

CHAPTER 5

A BRIEF ACCOUNT OF THE SITUATION IN THE REST OF AFRICA

5.1 INTRODUCTION

With the situation in respect of rehabilitation management in South Africa as the broad background, the world-wide management of rehabilitation in the mining industry was investigated briefly. The aim was to determine whether solutions to present and envisaged future problems could possibly be found and strategies could be formulated by studying the applied management and management accounting techniques used in other countries. Efficient overseas policies could be introduced locally, either unchanged or with the necessary adaptations. Improvements regarding current South African rehabilitation management issues could possibly be recommended, or incorporated into present strategic planning, after an analysis of the management accounting styles of other countries. On the other hand, a study of unsuccessful attempts to achieve an efficient rehabilitation management system as well as the reasons for such failures, could help to avoid similar situations in South Africa.

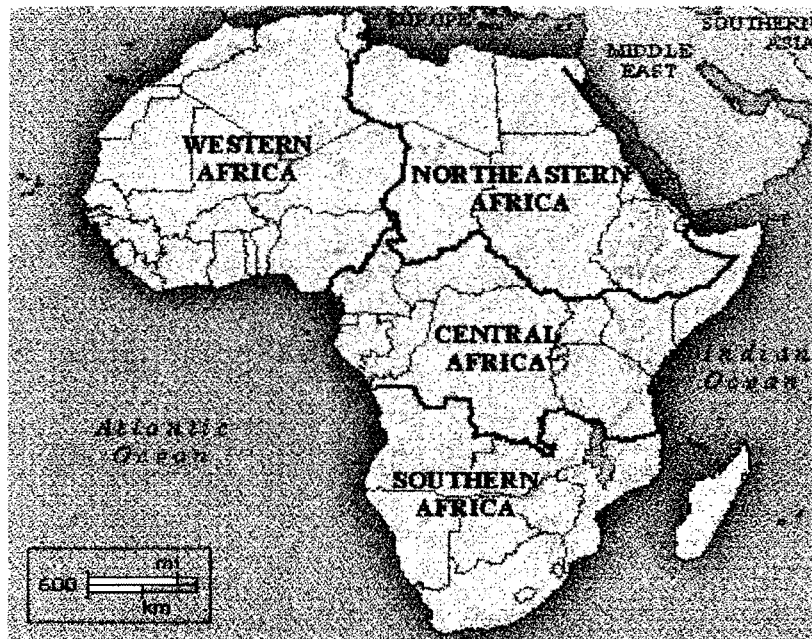
South Africa forms an important part of Africa in many respects. Not only is the country strategically well situated (see Figure 5.1), but its economic strength makes it the leading country in Africa. These attributes put South Africa in a very strong position to encourage and support positive developments in the rest of Africa, especially as far as the rehabilitation management of mining environments is concerned. Improved communication between the countries of the continent and specifically between the countries south of the equator enhances the prospects of mutual support and the exchange of useful knowledge between African countries.

As in Gore's Global Marshall Plan (1992:295), in which he suggests that the global environmental crisis should be solved by means of a global cooperative effort, rehabilitation management in the mining industry should also be approached in a global way. The diversity among nations as well as their radically different stages of economic and social development make regional groupings a feasible proposition, with distinctive strategies for each region (Gore 1992:300). Africa south of the Sahara or even South Africa and the immediate neighbouring countries could form a region for the purpose of

cooperating on rehabilitation management. For instance, the exchange of expertise could reduce research and development costs, as well as transport costs where a country in a particular region (as indicated in Figure 5.1) is already using advanced technology. Under these circumstances it would be cost-beneficial not to import from outside the region.

The objectives of this chapter are to investigate the situation in Africa in respect of rehabilitation management, as well as the management accounting practices related to mining ecological environments, and to establish to what extent South Africa could benefit from the successes and failures of these countries. An analysis of developments in management accounting, and particularly any endeavours to identify and measure financial and non-financial environmental losses and gains, is included in these objectives. Attention is also given to analyses of details such as the role authorities play in encouraging rehabilitation by means of legislation and taxation, to the measurement and reporting of rehabilitation efforts to the stakeholders and the public, and investments in the training and education of staff associated with mining and rehabilitation activities, and to the way these issues could influence and enhance local South African management accounting strategies.

Figure 5.1 Africa



(Microsoft Bookshelf 1996)

5.2 EVOLUTION AND DEVELOPMENT OF MINING AND REHABILITATION

Mining has a long and important history in Africa, as it has formed the basis for trade across borders. Herodotus first mentioned the existence of trade in gold along the northern and western shores of Africa in the fifth century BCE (before the common era). After the Arab invasion of North Africa during the eighth century, full descriptions and records of the trade were provided by Moslem travellers, who noted the exceptional wealth of African kingdoms. Salt mined in the Sahara was exchanged for an equal weight of alluvial gold and for slaves from the western coastal regions of Africa. Jewish cartographers were depicting African gold on their maps by 1375, indicating excessive riches in Guinea, now one of the poorest countries in the world (Harries 1995:4).

The extraction and smelting of tin began by approximately 900 BCE in the northern parts of Nigeria. Before 1904, however, these operations remained small-scale local activities (Alexander 1990:44). The quantities of tin produced were probably sufficient to satisfy the needs of the local peoples, and no trade in tin was reported. The extremely hard labour required to exploit this metal also limited the trade in tin as only small quantities were eventually available. In those days labour was cheap and was not regarded as an expensive production factor, as it is today.

In Southern Africa the Wankie Colliery (“Wangi Kolia”) in Zimbabwe occupied an important position in the economic history of much of the region’s transport and railway networks as well as in the mining industry. Since production commenced on the mine in 1902, most of the economic activities of the region were directly or indirectly linked to the coalfield (Phimister 1994:1).

In North-Western Africa (as illustrated in Fig 5.2) the commercial mining of gold was not viable owing to the low average gold content of the ore, narrowly concentrated amounts of gold, and small and scattered deposits. Throughout the centuries artisanal mining had been practised, mostly as a sideline, and proved to be the only practical means of exploiting the low-grade ore. Mining activities were restricted by the dangerous and labourious nature of such mining and by floods during the rainy season and a lack of

water during the dry season. According to Harries (1995:6), the methods employed by the Malian artisanal miner of today do not differ much from those of his ancestors. Scarce resources limited mining and rehabilitation operations in the past and to a great extent also do so today. The limiting factors are the low gold content, which does not yield sufficient income, as well as a lack of modern technology to improve unsafe working conditions and control climatic extremes. A further limiting factor is the average low level of development of the inhabitants, who are not ready to apply the advanced concepts originating from capitalism.

Foreign investment in these countries, supplied mainly by capitalist countries with the object of introducing modern mining techniques, including rehabilitation management practices, have been discouraged because of the unstable and unfavourable political climate after independence.

Commercial mining during the pioneer years of mining in Africa left a legacy of damaged and derelict land to the present generations. In Nigeria a worked-out mining landscape of this nature of about 316 square kilometres is found on the Jos Plateau. From 1904 onwards the first tin prospectors used picks and shovels which left relatively shallow mines of between three and four metres deep. By 1920 the pick and shovel had been replaced by the bulldozer and other more advanced equipment that could exploit tin-bearing ore from as deep as 10 to 30 metres and which caused much more damage than the less advanced technology of previous decades. The landscape is described as consisting of steep dumps enclosing these 30 metre deep hollowed-out areas (Alexander 1990:44,45). It would be difficult if not impossible for the present mainly impoverished generation to generate or find funds to rehabilitate this damaged land. Damaged land does not allow the inhabitants of the area to earn a proper living by means of agricultural activities, for example. This dark picture of continuing degradation of land calls for a rehabilitation management accounting strategy that would address all limiting factors, and that would introduce basic training and education for all people involved in mining activities.

In the overwhelming effort to minimise costs, the health and safety of workers on mines were neglected to an appalling extent. Phimister (1994:14,15) records that before 1910 workers at the Wankie colliery in Zimbabwe had to work eleven hour shifts seven days per week, on very low food rations. At one stage wages were also decreased by ten

percent to “economise wherever possible”. The favourable position of this mine as the only one in the country resulted in perfunctory official inspections. This preoccupation of the managers of the mine with getting the coal out of the earth at the lowest possible cost, and at the cost of the health and safety of their workers, did not leave space in their minds for rehabilitation management. On the other hand, the workers who were battling to survive physically under extreme conditions were not in the least interested in the condition of the natural environment. The exploited land was the birth place of neither the workers, who came from other regions in Africa, nor the colonialists. The philosophies surrounding the roles of the colonial capitalist, the migrant worker, and the natural environment that were developed during these pioneering years of mining in Africa and Southern Africa cannot be changed easily.

Africa is rich in many minerals, gems and metals that can be mined successfully. Scattered over most of the continent (Fig 5.1), from Sierra Leone in the west to the Congo in Central Africa, from Morocco in the north to South Africa in the south, a large variety are mined for export purposes (Table 5.1). All of these mining activities have a very important influence on the economies of these countries as valuable foreign exchange is earned and internal employment opportunities provided. About four million people are making a living out of mining in Africa (Hollaway 1995:20). The majority of these people are small artisanal miners employing limited technology to extract riches from the land.

Although Africa is rich in minerals, and millions are making a living out of these, environmental management and control are very fragmentary. The abundance of natural wealth or capital, in the form of minerals, metals and people, does not compensate for the lack of rehabilitation management and the accompanying management accounting strategies.

