

DECLARATION

I declare that this thesis is my own work except to the extent of the text, acknowledgements and the reference matter.

It is being submitted for the degree of Doctor of Philosophy in the University of the Witwatersrand Johannesburg. It has not been submitted to any other university for degree purposes.

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PRETORIA

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ABSTRACT

The objective of the study was to investigate downscaling in South Africa's mining industry and the manner in which it was managed with special reference to the gold mining sector. In this regard the study involved literature review, data and information gathering, participating in tripartite stakeholder forums and soliciting opinions from several role players in the industry. Driefontein Gold Mine, one of the largest gold mines in the world, was used as a case study to examine management of downscaling in the gold mining industry.

Literature investigation showed that South Africa's mining industry has always been cyclical and labour was vital for its development. A dichotomy was revealed in the study in that the early years of modern mining were besieged with a continuous shortage of labour; in recent years the opposite is true as the industry is continuously battling with downscaling and shedding of jobs. Historical data shows that the gold mining industry has gone through three periods: the Stable Period (Period 1: 1960-1975); Expansion Period (Period 2: 1976-1987); and Downscaling or Crisis Period (Period 3: 1988-2004). Sufficient evidence was presented to show that the downscaling period was triggered by a combination of political instability of the 1980s and economic factors such as declining gold grades and depressed gold prices.

Stakeholders followed a three-phased approach to address negative impacts associated with downscaling. The approach involved holding two tripartite summits; Gold Mining Summit (Phase 1) and Mining Summit (Phase 2) and incorporating recommendations emanating from the summits into the legislative process (Phase 3). At mine level, mines such as Driefontein managed downscaling through a number of initiatives including productivity improvement, restructuring and providing redundant employees with the option of taking extended leave.

Economic factors, such as gold grades and ore reserves, suggest that downscaling will continue well into the foreseeable future and will exacerbate the existing negative environmental and socio-economic legacies. It is against this background

that international experiences on the management of downscaling were investigated. The study concludes by proposing recommendations and a new strategy to manage downscaling in South Africa's gold mining industry. The strategy proposes a number of measures that need to be put in place at national, local community and mine levels.

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DEDICATION

To my wife, Gene and children, Ngoato and Tebogo, who provided me with support and motivation.

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LIST OF ABBREVIATIONS

AD	-	After the birth of Christ
ABET	-	Adult Basic Education and Training
ACP	-	African Caribbean and Pacific Group of States
ADM	-	Acid Mine Drainage
AIDS	-	Anti Immune Deficiency Syndrome
Al	-	Aluminum
ANC	-	African National Congress
ANOVA	-	Univariant analysis
ARM	-	African Rainbow Minerals
Au	-	Gold
BC	-	Before the birth of Christ
BEE	-	Black Economic Empowerment
CGS	-	Council for Geoscience
CAE	-	Centre for Adult Education
CANMET	-	Canada Centre for Mineral and Energy
CDIS	-	Closure and Downscaling Impact Study
CEPU	-	Communications, Energy and Paperworkers Union
CLR	-	Carbon Leader Reef
COM	-	Chamber of Mines
COREM	-	Consortium of Applied Research for the Treatment and Processing of Mineral Substances
COSATU	-	Congress of South African Trade Union
CSIR	-	Council of Scientific and Industrial Research
Cu	-	Copper
Devco	-	Cape Breton Development Corporation
DIAND	-	Department of Indian Affairs and Northern Development
DME	-	Department of Minerals and Energy
DRDGold	-	Durban Roodepoort Deep Gold Mine
eg	-	For example
FULCO	-	Full Calendar Operations

