# 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 skilful 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

land.

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 of, 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 Lohatlha 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 $m^3$) 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 ($FeS_2$) and fluorspar ($CaF_2$) 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 unbeneficiated 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 re-use 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 1996e: 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.