Table 5.1

African countries: Principal exports in terms of minerals, gems and metals
(excluding oil) (as a percentage of the total exports of the country)

Botswana	diamonds (80%), copper-nickel
Burkina Faso	gold
Central African Republic	diamonds (70%)
Democratic Republic of the Congo	copper (50%), cobalt, diamonds
Gabon	manganese, uranium
Ghana	gold (45%), manganese
Guinea	bauxite ore, alumina (70%)
Liberia	iron ore (60%)
Mali	gold
Mauritania	iron ore
Morocco	phosphates
Namibia	diamonds, copper, etc (50%)
Niger	uranium (70%)
Sierra Leone	rutile, bauxite, diamonds
South Africa	minerals, including gold (60%)
Togo	phosphates (25%)
Zambia	copper (82%), cobalt
Zimbabwe	gold & other minerals

(Compiled from Africa Institute: Pretoria News: 4/6/97)

Although Africa has a selection of most of the known minerals and gems in the world, the continent remains in the raw material phase. In order to develop strategies that would improve the quality of land and to train and educate vast populations, strategic management accounting policies are needed (Yemi Adedokun 1996a:14-15). Initial capital is, however, required to generate and accumulate capital for these strategies. This initial capital should include financial and non-financial inputs in the form of know-how, modern technology, direct monetary inputs and rehabilitation management accounting strategies. As soon as the improvement gets under way more capital can be acquired in the process to generate and accumulate capital.

Figure 5.2 Western Africa



(Microsoft Bookshelf 1996.)

5.3 DIFFICULTIES ENCOUNTERED WITH REHABILITATION MANAGEMENT

5.3.1 Introduction

As in South Africa, the basis of effective rehabilitation management, or even the introduction of rudimentary rehabilitation policies, stems from an awareness of the need to preserve the natural environment. It appears that even in the recent past the peoples of the rest of Africa had an attitude of environmental non-awareness in general. This can possibly be ascribed to economic factors such as the fact that most of the rural inhabitants of Africa have traditionally moved away from areas where they cannot make a living towards more fertile areas. These peoples generally need less than bare essentials to survive and are content with such a standard of living. They are not concerned about pollution from mining activities, and are ignorant or unaware of the negative effects of polluted air, water or soil which culminate in health and care expenses that would further reduce their standard of living.

As early as 1920 rural communities in Zambia exceeded the carrying capacity of the natural environment (Els 1996:2). At that stage there were already too many people and animals to survive according to traditional agricultural methods. People took more from the land than they were able to return for their own generation. Future generations were not taken into consideration. Communities have to make changes and gain living space by investing financially and non-financially in the rehabilitation of the areas surrounding mines.

Underlying the lack of awareness of the consequences of environmental rehabilitation of mining areas, are other environmental and economic issues. In order of priority they are: deforestation, poverty, water deficiencies and land tenure (Chamber of Mines Journal 1995c:12). Forests are being utilised and exploited for firewood and timber, and cleared for mining operations, and are destroyed by other causes such as acid rain. An extremely high percentage of the people of Africa are poor, and in the struggle for survival, conservation of the natural environment is given a very low priority. As on the asbestos mines in South Africa about one hundred years ago, poverty precluded advanced concepts, such as the rehabilitation of mining areas, from being included in management policies. Owing to the developing nature of most of the countries in Africa, sophisticated clean water supply systems are usually not present in rural towns. Existing water supplies are polluted by mining activities, among others. Although land was traditionally owned by tribal heads, all land belonged to everybody and to nobody, except for the “yard” and the cultivated field (Els 1996:495). In the end the responsibility for the conservation of the natural environment did not rest with any group or person.

Within the traditional view of abundance of good land, the value of land actually decreases and nobody realises or recognises that losses for present and future generations might occur. In the African situation various factors have a negative influence in respect of rehabilitation management, and should be taken into account in the development of a holistic strategy for rehabilitation management accounting. They are polluted air, water and soil, small-scale mining, illegal mining, the lack of law-enforcement, state-run mines, external pressure, international trade agreements, and the cultural heritage of the peoples of Africa.

5.3.2 Polluted air, water and soil

The major difficulties in respect of environmental management and rehabilitation in mining in Zimbabwe are given by Laurence (in Chamber of Mines Journal 1995c:17), and are largely applicable to Africa. Mining management, which includes the management accountant, has to find solutions to the primary problems of air pollution, surface and underground water pollution and damage to soil and land.

5.3.2.1 Polluted air

The air in the vicinity of mining activities is being polluted by dust spread by the wind from waste and sand dumps. In addition, the crushing and screening of mined ore emit more airborne dust. Workers and people living near the mines are exposed to gas from refineries, collieries and processing plants. Toxic chemicals and substances to which humans, animals, plants, soil and water are exposed are released into the air. Polluted air may come into direct contact with ecological systems near the source of pollution, or may be spread in the form of acid rain to more distant regions.

It is already difficult to measure the extent of pollution in the air. This is aggravated by the dilution of the pollutants as they are blown away from the source of emission. Many gases and toxic substances in the air cannot be observed without sophisticated equipment, and when they cannot be seen or smelled, they are unlikely to be detected by ordinary people. Methods of constantly assessing the pollution levels in the air, and of the damage caused by such pollution, should be found. These mostly non-financial assessments should be weighed against the cost of the introduction of measures such as the installation and maintenance of filters or cleaner processing methods in order to prevent or diminish the emission of damaging substances into the air. The cost of the rehabilitation of damaged areas caused by polluted air, as well as the potential cost of health claims and future fines, should also be considered.

5.3.2.2 Polluted surface and underground water

Chemicals used in processing, acid mine drainage and heavy metal particles are the main substances that end up in surface and underground water. As water masses usually do not remain in one area, but flow to lower levels, the pollution is spread both on the surface

and in underground water sources. Rivers become silted and polluted from unstable mining waste dumps, from gold panning, the removal of trees to make space for mining activities, and the diversion of rivers. Both opencast mining and alluvial mining operations alter water tables during excessive pumping from underground water aquifers. All these non-financial factors contribute to the already problematic situation in respect of financial investment in the provision of sufficient clean water to the inhabitants of Africa. Both the accountant and the management accountant are involved in a transformation process where the challenge is to include non-financial rehabilitation criteria in calculations and reports.

Since water resources are utilised not only for mining purposes, but also for agriculture and tourism, the management accountant should include this wider spectrum of affected and interested parties in strategies for rehabilitation management. In the Okavango Basin of Botswana there is increasing pressure from the population to divert water from the Okavango Delta for farming and the mining of diamonds (Encarta 1997). Large quantities of water are utilised to wash diamonds from the rest of the ore-bearing materials. Reduced water levels and polluted water coming from mining and associated operations have the potential to cause extensive ecological damage in a region that is known for its wildlife. Growing numbers of tourists, mostly South Africans or foreigners who are travelling through South Africa, visit the delta, providing employment to the local communities. Objections by residents, tour groups and environmental action groups lead to the decision to utilise underground water for mining purposes closer to the mine (Oliver 1997:18). Massive extraction of underground water without recharge could, however, also have devastating effects on the natural environment. Underground water tables could dry up at the higher levels, and so could wells and natural fountains which supply water to communities, animals and vegetation. It is possible that at a later stage water will only be found at very deep levels and withdrawing it will become very costly.

In this situation the management accountant, as part of the team of experts, should find a balance between the seemingly conflicting non-financial applications of water for the maintenance of wildlife and the potential financial income from tourists, and income from the mining of diamonds. It should be borne in mind that very high numbers of tourists could also damage ecological systems.

The number of years for which the natural ecological system could provide an income

to the country and sub-continent should be weighed up against the number of years for which the utilisation of water would provide an income for the miners before all the diamonds have been extracted from the earth.

As part of the rehabilitation management strategy, the muddy water produced by the washing of diamonds could be used to recharge the aquifers. Continuous geological changes, such as the gradual manmade and natural silting of the fingers of the deltas over several decades and even centuries and the influence of such silting on the availability of water for various purposes, should be included in long-term management strategies. Tourism is not the only aspect to take into account when determining those balances, one should not lose sight of the value of unspoilt ecosystems for future research projects to improve the quality of life of inhabitants of the region. An example of such future research is the search for remedies for ailments.

The basis of possible solutions to the water pollution problem is again the awareness of the mining sector of the environmental damage they have caused and the resultant effect on the people in the area. Once this awareness has been achieved the mining sector should be prepared to invest in more advanced technology and expertise in order to rehabilitate damage from past operations, and to prevent and reduce future water pollution. Continuous improvement by means such as investment in large-scale education schemes should be included as an important element of the quality management (Ciampa 1992:92-93) of the ecological aspects of mining operations, especially in Africa.

5.3.2.3 Polluted and damaged soil and land

Apart from the damage caused by polluted air and water, soil and land are also visually damaged by means of wind and water erosion. The adverse effects of mineral explorations include unprotected mine pits and shafts, uncapped drill holes, as well as drill pads, trenches and survey lines left unrehabilitated. Land surfaces subside from caved and collapsed stopes, and from underground pillar failures, making the area surrounding mining operations dangerous to people and animals. This may lead to extensive claims against owners or previous owners of damaged and dangerous land.

Even investments in the fencing off of dangerous areas, does not solve the problem. After mines had become worked out some mining companies in Zimbabwe used to fence mine

pits with the approval of the mining commissioner. In less than two years the fence would be gone, and the initial dangerous situation would again become an urgent problem (Chamber of Mines Journal 1995a:45), with an accompanying increase in failure and rehabilitation costs. Under these circumstances incurring the cost of an adequate preventive strategy would have preserved the value of the land.