GCC	-	Gold Crisis Committee
GDP	-	Gross Domestic Product
GDFI	-	Gross Domestic Fixed Investment
GNP	-	Gross National Product
GNLB	-	Government Native Labour Bureau
HIPC	-	Highly Indebted Poorest Countries
HIV	-	Human Immunodeficiency Virus
HBM&S	-	Hudson Bay Mining & Smelting Co.
HSRC	-	Human Science Research Council
IDC	-	Industrial Development Corporation
IMF	-	International Monetary Fund
ITCE	-	Investment Tax Credit for Exploration
LRCAC	-	Leaf Rapid Community Adjustment Committee
Ltd	-	Limited
MA	-	Million years
MDA	-	Mine Development Agency
MEPC	-	Minerals and Energy Policy Centre
MEPPC	-	Minerals and Energy Parliamentary Portfolio Committee
MHSC	-	Mine Health Safety Council
Mintek	-	Council for Mineral Technology
MITAC	-	Mining Industry Training and Adjustment Council
MPRDA	-	Mineral and Petroleum Resources Development Act
MQA	-	Mining Qualification Authority
MR	-	Main Reef
MSOA	-	Mine Surface Officials Association
NEDLAC	-	National Economic Development & Labour Council
NGOs	-	Non Government Organisations
NPI	-	National Productivity Institute
NRC	-	Native Recruiting Corporation
NSMDF	-	National Small-Scale Mining Development Framework
NSC	-	The National Steering Committee of Service Providers to the Small-Scale Mining Sector

NUM	-	National Union of Mineworkers
OPEC	-	Organisation of Petroleum Exporting Countries
PDAC	-	Prospectors and Developers Association of Canada
PGMs	-	Platinum Group Metals
RBF	-	Radial Basis Function
R&D	-	Research and Development
RNLO	-	Rand Native Labour Organisation
RRC	-	Regional Regulatory Committee
SA	-	South Africa
SADC	-	Southern African Development Community
SAMDA	-	South African Mining Development Association
SAS	-	Statistical Analysis System
SATOA	-	South African Technical Officials Association
SAWU	-	South African Workers Union
SIMRAC	-	The Safety in Mines Research Advisory Committee
Sn	-	Tin
SPC	-	Sector Partnership Committee
TGI	-	Targeted Geoscience Initiative
UASA	-	United Association of South Africa
UK	-	United Kingdom
UOA	-	Underground Officials Association
USA	-	United State of America
USGS	-	United States Geological Survey
VCR	-	Ventersdorp Contact Reef
WNLA.	-	Witwatersrand Native Labour Association

CHAPTER 1

INTRODUCTION

“We must accept the reality that the gold mining sector is in a long-term decline. Our gold reserves cannot last forever. Unless there is a dramatic increase in the gold price – which we can pray for but which we should not rely upon – and new and better methods of mining are found, we can expect both tonnage of gold produced and employment levels in the industry to decline.” Tito Mboweni, Minister of Labour, 1998.

1.1 Introductory Remarks

The South African mining industry, which produces about 59 types of minerals is largely underscored by gold, diamond, coal and platinum group metal mining and production (Mwape et al, 2005). The industry has acted as a catalyst and pillar for development of the country’s modern and efficient economic system. However, in recent years the mining industry has been beset by a number of problems including the loss of jobs, especially in the gold mining industry. Loss of jobs in the gold mining industry is attributed to a combination of problems and factors that include, amongst others, the following:

- Declining gold production;
- Depressed real gold prices;
- Increasing production costs due to deep mining and rising salaries;
- Changing national political landscape;
- Increasing national and global environmental awareness; and
- Globalisation of the mining industry.

Some of the problems have been in existence for many years, whilst others have only emerged in recent years. The above mentioned problems singly and in combination acted as catalysts to a number of changes, which included rationalisation, restructuring and unprecedented retrenchments.

This introductory chapter deals with the following issues:

- Aim;
- Outline;
- Problem definition;
- Definition of key terminologies; and
- Methodology.

1.2 Aim of the Study

The overall aim of the study was to analyse downscaling and its management in the gold mining industry of South Africa and to provide recommendations and strategy for the management of downscaling. In this regard, the following aspects were examined:

- Historic development of South Africa's mining industry with special focus on the diamond and gold mining industry;
- Current status of South Africa's mining industry;
- Current status of South Africa's gold mining industry;
- Events and factors that led to downscaling and the gold crisis;
- Strategies used to manage downscaling and the gold crisis;
- National and mine level initiatives to manage downscaling; and
- International approaches to managing downscaling.

