
</tr>
<tr>
<td>Reduction of years required for the environment to remediate by itself</td>
<td></td>
</tr>
<tr>
<td>True profits: none of the stakeholders incurs losses</td>
<td></td>
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(Source: Empirically developed)

This checklist provides a means of determining the responsibility of the industrialised sectors towards the natural resources and sustainability. It also gives an indication of the reaction of the mining industry to the environmental challenge to minimise pollutants, rehabilitate and remediate in both monetary and non-monetay terms.

The effect on the natural environment after rehabilitation programmes, is to a large extent linked to time. Historically oriented information could support improvement policies, but the eventual goal would be a sustainable living natural environment for future generations. Projections should be made in order to evaluate the state, sustainability and
financial and non-financial value of rehabilitated and remediated land after ten, twenty
and a hundred years. The comprehensive effect of past and present rehabilitation
programmes should be projected towards future remediation efforts and quality of life in
the area of dependency on soil, water and air.

8.6.6 Goal: Towards optimum equilibrium

The success of the equilibrium strategy depends on the measurement, accumulation and
reporting of rehabilitation and environmental information. Zero risk and total accuracy
cannot, however, be achieved in this optimalisation model, but the major objective would
be to apply quality management policies with the emphasis on continuous environmental
improvement towards an optimum equilibrium position. Feedback on the degree of
equilibrium consists of various documents to be prepared by the management accountant
(Maromonte 1996:147). These include information such as an explanation of the purpose
of this set of information, graphs and tables of evaluations, comparing the latest scores
with past and estimated future figures, emphasising criteria of quality, time, financial and
non-financial input and gains, technical development, and satisfaction of interested and
affected groups.

This equilibrium matrix would enable management to realise the impact of the
implementation of different policies on several variables simultaneously. Investments,
improvements and optimalisation in one section which would lead to deteriorations in
other sections (Epstein 1995:73; Juran 1989:143) could be detected by means of this
model. Information on environmental consequences of rehabilitation programmes is
linked to management accounting, control functions, financial and non-financial
disclosures and reporting, decision-making systems for cost management and capital
investments, the implementation of these policies and the influence of leadership.
Information accumulated in this scorecard would enable environmental leaders to build
bridges between mining companies, authorities and the environment. In addition to the
illustration of past and present rehabilitation performances, this matrix is also an
instrument for assessing projections of proposals for future rehabilitation programmes.

This rehabilitation and environmental equilibrium matrix could be adapted for the specific
circumstances of each individual mining company. Small and large companies could both
benefit from this model, as well as companies with high or relatively low volumes in
potential discard dumps and pollutants. The degree of damage that could be inflicted on the environment as well as the toxic content of effluent could be incorporated in this model.

An optimum equilibrium position in respect of total quality environmental management should eventually be found between economical and environmental objectives by weighing the costs of the protection of the environment against the short-term and long-term benefits to be gained from these investments. This would be in accordance with the vision of the mining company which should be achieved in the shortest practical time span as part of its long-term continuous strategy. An aspiration after an optimum equilibrium position would enhance the competitive position of the company in an increasingly global business environment which accords high priority to rehabilitation and environmental quality management.

8.7 SUMMARY

The functions of the management accountant form an integral part of the development and functioning of the various components encompassed in the strategy for total quality rehabilitation management accounting. In addition to the primary contributions discussed in the previous chapter, the following secondary contributions, briefly, are made by management accountants, or should be included in their overall contribution:

- As part of the support service management accountants render to management, they provide information and advice. In addition to financial indicators, relevant information should include qualitative and non-financial evaluations. If necessary, traditional and existing models are analysed and adapted to arrive at improved approaches in the form of paradigm shifts. By means of reengineering, radical and rapid changes and improvements could be obtained in productivity, timeliness and usefulness. This information and advice should make provision for flexibility, especially under changing circumstances. A system of continuous improvement in measurement and evaluation criteria has the potential to more accurately assess inputs and gains in financial, non-financial and qualitative terms. (Paragraph 8.2.)

- Performance evaluation and measurement should be included in the initial stages of strategic planning schedules. Financial analysis indicates the current position in relation to past and future situations in respect of each individual environmental
cost category. Non-financial and quantitative evaluation criteria would include health, safety, time and pollution level assessments. Performance is assessed to combine both financial and non-financial indicators. (Paragraph 8.3.)