The development of a management accounting strategy, both in Africa and in Southern Africa, for the management of the rehabilitation of damaged soil and land is a complex issue. These difficulties, which include the pollution of air and water, cannot be solved in the short term. A strategic management accounting plan should be developed in order to implement environmental and rehabilitation management gradually, in stages ranging from the creation of an awareness of environmental matters to education, from the implementation of more sophisticated equipment to the realisation of the benefits of continuous improvement.

5.3.3 Small-scale mining

Other more secondary difficulties in respect of environmental and rehabilitation management in Africa include the lack of cash resources to invest in rehabilitation operations. Smaller mining companies investing in Africa are not as meticulous about ecological concerns as larger companies. Small-scale miners are inclined to operate on a shoe-string budget, and in the process cause much more damage (Hollaway 1995:23) and reduce opportunities to restore dumps in the course of mining operations, for instance.

Small-scale mining, particularly in Zambia and Zimbabwe, has an enormous negative impact on natural environments. Smith (1995:33) describes the effect of small-scale mining activities in Zambia over an area of about one hundred and thirty square kilometres. There is no social infrastructure, with the result that water for sanitation and agricultural purposes becomes practically unusably polluted. Uncontrolled mining operations create a safety risk for workers and surrounding communities, and might eventually lead to high expenditure in terms of health claims, and rehabilitation inputs by future generations. It seems impossible to register mining operators in an effort to exercise some control over their environmental management. Small miners have almost no overheads, which enables them to produce more cheaply than larger enterprises.

But this situation of low production overheads effectively means a considerable cost to the natural and living environment. A portion of the cost savings should be ploughed back into the remediation of the land from which the savings and profits originated in the first place.

In Zambia efforts are made to influence buyers from small-scale miners to encourage and finance the improvement of environmental and rehabilitation management (Smith 1995:33). The importance of small-scale mining is recognised because this sector provides opportunities for the unemployed to earn a living. Authorities realise that this importance will increase in future, and that policies should be developed to reduce the negative impact on the environment.

About 25% of all gold produced in Zimbabwe comes from small-scale miners (Kumalo 1995:28). According to estimates, over 200 000 people were employed and self-employed in the small-scale mining business at the end of 1995. The effects of droughts, retrenchments and the troubled economy of the country will in future direct more people to small-scale gold panning. The ecological results of this mass movement towards the mining of alluvial gold are devastating. River banks are dredged and pits dug, and the result is that the rivers silt up over a distance of about 4 600 kilometres. This damage to the riverine system causes large areas of land to be degraded. In this continuous process of degradation, the value of land constantly decreases.

It is also extremely difficult for the authorities to assist in the management of small mining activities. Owing to poverty, these miners are often unable to invest in rehabilitative ecological operations. Miners and members of the communities are not environmentally educated and do not know much about the natural environment, and therefore do not care about damage caused to the land and water by unrestricted mining operations. Farming communities appear to be more concerned about their natural and living environments, however (Chamber of Mines Journal 1995a:45). Farmers have limited land available for farming purposes, whereas small-scale miners move on as soon as a patch of land is exhausted. Small-scale miners traditionally believe in the abundance of land, but farmers have to survive on limited resources, which makes them more conscious of the need to preserve the natural environment. This awareness creates the opportunity to employ people from the small-scale farming communities to positively influence the small-scale mining communities.

Increasing unemployment together with the resultant increase in poverty in South Africa could easily indirectly lead to neglect of rehabilitation management in the small-scale mining industry. Although the Minerals Act (50 of 1991) was promulgated to encourage the rehabilitation of mined-out areas, the law as such cannot prevent the damage effected by small-scale mining. The cost of rehabilitation would automatically be passed on to future generations.

Contrary to the aims of the Minerals Act (50 of 1991), however, the South African authorities (Department of Minerals and Energy 1997:17) are encouraging the development of a “junior mining sector”, a term which refers to small-scale miners. Under circumstances in which it is hardly possible to trace transgressors of environmental regulations in the larger mining categories, it would most certainly be impossible to supervise small-scale mining operations. A law means nothing if it is not enforced by an inspecting body. A costly situation to rectify, similar to that in the rest of Africa, could very easily develop in South Africa if adequate precautions are not taken timeously.

Management accountants, who are important members of multi-disciplinary teams in rehabilitation management, should be aware of the situation in the rest of Africa pertaining to small-scale mining as well as of the possible future attitudes of the national authorities on this matter.

5.3.4 Inadequate mining and rehabilitation methods

Inadequate mining and rehabilitation methods have the potential to cause pollution and eventually lead to major health disasters. These mining methods together with inadequate maintenance management policies could lead to enormous claims and resultant financial liabilities that could not be met, by either local or parent companies.

At Dunkwa in Ghana, where alluvial gold mining has occurred since the beginning of the century, contamination of water resources can be found for approximately fifty kilometres both above and below the mining town. During the process in which an amalgam is formed from the material before the gold is extracted, uncontrolled losses of mercury occur directly into water ponds (SA Mining, Coal, Gold & Base Minerals 1995:45). The amalgam is then smelted in two processes, first to recover the mercury from the first process, and secondly to recover the gold. In some dangerous spots the

mercury in the river water resources could take decades to decrease to acceptable levels. Dangerous levels of mercury in the air at the recovery plant pose a serious health hazard to workers as well as to people living downwind from the plant. Although high levels of mercury are found in the river water, the local community does not make use of that water, but use water from boreholes. Fortunately, government officials had already warned them not to use the river water because of other hygienic risks (SA Mining World 1995:14).

But the possibility still exists that mercury could enter the food chain and cause poisoning, although mercury has not yet been detected in fish eaten by the inhabitants of the town. Mercury can become bioconcentrated in fish and aquatic organisms, as fish have the ability to uptake mercury rapidly and have the inability to excrete mercury from their tissues (Sittig 1980:266). The presence of enormous mercury contamination in the water sources and the potential of mercury to enter the food chain could easily lead to a disaster similar to the one at Minamata in Japan during the 1950s. The inhabitants of the town suffered from severe physical and psychological disabilities, and 305 died, owing to mercury poisoning of the fishing water in the harbour. Chisso Corporation, the company responsible for the mercury pollution, was required by court to pay US \$200 million in compensation to the 15 000 victims who filed claims by the middle of 1985 (Perkins 1990:210-211).

The long-term effect of such a disaster could be felt for centuries after the initial pollution occurred. Prevention costs and the expense of investing in environmental consultants and improved technology in order to prevent disastrous pollution, should be weighed against the repair costs of rehabilitating the environment and failure costs in order to pay the claims to victims of poisonous contamination effects. The role of the management accountant is to include assessments of previously invisible environmental costs into rehabilitation management accounting strategies. Maximum and higher profits as such should not be seen as all-important but other considerations such as the application of some of the profits to prevent the effects of severe pollution should also be taken into account when assessing performance values.

Merryweather, the head of a South African environmental consultancy firm who was approached by the State Gold Mining Corporation, the mining company that is in the process of privatising the mine at Dunkwa, made recommendations to reduce the risks

from mercury contamination and poisoning (SA Mining World 1995:14). These recommendations include investing in the redesign of the gold processing plant, the monitoring of the aquatic biological systems, and a suggestion that the mine should play a more pro-active role in society and in respect of the conservation and rehabilitation of natural resources. People in the vicinity of the mine could benefit from timber that is felled when clearing the forests for mining operations. They could also be able to continue farming on land that should be rehabilitated by the company after exploration.

These strategies proposed by the environmental consultants in Ghana contain elements of quality management as described in the “14 steps of Deming”. They emphasise the elements pertaining to the correction of faulty systems and the wellbeing of the people (Riahi-Belkaoui 1993:3&4) who are directly and indirectly involved in the operations of the company.

In Nigeria incorrect soil removal procedures created considerable difficulties for subsequent attempts to rehabilitate dumps and holes. The commercial tin mining companies of the past did not follow the accepted practice of phased removal of the three different types of soil where topsoil, subsoil and overburden are removed and stored separately. Excavations involved the simultaneous removal of the three types of soil, resulting in the mixing of soil and the degrading of the reclamation properties of the area. As organic materials are usually only found in topsoil, the mixing of the different layers of soil decreases the average organic matter percentage and the capacity of the soil to be revegetated. The flooded holes in the countryside could be utilised to irrigate the revegetated dumps and undisturbed agricultural soil (Alexander 1990:45,49).

Management accountants should budget for adequate maintenance management after the completion of rehabilitation activities to prevent a situation similar to that in Nigeria. In 1959 the establishment of eucalypt plantations commenced on some of the reclaimed soil on the tin mining plateau in Nigeria without proper investigations and research on the effects of this scheme. From 1959 to 1983 nobody either questioned this policy or made any attempt to monitor its ecological impact. Timber was removed on a regular basis from the plantations. But all the leaves, twigs and other plant material that fell on the ground were also removed. This continuous removal of plant material nutrients from the system where soil and plants interacted continually decreased the ability of the land, already poor in nutrients, to be reclaimed (Alexander 1990:47,48). If the authorities still

aim to turn the damaged mine land back into agricultural land, the poor rehabilitation management of the past should be changed. Removal of any plant materials from the plantations except for timber should be prohibited. In addition, the example of one of the farmers should be followed. He utilised sorted urban refuse to increase the nutrient value of the soil on his farm. As eucalypts also have the natural tendency to cause long-term deterioration in soil conditions, the authorities were advised that the eucalypts should be replaced and vegetation with local trees and shrubs should preferably be included in the rehabilitation strategy.