It was essential to undertake a proper assessment of the past and present situations in the South African gold mining industry and the likely future direction in which the industry will develop. Although this study focuses on the gold mining industry, some generic issues relating to mining and mineral policy are also examined.

1.3 Outline of the Study

The main body of the study commences in Chapter 2, where an overview of historic developments of South Africa's mining industry and its labour is analysed. Since formal mining in South Africa began in the diamond fields, the study begins with an analysis of the labour market during the early years of

diamond mining. This is followed by a discussion of labour issues during the early years of the gold mining industry.

Chapter 3 provides a broad overview of the current status in South Africa's mining industry. Various aspects of the industry are analysed, which include, amongst others: role players in the industry; mineral statistical overview in respect of mineral resources; mineral production; mineral sales; and employment.

Chapter 4 examines the South African gold mining industry and its role in the country's economy. In addition a brief discussion on the impact of gold mining industry on the environment is discussed and key issues on pollution are highlighted.

Chapter 5 presents an analysis of events and factors that led to downscaling and the gold crisis. In this chapter, the commencement of downscaling is investigated and the gold crisis period defined. The impact of selected business factors on employment, downscaling and the gold crisis are analysed. In Chapter 6, a quantitative statistical analysis of the role of selected factors on employment in the gold mining industry is undertaken. Significant factors affecting employment and therefore downscaling are identified and used in developing regression models for determining employment levels in the gold mining industry.

Various national initiatives implemented by stakeholders in order to manage downscaling and the gold crisis are discussed in Chapter 7. In Chapter 8, Driefontein Gold Mine is used as a case study to investigate how selected business factors impacted on employment and contributed to downscaling and the gold crisis. In addition, an analysis of several measures and strategies put in place at Driefontein to address downscaling and the gold crisis, is discussed.

International experiences on the management of downscaling are investigated in Chapter 9, which is subsequently followed by Chapter 10 wherein an assessment of possible future scenarios in respect of employment and related business factors

in the gold mining industry is undertaken. In Chapter 11, international experiences are taken into consideration in proposing a strategy for the management of downscaling in South Africa's gold mining industry. Conclusions and recommendations in respect of the management of downscaling, in South Africa's gold mining industry, are presented in Chapter 12.

1.4 Problem Defined in the Study

The problem statement in respect of downscaling in South Africa's gold mining industry is that mining is a process involving the exploitation of finite mineral resources. This process can be subdivided into two phases; namely, the expansion or growth phase, and; the contraction or the downscaling phase. The former entails injection of capital into the mine and surrounding areas as well as increased employment. Conversely the latter leads to loss of capital and jobs. The South African gold mining industry has largely gone through the first phase and there is considerable evidence that the industry is currently in the downscaling phase.

The problem is furthermore compounded by the fact that the South African gold mining industry has been exposed to global and national challenges in recent years, especially in respect of the following:

- Political changes;
- Cultural and social changes; and
- Economic and environmental challenges and concerns.

The combined effect of these changes and challenges has brought about negative state of affairs and pertinent questions that need to be addressed are:

- What influenced downscaling in the gold mining industry?
- What was the impact of downscaling in the gold mining industry?
- How well did stakeholders manage downscaling in South Africa's gold mining industry?

- What are the possible future scenarios for the gold mining industry?
- How did other countries manage downscaling in the mining industry? and
- What processes and strategy should be put in place to manage downscaling in South African mines?

In order to answer the above questions and also decipher some of the problems associated with downscaling in the mining industry, this study investigated the following key issues:

- Historic and current developments in the mining industry, with special emphasis on the gold mining sector;
- Factors which affected downscaling in the gold mining industry;
- Stakeholders' initiatives in respect of managing downscaling in the gold mining industry;
- International experiences on the management of downscaling and mine closures;
- Possible future scenarios for the gold mining industry; and
- Recommendations on the management of downscaling in the South African mining industry.

The argument and premise of this study is that once one understands developments in the industry and the stakeholder initiatives in respect of managing downscaling, it is possible to foresee future developments in respect of downscaling. Such an understanding combined with lessons learned will ensure that processes and strategies that are needed to address future downscaling are put in place.