- Environmental reports are provided to communicate with stakeholders. Financial disclosures include obligations, contingencies, reserves for closure, risks, capital and current expenditures, environmental liabilities and the value of natural resources. This information is linked to non-financial input and gains in relation to rehabilitation and environmental performances throughout the company which include budgets and standards, waste and pollution levels, reclamation programmes - all of which should be seen against the background of trends, attitudes and culture. The various groups of environmental costs incurred are disclosed according to categories. Projections are made of future rehabilitation costs that must be incurred as well as of expected results. Information in these reports should be communicated in order to be accessible to users and to assist management as part of the feedback function. Procedures for financial and taxation statements would be extended to include the disclosure of rehabilitation and environmental aspects for the broader group of stakeholders. (Paragraph 8.4.)

- The feedback mechanism provides adequate information about actual results and achievements for the required continuous improvement of accounting and management functions. The management team has to follow up on positive as well as negative feedback in order to modify actions for improved present and future performance. A change in the role of the management accountant from controller to facilitator is needed. (Paragraph 8.5.)

- By means of a set of checklists an environmental equilibrium position is determined. The ideal situation would be to find an optimum total quality equilibrium position regarding environmental rehabilitation implementation, environmental leadership, financial and non-financial input and gains, and the natural environment. In this model optimum rehabilitation and environmental programmes in one section would indicate deteriorations in other sections. Short-term as well as long-term financial and non-financial input and gains are combined in this equilibrium matrix for the assessment of environmental excellence. (Paragraph 8.6.)

Apart from the possibilities of continuous improvement in these contributions, management accountants would also take into account the interests of the broader
spectrum of stakeholders. Actual accomplishments as well as future strategies according to this scheme would strengthen the comprehensive strategy for rehabilitation and environmental cost management.

The accountant and management accountant form an integral part of the team that ensures the development of mutually reinforcing practices for the success in quality rehabilitation and environmental management. They have to experiment and seek new and advanced ways of utilising their expertise and enlarge their competence by presenting management accounting as a broader function for use in management decision making.
CHAPTER 9

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

The background situation pertaining to rehabilitation management systems in the mining industry in South Africa, in Africa and in the most highly developed countries of the world, namely Canada, the United Kingdom and the United States of America, was investigated. A comprehensive strategy has been developed for the implementation of a rehabilitation management accounting system in the mining industry. This strategy is aimed at both long-term and short-term planning for success, includes ways to implement these plans and is based on the management accounting dimensions of quality, cost and time.

This chapter contains a summary of conclusions reached in the previous chapters as well as recommendations that were made.

9.2 CONCLUSIONS

The general conclusion is that in highly developed countries such as the United States of America environmental management accounting is less advanced than one would have expected. Increasing interest in the natural environment would permit the evolution and development of environmental and rehabilitation management together with the development of the accompanying management accounting systems. These developments would in time lead to globally applied systems.

In South Africa in particular the most important developments have been the increasing promulgation of legislation by central authorities to prevent and combat pollution. The whole movement towards environmental protection could well result in enormous future financial environmental liabilities as well as control and failure costs if attention is not given timeously to preventive and assessment measures.

According to responses to the questionnaire from rehabilitation and environmental
managers in the mining industry in South Africa, there is a need for the implementation of a comprehensive management accounting strategy for long-term rehabilitation management. Consequently a system has been developed for the remediation and rehabilitation of mined-out areas in such a way that equilibrium will eventually be established between environmental rehabilitation programmes; the financial and non-financial implications; leadership; and the natural environment.

Rehabilitation management practices in the rest of Africa stem from a history and culture of inadequate rehabilitation policies, accompanied by improper cost management in both the short and the long term. This heritage still has an influence in local mining and rehabilitation attitudes and behaviour, and might still have an impact in future. These characteristics of the existing system coincide with the behavioural, cultural and technical attributes of a management accounting system as defined by Ansari et al (1997b: MMEC-14). In the long term this existing series of inadequacies could be improved upon by means of research and development programmes, and investments in environmental education and training. The implementation of technical features such as an extended relevant information system which would provide a better understanding of the processes of rehabilitation and environmental cost management would positively influence cultural perspectives and lead to improved behaviour in the form of more adequate decisions.

South Africa could benefit by researching and applying highly developed skills and technologies from leading developed countries such as Canada, the United Kingdom and the United States of America. Although South Africa is not far behind as regards technological developments in rehabilitation management in the mining sector, the management accounting profession in these developed countries realises the importance of continually improving the present systems of environmental and rehabilitation management, measuring and disclosing environmental rehabilitation efforts and encouraging and expanding the positive involvement of authorities.