Maintenance management of rehabilitated mining areas, such as in Nigeria, forms an integral part of the whole strategy of rehabilitation management. The United Nations Industrial Development Organisation (UNIDO) (1994:16) observed that managers and management accountants in developing countries such as in the rest of Africa include only the direct costs of maintenance. They are inclined to ignore other factors that should also be taken into account in the calculations, such as the negative effects on safety and the natural environment. The following three forms of maintenance are identified (UNIDO 1994:41):

- Design-out maintenance, which provides for less future maintenance expenses at the planning and designing phase, such as planning to revegetate with indigenous plants.
- Preventive maintenance, which includes periodic and condition-based maintenance, that are planned to reduce the eventual cost of maintaining rehabilitated areas.
- Corrective maintenance, which is unplanned maintenance such as in Nigeria, and which requires for higher financial inputs in the end.

In order to achieve quality rehabilitation management, ways and means should be introduced to continuously improve the methods and practices inherited from previous generations. A balance should be found between the cost of inputs in respect of improved management policies and actual benefits in the short and long term. To be able to develop strategies for improvement, especially in respect of financial and non-financial aspects on the input side of the proposed balance, the rehabilitation management accountant should consult with experts such as botanists on vegetation issues.

5.3.5 Illegal mining operations

The South African management accountant should be aware of both the short-term and the long-term negative effects of illegal mining operations in the rest of Africa. With this background information in mind, models and strategies could be developed to improve the rehabilitation management situation in South Africa.

Abandoned mining properties which were not adequately rehabilitated are targets for illegal miners. These illegal miners, especially in Zimbabwe, cause further damage to the natural environment, and are prone to fatal accidents inside old mines (Chamber of Mines Journal 1995c:14,12). Before long enormous amounts could be claimed against previous owners of abandoned unsafe mines.

This negative influence of illegal mining on rehabilitation management appears to continue unhindered, and with the unofficial approval of the government, since officials are also involved in gold panning to supplement their low incomes. The extreme poverty of large sections of the communities forces people to embark on illegal mining activities (Kumalo 1995:28). While people are struggling to survive from panning gold, the legalisation of their source of livelihood or the rehabilitation of the surroundings are of no importance at all to them. Illegal alluvial gold panning in the rivers closer than the legal three metres from the banks causes siltation, resulting in the loss of species biodiversity and soil erosion. Future generations will inherit huge liabilities in the form of reduced land value and inadequate official measures to rehabilitate these vast areas at high cost.

In Zimbabwe alone the state lost over \$1,4 million per month during 1995 to illegal dealers in alluvial gold which ended up outside the country (Kumalo 1995:28). This aggravates the financial situation of a poor country which needs more officials to legalise mining activities as well as for the enforcement of the legal buying and selling of gold produced by illegal small-scale miners. The government revenues lost should have been applied directly and indirectly to remedy the damage done in the past and provide for ongoing rehabilitation practices.

Illegal mining operations could have been prevented in the first place by enforcing the rehabilitation of mines that are closing according to predetermined specifications. As has

always the practice in the mining industry in South Africa, African governments should take responsibility for the rehabilitation of abandoned mines where owners have gone bankrupt or died. Experts such as environmental managers and management accountants employed by larger mines should train smaller miners in environmental and rehabilitation management before small-scale miners legally commence activities at abandoned mines.

Although the governments of Zimbabwe and Zambia realise the importance of small-scale mining to the social economies of these countries, the future financial impact of illegal mining operations and the lack of rehabilitation of such areas are not recognised. South African authorities and communities should take cognisance of artisanal mining in Africa, which causes severe environmental damage and gives rise to future rehabilitation costs, and should only allow this form of mining under certain conditions (Department of Minerals and Energy 1997:54). Future generations will inherit the rehabilitation liabilities as well as the decreased value of land, if management teams, including management accountants, do not act timeously by developing appropriate rehabilitation strategies.

5.3.6 Lack of law-enforcement procedures

The threat to the environment caused by inadequate mining rehabilitation practices in most of the southern countries of Southern Africa, excluding South Africa, is associated with good intentions in legislation, and an almost total absence of expertise among environmental managers, management accountants and law-enforcement staff, as well as a lack of funds for control purposes.

Hollaway (1995:23) provides examples of this attitude in various countries. An Environmental Protection Act which was promulgated in Zambia in 1990 sets standards for regulating the pollution of air, water and soil. But a lack of funds and legislation under which to prosecute air polluters makes these standards unenforceable for practical purposes.

In Ghana the Minerals and Mining Law of 1986 (sections 72 and 83) specifically deals with environmental concerns in respect of mining operations. In addition the national project, the Ghana Environmental Resource Project, was launched in 1993. The range of facilities and services for environmental control was, however, minimal in 1995

(Hollaway:23), while the main violators, the poor artisanal miners, are continuing with their activities which cause extensive damage to the natural environment, without any interference by the authorities.

For some years Tanzania has planned to introduce a set of environmental regulations, as the country does not have any. Mercury poisoning is the main danger in the gold mining sector. Almost all the gold produced in the country is the product of a process in which mercury is amalgamated with gold, and effectively none of this mercury is recovered. The mercury is discharged into the environment. Similar practices are followed in Ghana in the mining of the pillars of old gold mines by small-scale miners.

According to a 1992 review on seven of these southern countries, which included visits to 35 mines and mining enterprises, only Zimbabwe had a full range of environmental regulations. They are, however, scattered over eleven pieces of legislation and administered by four government departments (Hollaway 1995:23). Kenya has 66 pieces of legislation concerned with environmental protection, but these are scattered and ineffectual (Business Africa 1996:9). These legislative systems make it practically impossible to successfully implement environmental management principles or management accounting practices for rehabilitation purposes. Ultimately the value of land decreases and future rehabilitation liabilities are created.

Since 1946 legislation has existed in Nigeria in the form of the Minerals Act, which requires mining companies to restore worked-out sections of their mines. From 1948 most of these reclamation activities on the tin mines consisted of the removal of tailings from present excavation areas to partly fill up nearby abandoned mines. These rehabilitation efforts represent approximately one percent of the 316 square kilometres of derelict land left abandoned after mining operations ceased. Failure to implement law-enforcement procedures led the government of Nigeria to declare this area a “disaster area” in 1982. Public concern about the safety of this area as well as an attempt to obtain funds for reclamation purposes provided support for this step. But the political situation in the country with opposing groups in government and in various states, did nothing to promote rehabilitation management efforts. (Alexander 1990:44,45.)

This emphasises the fact that when authorities which should be the watchdogs of the natural environment do not perform their functions adequately, the result is chaos. At

this stage the necessary legal structures are not in place to enable rehabilitation management accountants to contribute their knowledge and expertise to the degree that is actually required by the natural environment.

Alexander (1990:45) explains the difficulties that have been experienced with the enforcement of the Nigerian Minerals Act since 1946. Vague wording such as “reasonable restoration” allow wide interpretation of terms like “reasonable”. Supervising authorities have been unwilling and unable to monitor and enforce legislation. Mining companies have been unwilling to surrender leases on land after the mines have been worked out, arguing that there is still some tin-bearing ore left. Restoration activities were therefore often postponed, and rehabilitation funds utilised for other purposes. Authorities appeared not to recognise the importance of the prevention of future environmental costs and decreases in the value of land.

Economic considerations such as the low market price for tin in the 1980s have meant that Nigerian mining companies would have become bankrupt if restoration legislation had been enforced. This would have caused the cessation of mining operations and would have led to unacceptably high levels of unemployment on the Jos Plateau. To prevent a situation where the cost of rehabilitation activities would cause such a negative impact on the economy of a region, provision should be made in advance, and the trust funds administered separately, to enable maintenance management to perform the necessary rehabilitation operations after the closure of mines or sections of mines. In South Africa, which is a more developed country, similar procedures are prescribed by the Minerals Act (50 of 1991). The rest of Africa should follow.

The lack of law-enforcement procedures in Africa emphasises the need for central control and monitoring measures to be included in total quality management policies. Juran defines quality control as the measuring of the quality of the actual performance, the comparison of this quality with the set standard, and the acting on any differences and deficiencies (Schonberger & Knod 1994:29). South African management accountants should realise that the lack of adequate involvement of authorities in rehabilitation management issues would make their task more difficult.

5.3.7 State-run mines

The major culprits in environmental mismanagement and pollution from mining operations in Africa seem to be state-run enterprises. They are usually driven into bankruptcy by political pressures.

Examples of these disastrous practices (Hollaway 1995:23,25) are found in Ghana at the state mines of Dunkwa, where alluvial gold mining dredging processes have polluted the rivers, and at Prestea, where tailings are dumped into the river system. In Zambia an estimated 500 tons of copper land in the Kafue River every month. Air pollution cannot be reduced because there are insufficient funds to replace expensive filters, although the African Development Bank secured a loan to introduce measures to stop the pollution of water and air. The loan was spent on other operations not specified in the original loan agreement.

The laissez faire attitude of these states in respect of environmental and rehabilitation management will cost the countries dear in future when usable river water and clean air will become unavailable. At present the availability of clean water is one of the major crises in Africa. It should be the duty of authorities to utilise the expertise of external environmental and rehabilitation management consultancies, such as are already available in South Africa, when they realise that they are not able to solve their ecological problems internally. In the process of utilising external experts, local managers and operators should also be trained and educated. Future financial and non-financial effects of polluted water and air should be measured against the cost of improving the present situation, and the benefits arising from such investment in improvements.