1.5 Definitions

1.5.1 Downscaling, rightsizing, rationalisation and retrenchments

The word downscaling is often interchangeably used with other related words, eg downsizing, rightsizing, rationalisation and retrenching. All these terms may in one way or another involve loss of jobs, enhancement of efficiency, reduction of cost and improving profitability. This section will discuss the various terms used to describe the process of restructuring that may or may not involve a reduction in workforce.

It must be pointed out that different business sectors use the aforementioned words in different contexts, and may in some cases be intended to mean the opposite, depending on the user. For instance, according to Itshar (1995), in the Information System Sector, the term “downsizing” refers to the migration of corporate applications from comprising huge mainframe systems to smaller size, lower price-reduced network computing and the aggregation of individual PC workstations into a common network. It is important to realise that this form of downsizing does not necessary involve head counting and subsequent loss of jobs. On the other hand Tylczak (1991) refers to downsizing as planned workforce reduction.

Interaction with various stakeholders in the mining industry of South Africa revealed that different stakeholders use different words to suite their circumstances. Companies prefer to use the word rationalisation – a none too subtle euphemism for layoff or early retirement programmes - when referring to the process of restructuring and reduction of workforce. On the other hand, labour unions prefer to use the phrase “retrenchment process” when referring to any restructuring process which results in job losses. Government officials, who often endeavour to be neutral in respect of retrenchments and downscaling matters, interchangeably use the words downsizing, downscaling and retrenchments, depending on the circumstances at the time.

According to Itshar (1995), the term “downsizing” was originally a general business term, which referred to restructuring and shrinking the organisation by stripping away the layers of management which delay a quick reaction to opportunities in the market. Itshar (1995) furthermore stated that the term is now not only used to refer to the removal of layers of management, but also in describing the process of restructuring and reduction of workforce.

The term “rightsizing” can be defined as a process of creating the most appropriate organisational structure and may or may not involve reduction in workforce. In some instances, rightsizing may result in an increased workforce, therefore it is wrong to use the word rightsizing as a loose synonym for downsizing.

In this study, downscaling is defined as a process of labour reduction and organisational restructuring in order to achieve specific benefits, such as reduction and control of costs, as well as improved profitability. The process of labour reduction may either be voluntary or involuntary.

1.5.2 Sustainable development

A worldwide accepted definition of sustainable development is that of the Brundtland Commission, which states that “sustainable development is development that meets the needs of present generation without compromising the ability of future generations to meet their own needs” (Johnston, 2002; Brudtland et al, 1987). Cordes (2000), states that the concept is an ethical position packaged for political purposes, and that it places an ethical demand on society. Cordes further points out that the concept is neither economic nor ecological. According to Eggert (2000), sustainable development, broadly defined, reflects the desire of human beings to act in ways that simultaneously sustain or even enhance the natural environment, economic wellbeing and social justice.

The concept of sustainable development in mining can be described as mining activities that are conducted in a manner that optimizes profits whilst minimising

any adverse environmental and socio-economic impact, and involve stewardship, good governance and optimum utilization of mineral resources.

1.5.3 Gold Crisis Committee

The Gold Crisis Committee (GCC) was a tripartite forum created in 1997 to address problems relating to the then depressed gold price and loss of jobs in the industry. The forum comprised representatives from, government, labour unions (National Union of Mineworkers) and business (Chamber of Mines).

1.6 Research Methodology

1.6.1 Research method and design

The research method on which the study was based contributed to the conception of the problem associated with downscaling in the South African mining industry. The author's participation in the implementation of strategies employed to address downscaling and rationalisation in the mining industry was vital for assessment of downscaling in South Africa. The study involved:

- Data and information gathering through literature review;
- Data collection and collation through the GCC and other stakeholder forums established to address downscaling;
- Discussions with mine, union and government officials;
- Utilising Driefontein Gold Mine as a case study to analyse the management of downscaling; and
- Data collection from relevant international organisations.