The need to compile and implement a comprehensive long-term management accounting strategy for the mining industry in respect of rehabilitation and environmental management was followed up and proposals were made through the development of a strategy to satisfy this need. Although present rehabilitation policies are mostly within the limits of the law, and the important role of management accountants is somewhat neglected, their leading role as part of the management team is envisaged.
9.3 RECOMMENDATIONS

Recommendations following from this study are based on the fact that since sources of knowledge and information are inexhaustible, teams of rehabilitation management experts, including management accountants, should move between disciplines borrowing ideas, models and concepts. These various types of information instruments should be applied with care by management accountants, taking into account aspects such as communication and analytical skills, as well as strategic thinking and planning.

As part of the function of providing management accounting information for decision-making purposes, a comprehensive rehabilitation management strategy has been designed which provides for varying needs under different and changing situations. The following guidelines and contributions are included in this strategy:

- An appropriate background knowledge of the influences of time, cost and environmental perspectives would facilitate the production of information of a higher quality.

- A holistic view needs to be taken of the interdependence and independence of relevant aspects, including life-cycle costs, value-added activities, sustainability, the needs of the community, paradigm shifts, flexibility, the interests of stakeholders and the costs of the extended enterprise.

- Information and advice on improved cost management would include suggestions on adaptations to changed circumstances, target costing, total and full cost accounting, adequate feedback mechanisms and the extension of non-financial indicators.

- Control and failure costs could be limited if due cognizance was taken of the legal aspects of local and central authorities.

- Total quality environmental management approaches should be extended to include as many as possible of the instruments inherent in this proposed system by means of compliance with international standards, total quality control, and long-term strategies.

- Investments of money and time in education and training as well as in research and development would result in both financial and non-financial benefits in the long term, beginning with gradual changes in behaviour and cultural influences.

- Ethical aspects and the resulting welfare and well-being of the community should
not be neglected. A Pareto optimum position should be achieved; that is a position where no interested or affected party would be worse off owing to mining rehabilitation operations.

- Relevant information needs to be selected, providing for a better understanding of rehabilitation processes, and for continuous improvement and flexibility.
- Performance evaluation should be included from the initial planning stages, including both financial and non-financial assessments.
- Disclosure of rehabilitation and environmental input and gains, liabilities and projections in both historical and futuristic terms, should be encouraged.
- Both short-term and long-term financial input and gains are combined in the equilibrium matrix for the assessment of environmental excellence.

Since individual mining companies are operating under different circumstances and have unique rehabilitation and environmental problems, adjustments should be made within the wider framework. The provision of relevant information for management decision making would distinguish rehabilitation and environmental costs from traditional overheads and categorise them into prevention, assessment, control and failure costs. This would lead to a better understanding of these decision-making processes. A better understanding of these processes would change the traditional culture of values, beliefs and mindsets and lead to improved behaviour in the form of evaluation in non-financial terms as well financial terms and the more adequate allocation of rehabilitation and environmental costs.

9.4 CONCLUDING REMARKS

A general change of emphasis in management accounting could be effected, especially towards a more holistic approach which includes total quality environmental management and non-financial indicators. More emphasis could be placed on the interests of all stakeholders in the extended enterprise. This changed approach may be illustrated in the arena of rehabilitation and environmental management in the mining industry in South Africa.

A better comprehension of the rehabilitation process would indicate the causes of failures by identifying the various components of rehabilitation activities as well as the interaction between these activities. As a result of this information which is provided by the
management accountant, improved and altered beliefs would culminate in more adequate decisions on rehabilitation management.

The implementation of the developed comprehensive rehabilitation and management accounting strategy would set a system to work that would

- positively change the inadequate allocation of environmental costs
- make the invisible environmental costs visible
- positively change traditional values, beliefs and mindsets concerning environmental cost management
- include evaluations in non-financial terms as well financial terms

The increasing utilisation of technology and the evolution of expert systems would enable management accountants in the near future to expand on the basic environmental and rehabilitation management accounting strategy which has been developed in this study. They would have to design management information systems to meet new requirements, and to develop precisely the system required for their individual circumstances.

The correct and skilful application of management accounting instruments, especially in the form of the provision of relevant information, has the power to make environmental costs visible and to change traditional and narrow perceptions. This would lead to new ways of thinking and decisions that would enhance the wellbeing of all interested and affected parties involved in mining rehabilitation operations.
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