One aspect of quality management that should be included in the management accounting strategy in respect of pollution by state-run mines is continuous improvement, which also involves consultation with outside experts by authorities, and the resulting creation of an atmosphere of ongoing education and training. When South African management accountants develop new strategies and models to accommodate future rehabilitation management policies, tendencies like the change of ownership outlined in the Minerals and Energy Green Paper (1997:33) which could develop into the nationalisation of mines, together with the African experience of state-owned mines, should be included.

5.3.8 Pressure from outside on African mining companies

Management accountants in Africa and in South Africa should be conscious of the immense influence of international pressure groups on the economy of a country as well as on the resulting standard of living of the inhabitants. There is an increasing awareness world-wide of ecological matters and of the fact that global natural resources could be permanently exhausted by irresponsible actions. Evidence of the need to improve environmental management could be found in the United Nations Conference on the Environment and Development held in Rio de Janeiro in 1992. Agenda 21 was adopted, which emphasises the acceptance of environmental guidelines for the development of natural resources (Chamber of Mines Journal 1995c:15).

As mining is an export-oriented industry in Africa as well as in South Africa, in the final analysis international markets dictate mining rehabilitation policies. If the stringent environmental prescriptions of developed countries are followed in developing countries, economic development would be slowed down, since mining is one of the important growth industries in most of Africa.

Walde (1992:23) describes four different scenarios as regards the position of developing countries for attracting Western capital for the development of mining and accompanying rehabilitation operations.

- (1) Since African countries are dependent on finance, markets and technology from Western countries, conditions are added to loans. Lending countries attach preconditions for environmental and rehabilitation management when granting loans to borrowing countries. These loans include the whole spectrum from World Bank loans to government loans to private loans from banks.
- (2) Countries not complying with these environmental management prescriptions are penalised by the imposition of levies on metal imports.
- (3) Technologies for the mining industry are mainly developed in Western countries, and are adapted to the environmental regulations of these countries. In order to fully utilise the most advanced equipment, African countries are forced to introduce rehabilitation and environmental technologies.
- (4) Finally, with the Bhopal chemical environmental disaster as an example, it should be realised that judges in Western countries could impose enormous liabilities on

parent companies in Europe or the United States. Domestic circumstances and attitudes towards environmental and rehabilitation management of countries performing mining operations may not be applicable. In order to prevent such a costly situation, Western countries either do not invest in mining activities in Africa at all, or introduce strict control over safety and rehabilitation conditions.

The situation of Western groups vis-à-vis developing groups in Africa is complex. On the one hand it is relatively easier for the Westerner to criticise other people for damaging forests, landscapes, water and air for mining activities than to encourage their own group to diminish or even give up on the excessive use of the convenience and luxury items which are the products of the mined metals and minerals coming from Africa, such as cars, heating and cooling systems. On the other hand, Africa is over-populated with millions of people who are more concerned about food and shelter than about the ecological condition of the land which future generations will inherit.

Poor developing countries in Africa may argue according to the principle of national sovereignty that they have the right to pollute. According to their politically oriented arguments, economic development should be accorded more importance than environmental issues. They argue that the value of clean air, water and soil is incalculable. The desired economic development might however be reached within five to ten years if every capable citizen contributed his or her full share to the economy by exploiting the earth. But the recovery of damaged land, polluted by mining wastes in the air, water and soil over the same ten-year period, would take up to two hundred years on its own without the presence of any humans. After ten years the population may have monetary riches, but may not have a countryside, trees, clean water and an acceptable environment in which to survive. The invisible power of a damaged natural environment would eventually drive employers as well as employees - who are poor as it is - away. An integrated holistic management accounting strategy should therefore be devised in order to affect a gradual transitional process in rehabilitation management (Beukes 1998:13).

It would therefore be wrong and cynical to deduce that as natural assets do not have a visible price, that they are worthless. In this regard Oscar Wilde (1916:113) defines a cynic as “one who knows the price of everything and the value of nothing”.

In the opinion of Donaldson (1996:52), these extremes should be balanced by the management accountant; respect should be shown for core human values and for local traditions, and the context should be considered. When assessing the rights and wrongs of environmental management practices it is not always possible to evaluate developed and developing countries by the same criteria.

While pressure groups outside Africa realise that the lack of proper rehabilitation management in Africa could eventually lead to the collapse of life on this continent, they would continue to put pressure on mining companies in Africa to include environmental and rehabilitation management policies in their operating strategies. Since African leaders increasingly seek the approval of leaders from outside Africa, a new form of colonialism could involve the rescue of environmental policies on the continent (Von Keyserlingk 1998:5). These new leaders include the World Bank, the International Monetary Fund and even big investment companies in South Africa. This awareness of pressure from outside on African nations would influence the strategies to be developed by management accountants in South Africa.

5.3.9 International trade agreements

It could be argued that the current international trading conventions add significantly to global resource degradation. Trade rounds such as the World Trade Organisation (WTO) propagate freer trade in order to encourage economic growth, which in turn would damage the ecological environment of the producer country. Strict quotas and tariffs on imports in the international trading system serve as protection measures, but they are often overruled by international agreements. This freer trade enables countries to produce various commodities which may then be transported over many thousands of kilometres to their destination markets. The cost of transport decreases the calculated profits considerably. In an effort to bring down costs, funds for rehabilitation purposes are applied for transport (Pearce 1995:74; Cheru 1992:502). To increase foreign exchange income, these countries have to export more products, and therefore further reduce the value of the natural resources.

Both in South Africa and in the rest of Africa management accountants should develop strategic plans that would prevent mining resources from being exploited simply to gain foreign exchange in the short term, at the expense of the natural environment. These

programmes should be aimed at the rehabilitation of the natural environment which is the source of mineral wealth.

The heritage from the colonial era in respect of international trade (IUCN 1986:31) adds to the difficulties of implementing rehabilitation management in Africa properly. In an effort to supply Europe with raw materials, the original economic systems in Africa were distorted. Nearly all the natural and evolutionary mechanisms, such as mobility and epidemics, which previously kept the demand for natural resources low, were removed. A dependence on cash from products and commodities developed during the colonial period, but during the 1960s and 1970s production for export became too costly. Ineffective management of centralised marketing institutions which these countries inherited from the colonial era, aggravated the inadequate economic situation.

The lack of efficient international marketing mechanisms for raw products, together with the inability to further process these raw materials locally for external markets, have a negative effect on the economies of African countries. Turning the clock back to the good old times of the pre-colonial era would not be feasible either, as the citizens of African countries have reached a certain phase of development and should be encouraged to advance.

Under the circumstances created by international trade agreements, the management accountant acts as advisor as well as arbiter. Investments in continuing improvements and education are elements of quality management that would lead to better centralised costing policies and rehabilitation management in mining in future.

5.3.10 Cultural heritage

Traditionally peoples in northern America had a strong relationship with the earth, as can be deduced from the following reply by a chief when approached to sell his land (Gore 1992:259):

How can you buy or sell the sky?...

Will you teach your children what we have taught our children? That the earth is our mother?...

After displacement from their land, the Taos Indians wrote (Daly & Cobb 1989:101)

...This was our land

The land that provided everything good for my people...

The worship of a single earth goddess who was the source of all life and who was responsible for harmony among living creatures spread from India and the Near East to ancient Europe (Gore 1992:261).

But in Africa south of the Sahara, before the era of colonialism, no such cultural elements of the strong relationship between people and earth were found (Baines 1994:92). In this region people believed that they had the right to consume everything in nature before somebody else could do so, and that this right is not negotiable (Els 1996:396,471). These people's perception of time is mainly confined to the present time, is strongly focussed on the past, but has virtually no grasp of the future (Vorster 1981:39). The needs of the present time are regarded as the first priority, and are put before the needs of the future. Short-term pragmatical rational judgements regarding the utilisation of nature are given preference, because people have to live from one day to the next (Els 1996:396, 472).

Mining activities would leave behind useless dumps and holes, and pollution of the air, water and soil. Adversity under these circumstances is attributed to transgression of tribal taboos, or to witchcraft. The sufferers did not see that they had done anything wrong, were not considered to be responsible for ineffective environmental management and were regarded as innocent. Somebody else had brought the bad luck on them and had to be identified and punished (Vorster 1981:41,45). The reason for guilt was regarded as external to the person. They did not really understand why they should act responsibly towards nature and why they should exploit the natural environment carefully (Els 1996:403).

As a result of their cultural heritage, the peoples of Africa south of the Sahara traditionally do not make provision for the future (Baines 1994:120), reason that they are not guilty of mismanagement of the natural environment, and find somebody else to blame for their failures. These traditional conceptions mean that people are unlikely to effect changes on their own (Els 1996:iv).

These cultural attitudes influence management decision making as well as management accounting assessments. The mindsets of groups of people with the same ethnical background have the potential to negatively dominate quality decisions (Ansari et al 1997c:SMA-12).

The solution would be to begin cultivating an awareness of present and future dependence of people on the natural environment, and to invest in education and training to continuously improve perceptions of the importance of providing for the future and future generations. The campaign should continue along the lines of the effective measures introduced by colonialists. Although schools in South Africa, for example, provide programmes on environmental awareness, and awareness talks are given to rural male adults, Els (1996:498) is of the opinion that these programmes are still inadequate. All pupils should understand why they should be conscious of their natural environments, and the women, who have a great influence on the positive changing of traditional attitudes in future generations, should also be included.