1.6.2 Delineation of case studies

In order to assess and thoroughly understand the impact and management of downscaling on South Africa's gold mines, Driefontein Gold Mine was used as a case study. The choice of the mine was based on the following characteristics:

- Its long history in respect of gold mining in South Africa;
- Being one of the largest mines, it would provide an ideal representation of the gold mining industry in South Africa; and
- Its participation in the processes of the GCC.

On the international front, Canada, the United Kingdom, Poland and Australia were used as case studies to investigate international experiences on the management of downscaling in the mining industry. The choice of the countries was based on their long history of mining and the ease of availability of information in respect of downscaling in the mining industry.

1.6.3 Information gathering

Information in respect of this study was compiled using statistical data and other related information from, for example: the Department of Minerals and Energy (DME); Council for Geoscience (CGS), Chamber of Mines and the GCC. In addition, a literature study was undertaken to enhance the understanding of downscaling in the mining industry and other sectors.

The important part of the study involved gathering and analysing information on the gold mining industry of South Africa and Driefontein Gold Mine, one of the mines affected by downscaling and the gold crisis in 1998. As the former employee of the DME and the Head of the GCC Secretariat the author had the opportunity to gather first-hand information on the management of South Africa's mining industry as well as downscaling. The GCC enabled the author to develop a sense of the context within which downscaling, especially in the gold mining industry, took place. A review of selected international literature on the management of downscaling in Canada, United Kingdom, Poland and Australia was undertaken with a view of understanding international experiences. This in turn, enabled the hypothesisation of the manner in which a variety of factors impacted on the processes of downscaling as it relates to employment and the possible future management of downscaling in South Africa's mining industry.

In summary the objectives of this study were realised through the following:

- Literature survey;
- Analysis of historic data;
- Visiting selected areas affected by downscaling;

- Discussing pertinent issues with relevant stakeholders; and
- Participating in tripartite forums such the GCC, Gold Mining Summit, Mining Summit and Sector Partnership Committee.

CHAPTER 2

HISTORICAL DEVELOPMENT OF SOUTH AFRICA'S MINING INDUSTRY AND LABOUR MARKET IN THE DIAMOND AND GOLD MINING INDUSTRIES

“The history of mining of metals in southern Africa spans at least the past 2000 years but only the past 200 are well documented” D. Miller, 1995.

2.1 Introduction

Mining has for many years played a critical role in the socio-economic development of South Africa and southern Africa. The historic development of South Africa's mining industry can be subdivided into the following two categories:

- Indigenous or pre-modern mining; and
- Modern mining.

For the purpose of the study, indigenous or pre-modern mining refers to mining that took place prior to the discovery of diamonds in South Africa. Modern mining is large-scale commercial mining that commenced with the discovery of diamonds in the early 1880s.

2.2 Indigenous Mining in South Africa and Southern Africa

2.2.1 Non-metal mining

Although it is difficult to determine the exact commencement of mining in South Africa, archaeological studies have demonstrated that the earliest mining in southern Africa (apart from informal small-scale quarrying of lithic raw materials for stone tools) was for minerals used in cosmetics (Miller, 1995). Lock (1998) states that archeological records for southern Africa show that mining of red ochre and specularite for paint base and cosmetics was in existence as far back as 31 000 BC. Beaumont (1973) has summarized information about ancient workings in southern Africa and according to him, evidence from Ngwenya in

Swaziland indicated that prehistoric underground mining was already in existence some hundred and twenty millennia ago.

According to Morton (1996), ancient miners at Lions Cave in Swaziland cut a tunnel 25 feet wide, 30 feet deep and 20 feet high – the tunnel has been dated to go back at least 43 000 years by carbon dating and probably goes back to 70 000 - 110 000 years ago. The ancient miners mined nearly 2 700 tons of material to extract red ochre - a pigment used as body paint for rituals (Morton, 1996).