As South Africa forms an integral part of Africa, these aspects of the cultural heritage of the peoples of Africa should not be ignored by management accountants when formulating rehabilitation management strategies. The UNEP (United Nations Environmental Programme) of 1993 identified five major environmental education needs, of which greater environmental awareness is the first one mentioned (Ulhøi, Masden & Rikhardson 1996:141). This was followed by the need to educate present and future managers, environmental specialists, engineers and professional people, and workers.

Management accountants have the task of preparing both short-term and long-term budgets which make provision for investments in education and training in natural environmental management. The financial statements of mining companies should also be modified so as to include specific disclosures such as contributions towards natural environmental education and relevant training of workers and their families (Oberholster 1997:7).

South African management accountants should be sensitive to the African culture surrounding rehabilitation management in the mining industry. This would enable them to understand how rehabilitation management issues should be approached, what management information should be provided, and how the necessary information should

be presented for decision making (CIMA 1996:30).

5.3.11 Conclusion

The South African management accountant is confronted with numerous difficulties that exist in Africa in respect of rehabilitation management in the mining industry that could to a large extent be attributed to a lack of awareness of the need for an acceptable natural environment.

Polluted air, water and soil are the primary areas of concern. These pollution problems are caused mainly by a combination of small-scale mining operators, inadequate mining methods; illegal mining operations, the lack of law-enforcement procedures, state-run mines, pressure from outside on African mining companies, international trade agreements, and the cultural heritage of the inhabitants of the African continent south of the Sahara.

The management accountant is confronted with a situation where

They draw too heavily, too quickly, on already overdrawn environmental resource accounts. ... They may show profits on the balance sheets of our generation, but our children will inherit the losses.

(Meadows, Meadows, Randers & Behrens 1992:44 quoting the World Commission on Environment and Development.)

Since the greater part of the continent of Africa south of the Sahara experiences more or less similar difficulties in rehabilitation management, cooperation in the form of a regional group included in Gore's Global Marshall Plan (1992:300) should be seriously considered. Smaller groups of countries could support each other financially as well as in respect of non-financial issues like knowledge and technology. Inside the group provision could be made for benchmarking, communication, cooperation and a review of positive and negative experiences as well as expertise. A team approach should be followed in which the management accountant has a major role to play when developing strategies on rehabilitation management.

These proposed management accounting strategies are based on the attributes of a good

management accounting system, namely technical, behavioural and cultural attributes (Ansari et al 1997c:SMA-9). The characteristics of strategic environmental management which are based simultaneously on quality, cost and time aspects (Ansari et al 1997b:MMEC-2), are linked to these attributes of good management accounting (Ansari et al 1997c:SMA-14).

5.4 SUCCESSFUL REHABILITATION MANAGEMENT

5.4.1 Introduction

Despite economic forecasts of high growth rates in Africa in the 1960s, both output per capita and living standards deteriorated greatly up to the early 1990s. Signs of improvement have been detected during the past few years, however. Inflation, governmental borrowing and deficits have declined while the per capita output has increased by more than 1% a year since 1995. These improvements in a number of countries could have been encouraged by the pressure of diminishing inflows of overseas development funds. In order to sustain the present growth tendencies, still further reforms are needed, such as the upgrading of the infrastructure and legal systems, reduced corruption and better financial systems (Chote 1998:1). This economic environment of growth and improvements in some of the countries south of the Sahara is likely to encourage more acceptable rehabilitation management strategies in the mining sector. This process draws on the knowledge and skills of the management accountant.

Although there are numerous and complex difficulties with rehabilitation management in Africa, management accountants should also take note of efforts towards successful environmental management in the mining industries. The most important of these are policies that bring about continuous improvement in existing practices, such as improved rehabilitation management policies, more positive legislative and taxation approaches by the authorities, an awareness of the measurement and reporting of rehabilitation efforts, and investments in environmental education and training.

5.4.2 Improved rehabilitation management policies

South African management accountants should also note that improvements are taking place in Africa in respect of rehabilitation management. These positive trends should be

considered when compiling strategies for rehabilitation management accounting purposes.

In Nigeria, for example, after initial rehabilitation policies had been attempted after the introduction of regulations governing rehabilitation from 1948 onwards, additional research projects were undertaken during 1983 to improve the situation. The whole purpose of rehabilitation management and the methods employed at tin mines were reviewed. Researchers then found that the eucalypt plantations were not serving the original purpose for which they were introduced to the dumps, and that alternative strategies should be considered. The purpose of rehabilitation policies is to return as much land as possible to agriculture in the short and long term. As traditional agricultural systems depend on rainfall only, flooded mine shafts could be utilised to sustain crops on the poor quality soil. Consultants also recommended that sorted town refuse be applied as organic material, and that the levelled areas be landscaped to fit the natural contours of the countryside, especially where natural streams and rivers flowed (Alexander 1990:48,49). The cost to the community for disposing of urban waste were added to the costs of mining enterprises for remedying damage from operations, and both parties gained by reducing costs.

Some of the principles of quality management were applied in Nigeria, such as the principles of adopting new philosophies in seeking expert advice, of working towards continuous improvement, and of producing a product (the natural environment) of better quality (Deming 1982:16,17). Input costs for rectifying inherited mistakes and introducing rehabilitation management into the current system of mining operations were kept to a minimum in accordance with the means of the communities, most of which are impoverished. Relationships inherent to quality management could be distinguished such as the relationships between time and quality and between performance and quality (Kennedy & Sugden 1994:17). If tactical and strategic planning of this kind could be executed properly in future by a team of experts which included a management accountant, the agricultural sector at least would reap the benefits. In the long term the people on the Jos Plateau would have a better natural environment with all the benefits associated with it. Both financial and non-financial inputs were applied and the result was financial as well as non-financial benefits to the affected and interested parties.

Another example of a company which improved its rehabilitation management policies is African Associated Mines (AAM) in Zimbabwe, which spent about \$4 million (out of

an annual turn-over of \$600 million) on the rehabilitation of asbestos dumps during 1995 (Chamber of Mines Journal 1995d:37). Although it is extremely difficult to revegetate asbestos dumps, a local consultancy succeeded in revegetating the flat tops after three years. The mining company made further financial provision to revegetate the slopes as well. Since 1960 AAM has been undertaking projects to rehabilitate this area, the first of which was the reduction of atmospheric dust.

AAM regards the reduction in the impact of their activities on the natural environment as an ongoing process. The quality management goal of continuous improvement was achieved as quality principles were reinforced through ongoing benchmarking, communication and observations (Russell 1990:73). These successful rehabilitation policies indicate that management and the management accountant at AAM were able to find a balance between financial and non-financial inputs and the positive results of these investments. This could make a valuable contribution towards rehabilitation management strategies in the Southern African context.

Anglo American Corporation (AAC) of South Africa took over the Wankie Colliery Company in 1953, and introduced improvements, both to the town and to the technical and administration efficiency of the mine (Optima 1962:38). Since 1985 financial as well as non-financial means were put into the rehabilitation of badly damaged land (Chamber of Mines Journal 1995e:38). This mine is the biggest opencast mine in the country and this rehabilitation programme is also the biggest in Zimbabwe. Worked-out areas were transformed from burning dumps to natural landscapes. The principle that the management team of these mines applies, is that the surfaces of opencast mined-out areas should not be left in a worse state than before the commencement of mining operations. It was found that it is more directly cost-effective to plant vegetation that has been removed from new sites on old sites than to wait for some years and then invest in plant material. Indirectly the pollution and damage caused by abandoned sites could be lessened, and the cost of rectifying the situation at a later stage would be reduced.

Other mining operators in Africa, as well as extended management teams which include management accountants, could benefit by gaining information on the extent of the investments made and the short-term and long-term effect of such investments. These successful opencast rehabilitation efforts by AAC were recognised by the Chamber of Mines which awarded AAC the first prize for the fifth consecutive year (Chamber of

Mines Journal 1995f:38).

The National Resources Board (NRB) in Zimbabwe was established by means of an Act of Parliament in 1941. To encourage mines to rehabilitate abandoned areas, the NRB introduced an annual competition and awards in 1982, which resulted in positive attitudes and improved management and accounting policies. The BNC nickel mine, the award winner for 1995, applied improved rehabilitation policies which resulted in better relations with employees and surrounding farming communities. Management of the BNC mine would like the competition to include the broader aspects of environmental management as contained in BS 7750 and ISO 14000. (Chamber of Mines Journal 1995 Nov:40,41.)

On the one hand mining companies are prepared to invest extra money and reduce profits in order to gain recognition as award winners in rehabilitation management and for the positive publicity. But on the other hand the management teams of companies realising the long-term financial and non-financial benefits of their rehabilitation efforts also gain some short-term recognition from the authorities.

At the Mhangura copper mine in Zimbabwe, Northard and Figg (1992:11) reports that the construction and siting of slimes dams made it really difficult for management to implement rehabilitation strategies. But rehabilitation programmes were introduced with such marked success that after revegetation no further maintenance expenditure was necessary for rehabilitated areas. The success of this rehabilitation project is ascribed to the drive, co-operation and team effort of all the people involved in the improvement of the natural environment, from management right down through all ranks. Maintenance costs are kept at a minimum level in a poor community if the correct rehabilitation procedures are followed from the start. A successful rehabilitation project could be compared with quality of conformity, with the associated cost categories of prevention and appraisal costs (Welsch, Hilton & Gordon 1988:313), as well as of internal and external failure costs.

Companies also invest in profitably processing tailings dumps from previous decades, as in South Africa. On the border of Zambia and the Democratic Republic of the Congo (formerly Zaire), America Mineral Fields (AMF) plan to recover annual amounts of 30 000 tons of copper, 200 000 tons of zinc and 400 000 tons of sulphuric acid at Kipushi.

Tailings resulting from about 70 years of mining could have a potential value of \$800 million (Business Times 1997:18; Sake-Beeld 1997:4). Not only do these financial investments in rehabilitation result in direct monetary gains for employees of the company and profits for investors, but in non-financial terms they also mean that the natural environment may benefit after many years and provide a better quality living space for the inhabitants of the area.

A process of continuing improvement is noticeable in some African countries. Elements of continuous improvement that could be perceived to a lesser or greater extent, are innovations and flexibility (using urban waste as fill in poor communities), short lead times (rehabilitation as part of the mining process), and quality and cost consciousness (rehabilitated land ready for general use) (Kennedy & Sugden 1994:20). Investments are made in research projects, external advisors, and revaluation schemes concerning previous rehabilitation efforts. Awards are introduced by authorities to encourage investments in rehabilitation management policies. These positive trends should be noticed by South African management accountants and supported in order to allow them to develop and expand to all the countries of the region. Positive tendencies in rehabilitation management in Africa are important factors to be considered in the development of strategies and models for rehabilitation management accounting in South Africa.

5.4.3 The role of authorities

Since management accountants are important members of the team involved with rehabilitation management, they should be informed about the legislation and taxation policies of African authorities and the possible influence of these attitudes on South African authorities and strategies.

At the Environment Conference in May 1995 in Zimbabwe various issues concerning mining rehabilitation in the country were discussed. These discussions highlighted the importance of communication between regulators, legislators and the mining industry. Each group represented a different part of the same business sector. Communication between interested and affected parties is a primary element in the development of management accounting strategies concerning rehabilitation policies.

Johnson realised that some tax benefits should form part of the financial incentives offered for dealing with abandoned mine sites from the past (Chamber of Mines Journal 1995b:49). Reduced taxation liabilities would increase the financial resources available for rehabilitation purposes. He cautioned authorities not to impose statutory standards that are impossible to implement, such as over stringent prescriptions for water and soil quality standards. In a poor country compulsory immediate huge investments by mining enterprises to achieve the required quality standards for water and soil could ruin the mining industry financially. On the other hand owners of mines would simply ignore the standards that had been imposed when they could not afford to implement them. The role of proper legislation was recognised by Johnson, who highlighted the devastation of uncontrollable levels of small-scale mining operations in other developing countries like Brazil. The authorities realised that the legal regulation of small-scale mining should be just as important as the legal issues associated with the large-scale mining sector in Zimbabwe. This would influence the cost and value of the land occupied by small-scale miners.

In July 1994 the United Nations General Assembly adopted a code of conduct for sea-bed mining that would ensure that the profits which are generated by sea-bed mining are shared with developing countries (Murray 1994:16,17). An example is the mining of diamonds in Namibia off the coast. To reduce the incentive to mining operators to go offshore for tax purposes, African countries substantially revised their mining laws to provide more attractive local investment conditions. These included internationally acceptable regulations for investments in rehabilitation management projects.

Failure costs in the form of fines and penalties are becoming reality. The Zambian government has started imposing fines on polluting mining companies, such as the recently imposed monthly fine of US\$40 000 on the Zambia Consolidated Copper Mines for the emission of toxic gases into the air. Environmental impact assessments are also compulsory for many projects (PanAfrican News 1997).

The role of legislation and taxation is recognised by some authorities in Africa as an important tool for regulating rehabilitation management in the mining industry. This is an important positive element for the management accountant to reckon with when preparing strategies for rehabilitation management accounting procedures.

5.4.4 Measurement of and reporting on rehabilitation efforts

A positive aspect regarding the measurement of and reporting on rehabilitation efforts in Africa is the gradual development of the awareness of accountants of the need to disclose rehabilitation information to interested and affected parties. Although there is no clear policy on the reporting of rehabilitation management policies and expenses in Zimbabwe, for instance, Johnson (Chamber of Mines Journal 1995b:49) is of the opinion that the mining industry is entitled to a reasonable set of standards for the disclosure of their rehabilitation activities. In addition to the disclosure policy, he also stressed the need for reliable data sets on environmental practice in the country. In most developing countries enough data is already available for consultants to prepare environmental and resource accounts (Ahmad 1989:6) which could assist policy-makers, but it would take time to prepare such accounts.

The implementation of the reporting of rehabilitation expenses, the disclosure of projections of future investments in mining rehabilitation operations and the publication of the results of these investments, should serve as an incentive to management accountants to recommend investments in and the introduction of more and better rehabilitation strategies. New approaches should be considered, such as the treatment of depletable natural resources as inventory and not as fixed capital, with the depletion treated like the sale of assets (El Serafy 1993:17). Rehabilitation expenditure could be regarded as expenditure on maintaining the value of depletable natural capital resources, such as land.

Complicated calculations are required to find a balance between the output of metals and minerals from a natural resource and the input in terms of polluted air, water and soil. This could be accomplished by means of the assessment of the long-term limits to throughput for these elements (Meadows et al 1992:46). Suggested limits are the following:

- For renewable resources such as water, soil and animal life, the rate of use should not be greater than the rate of regeneration.
- For non-renewable resources such as coal and fossil water, the rate of use should not be greater than the rate at which a renewable resource could be substituted for the resource being used, for example the development of solar energy and water

purification systems.

- For a pollutant the rate of pollution should not be greater than the rate at which that pollutant could be recycled, absorbed or made harmless to the environment.

These groups of throughput assessments are the primary focus of rehabilitation management accounting, and should in particular be included in long-term strategies. This emphasises the important role of non-financial criteria which encourage technical improvements in the form of better processes, methods and equipment (Kennedy & Sugden 1994:149). The principle applied by Meadows et al is to maintain natural capital resources.

There is a relation between the rate of growth and the economic development of a country, and the adequacy of the accounting system and the degree of accounting development (Riahi-Belkaoui 1994:21). Economic growth and development could also include an increase in various forms of capital, such as better rehabilitated mining land and a better trained and educated workforce. Since there are promising signs of economic growth in some of the African countries, the accompanying development in accounting procedures should also be present. Better accounting and management accounting proficiency and information inevitably lead to better decision making and increased growth.

5.4.5 Investment in training and education

Education and training equip people with environmental and ethical consciousness, values, attitudes, skills and behaviour which eventually lead to human development. Emphasis on and investment in training and education by authorities with the aim of reducing ecological damage to the environments of mining communities, is yielding positive results, especially in Zimbabwe. In that country an evolutionary process is already noticeable which can largely be attributed to the efforts of the Chamber of Mines. The main objective of one of its committees is to put an end to dangerous situations before they can become a real source of dissatisfaction to local and international communities (Hollaway 1995:25). The envisaged result is that financial and non-financial preventive actions will diminish future failure costs such as fines (Ansari et al 1997b:MMEC-4) as well as health and medical claims.

Other local mining companies in Africa have also adopted good environmental and rehabilitation standards. Holloway (1995:25) mentions examples in Ghana and Tanzania where both gemstone and gold mines follow such policies, usually initiated by managers with previous training and experience on large, well-operated mines.

Further training and education methods for rehabilitation managers and management accountants are seminars, such as the one organised by the Environment Forum of Zimbabwe during October 1994 (Chamber of Mines Journal 1995a:43). By means of such seminars a wide selection of participants from both the government and the private sectors are brought together for benchmarking with the object of jointly finding the best practices in order to solve rehabilitation management problems. At these gatherings the management accountant as part of the team of experts, is well equipped to find a possible balance between the negative impacts of mining and the economic benefits arising from mining operations. Relationships could be developed and established which are of benefit both to local communities and to the country and region as a whole.

This seminar opened the debate on the cost of maintaining environmental policies after the closure of sections of mines, and whether the next users of that piece of land would be able to survive. Such policies would form the basis for the assessment of the cost and value of closed mine properties. At this seminar participants resolved to establish a Southern African Regional Forum that would pursue policies such as the communication of issues and strategies among all relevant parties, and to ensure that the cost of environmental management policies is incorporated in all budgets and research studies (Smith WE1995:37). Large mining companies would have the responsibility for setting the example of adequate rehabilitation and environmental management (Chamber of Mines Journal 1995a:45).

Expertise will therefore be exchanged accross borders, and South Africa could both contribute to and benefit from such strategies. International cross-cultural and cross-functional environmental management teams in the southern region of Africa (Department of Environmental Affairs and Tourism 1998:38) would therefore cooperate in accordance with a regional grouping of the global plan of Agenda 21 (Department of Environmental Affairs and Tourism 1998:4). This phenomenon of globalization could have a positive influence on education systems and people's access to and choice of environmental management information (Department of Environmental Affairs and

Tourism 1998:78). Expenditure on training and education as well as on research and development to devise new rehabilitation schemes which might already exist in other countries in the region could be reduced significantly for participating countries.

5.4.6 Future perspective

In order for management accountants to assist in the development of strategies for rehabilitation management, they should be conversant with the perceptions of the future of African people as well as with existing tendencies that are likely to influence events in the near and distant future. Future expectations pertaining to financial and non-financial inputs and gains regarding rehabilitation management accounting developments should be emphasised.

The time perspectives of African peoples are changing, mainly as a result of Western education and technology. Their ideas about the future are becoming more pronounced, especially as regards issues concerning Western practices. But the traditional concept of the future is still strongly present in their thinking, attitudes and basic needs (Baines 1994:120,121).

The lack of environmental indices to indicate whether a country is more or less habitable in different years, was noted by Toffler back in 1973 (411). Present day short-term policies could not be compared with suitable future long-term social and ecological goals, as “economic indicators” such as the gross national product (GNP) were the only yardsticks of measuring economic performance. There were no “social indicators” or “environmental indicators” for the assessment of the health of society or the natural environment outside the formal economic sector. Gross national pollution (“GNP”) should for instance be considered as an index next to the gross national product (Porritt 1984:35,36) to permit a more complete comparison of gains and losses.

The expenses involved in controlling pollution could be quantified in most instances, but it is more difficult to attach a monetary value to the benefits derived from such expenditure. This can partly be ascribed to an ecological time-lag because when it is much too late to do anything about it damage could become apparent (Porritt 1984:35,36) and unpredictable amounts would have to be invested to rectify the damage and rehabilitate the land. Time perspectives, as non-financial indicators, should be included

in a comprehensive rehabilitation management accounting strategy. Time should be regarded as a source of capital in the context of a scarce natural resource. Rehabilitation costs incurred at present or in the near future would be relatively much less than after a few decades. Other than in Africa, a more fully employed and high-growth economy would allow people the time to become aware of pollution and their natural environment.

Although formal environmental assessments are not yet visibly being applied in most of Africa, efforts are indeed being made towards the improvement of the future situation in respect of the disclosure of rehabilitation management strategies in the mining sector.

In this regard the Minister of the Environment and Tourism in Zimbabwe made the following recommendations at the Environmental Conference on 15 May 1995 concerning future rehabilitation management policies in Africa (Chamber of Mines Journal 1995b:47).

- Training in environmental issues is regarded as fundamental to the future development of the mining industry.
- Formal and public environmental policies should be introduced.
- Environmental impact assessments should be considered.
- Data on the performance of rehabilitation management policies should be collected and disclosed.
- The mining industry should develop guidelines for rehabilitation and encourage their implementation.

In order to comply with these suggestions, management accountants should budget for money that should be provided or reserved for purposes of short- and long-term rehabilitation management policies. The results should be measured after one, two and ten decades.

The mining sector in Zimbabwe is already progressing towards the best contemporary practice (BCP), but the standards of existing and new mines should differ (Chamber of Mines Journal 1995b:49). Within the next fifteen years BCP could be achieved. The concept of best available technology not entailing excessive cost (BATNEEC) has been recommended. This has already been attempted in South Africa for the rehabilitation of abandoned mining areas (Baxter 1993:15).

In support of the views of the mining sector in Zimbabwe, Yemi Adedokun (1996b:21) propagates future joint venture agreements between the owners of technology and local African producers of raw materials. This would improve the capitalisation process and eventually the financial position of the inhabitants. Instead of raw minerals and gems being exported at very low prices, only to be re-imported at a later stage as finished products at very high prices, further local processing could generate local and overseas capital. From training and education to research and development programmes, the management accountant could help to bring about a variety of improvements that could be achieved by joint investments of capital, labour and raw materials. Simultaneously, technology and expertise for the rehabilitation of mines should be included in these joint ventures.

Just as the twentieth century (1880-1980) was hailed as the century of socialism, Bramwell (1989:247) predicts that the next century will be the century of the global ecologist. Care should, however, be taken to prevent radical situations such as those that occurred in the Eastern Bloc where ecological damage and massive pollution were allowed as a result of socialism at the cost of capitalism and private enterprise. Preference was given to investments and developments that would promote the socialist ideologies of human equality, and the natural environment and pollution were not regarded as being of much importance. Radical ecology theories in the next century could easily result in a return to primitive living conditions. Where expenditure is directed solely to restoring original natural environments, the result under extreme circumstances could be negative growth and reverse development.

It is therefore important for policy-makers, including management accountants, to develop long-term strategies that would result in lower key, holistic balancing positions. The problem that must be solved, is to make the “best choice among given alternatives” which would lead to a paradigm shift (Dopfer 1976:5). The solving of the ecological problem should be approached in a way that includes a holistic perspective (Dopfer 1976:34) within an interdisciplinary system with the emphasis on long-term solutions, taking into account historical facts as well as current political structures.

5.4.7 Conclusion

Successful rehabilitation management policies in the mining industry are emerging in

Africa. In view of these successes, the management accountant can be sure of positive developments in rehabilitation management accounting issues.

There have been notable improvements in practices and approaches of the past. Such improvements are encouraged, for example, by awards given by authorities. Legislative and taxation intentions reflect the concerns of authorities about adequate rehabilitation management policies. There is a notable awareness of the need to measure and report both financial and non-financial rehabilitation inputs, and to compare these inputs with the gains obtained. Underlying all these improvements and successes are increasing monetary contributions towards better education and training in rehabilitation awareness and technology. In Zimbabwe on the coal mines, for example, it would seem that rehabilitation management issues are moving in the direction of a future balance between monetary inputs and the reduction of profits, and the long long-term financial and non-financial benefits that the natural environment would produce.

5.5 SUMMARY AND CONCLUSION

The South African management accountant should realise that rehabilitation management accounting practices in the rest of Africa stem from a history and culture of inadequate rehabilitation management policies. As this heritage still has an influence in day-to-day mining rehabilitation activities, management accountants should include these factors in rehabilitation management accounting models.

Difficulties in respect of rehabilitation management in Africa are based on a general lack of awareness of the necessity to make provision for a habitable natural environment for the future. The major sources of concern are polluted air, water and soil, the product of unacceptable mining methods. Contributing factors to these pollution effects are small-scale mining activities, inadequate mining methods, illegal mining operations, a lack of law-enforcement procedures, state-owned mines run by unstable authorities, external pressure on African mining enterprises, limiting international trade agreements, and a cultural heritage that does not include a future perspective. What these negative factors have in common is the aim of extracting minerals, metals and gems at the lowest possible cost, and immediately exchanging these valuables for money. There have been no long-term strategies, and even the short-term management strategies are very short-sighted.

During the 1950s the first steps were taken towards formal rehabilitation management strategies in Africa. These included various policies to improve existing situations, and contained elements of quality management, such as the introduction of new ideas. Strategies were devised to implement rehabilitation procedures at the lowest possible cost in communities that are poor for the most part. At Mhangura, for example, financial and non-financial successes were ascribed to the cooperation of all members in team context (Northard & Figg 1992:11). The important role of training and education, is continually realised, both in the primary phases of awareness of the natural environment, and in the advanced phases of rehabilitation management leadership.

As with the project in Mali where South African expertise was applied to start a \$250 million gold mining operation, including appropriate impact studies (Harries 1995:9), there is a need to share the know-how of various countries and inter-disciplinary groups on the African continent. Both ancient and modern mining activities are accommodated in this project.

Non-financial management accounting approaches can no longer be ignored; for example the latest and best mining technologies cannot be separated from environmental technologies. Both technologies are included in advanced methods where the complete process from exploration through to production and environmental costing is selected and designed. Rehabilitation technology and environmental management should no longer be regarded as an add-on cost to remove the pollution caused by operations at the end. The total cycle and its implications for the environment should form the basis (Department of Environmental Affairs and Tourism 1998:21) for determining an optimum combination of investments in both types of technology at an early stage of the development of strategies.

The solution to the problems of mining rehabilitation management in developing countries in Africa is summarised by Walde (1992:27) in the guidelines on minimum standards for governments, mining enterprises and mineral industries. The management accountant has a key role to play in all of these management teams, and should consider the following steps towards a rehabilitation management accounting strategy.

- (1) Assign high priority to environmental management. Establish environmental accountability at the highest policy-making levels.

- (2) Encourage employees at all levels to recognise their responsibilities in all phases of mining operations.
- (3) Adopt the best practices in the absence of specific environmental regulations. Adopt appropriate technologies that would reduce waste products in all phases of mining activities, including small-scale operators. Try to obtain additional capital to improve the environmental and rehabilitation policies of existing mining operations.
- (4) Adopt risk analysis and contingency strategies for the handling and disposal of hazardous mining and other wastes.
- (5) Reinforce the whole infrastructure around environmental and rehabilitation management regarding all mining activities.
- (6) Avoid the application of restricting environmental regulations which may prevent trade and investment opportunities.
- (7) Recognise the balance between ecology, socioeconomic and cultural conditions, and the health and safety of the workers, both in the workplace and in the surrounding natural environment.
- (8) Evaluate and adopt appropriate economic and administrative measures, like tax-incentives, to encourage the reduction of pollution and to introduce improved methods and technologies.

These guidelines coincide to a large extent with the principles contained in the White Paper on Environmental Management Policy for South Africa (Department of Environmental Affairs and Tourism 1998:13). Management accountants link these guidelines with their primary functions of gathering, reporting and analysing relevant information, together with their support to management (Rayburn 1986:12) in making decisions and interpreting results.

South Africa is playing a leading role on the continent and is in a better position to survive economically than many of the poorer African countries, mainly because of advanced mining and rehabilitation activities of the past. But South African management accountants, as part of the teams responsible for rehabilitation management, should also learn from the lessons and mistakes of the rest of Africa, and try to avoid surrendering the positive leading position they occupy.