2.2.2 Metal mining

Metals such as iron, copper and gold have been mined in South Africa and southern Africa for many centuries. The “early-years” of exploitation of these metals are discussed below:

Iron metal (Fe)

According to Hammerbeck (1976), iron ore was extensively mined by indigenous South Africans prior to the arrival of Europeans. Whilst ancient workings in Swaziland indicate that the mining of iron for pigment purpose dates back approximately 110 000 years (Beaumont, 1973 and Morton, 1996), earliest evidence of iron smelting goes back 270 AD (Astrup et al, 1998). According to Astrup et al (1998), the smelting site was near Tzaneen in the Limpopo province (Figure 2.1). Other sites dating between 2nd and 6th centuries have been located in Mozambique (Miller, 1995; Sinclair et al, 1993). There has also been evidence of metal jewellery fabrication and iron processing in ancient southern African towns of Mapungube (in Limpopo province), Bosutswe (in Botswana), and the Great Zimbabwe Ruins (in Zimbabwe). At these sites, iron ore mining primarily involved exploitation of ferruginous laterites, goethite and magnetite (Miller, 1995).

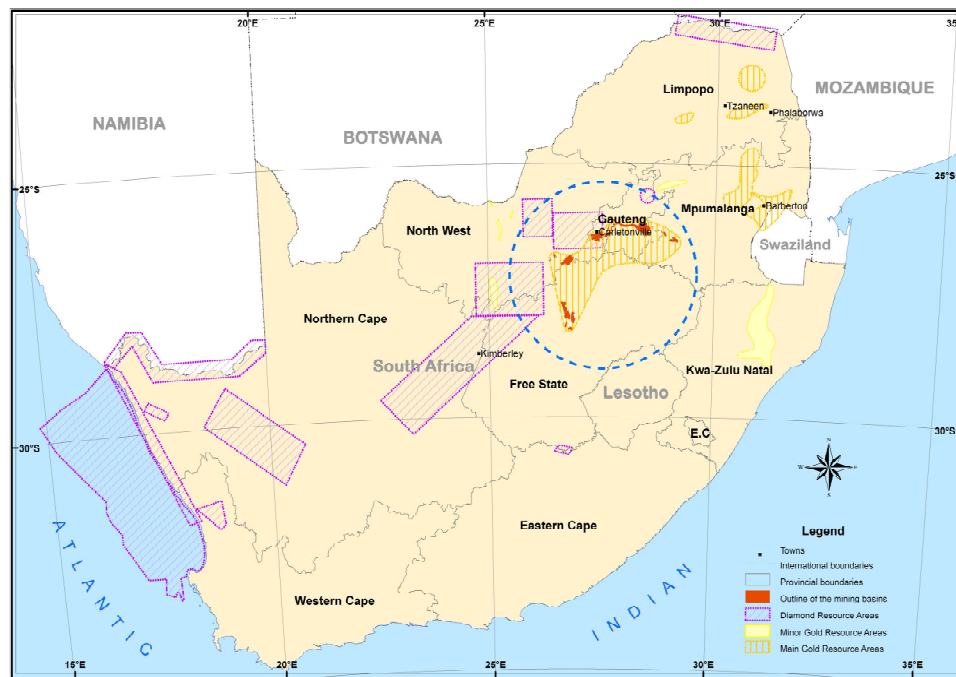


Figure 2.1 South Africa's political boundaries, diamond fields and gold fields (Source: Council for Geoscience).

Copper (Cu)

Although small occurrences of ancient copper mining have been recorded in many areas of the former Transvaal, extensive mining of the metal has been recorded in Musina and Phalaborwa. It is well known that the most important copper deposits of South Africa (Phalaborwa, Okiep and Musina) were worked prior to modern mining taking over (Wilson, 1998). Wilson (1998) furthermore states that in 1598 when Vasco Da Gama sailed around the southern coasts on his way to the east, he was impressed with the quantity of copper than the people living at the mouth of the present day Limpopo river wore and displayed.

Gold (Au)

Over 4 000 gold workings, dating as far back as 1 400 years, have been identified in Zimbabwe (ANC Discussion document on Minerals and Energy, 1994).

Archaeological gold jewellery and artifacts from Mapungubwe (near the Limpopo river) and Great Zimbabwe (in Zimbabwe) indicate widespread gold trading during those times (Miller, 1995). In addition to the artifacts, evidence of gold processing is emerging in Great Zimbabwe and Thulamela in the Kruger National Park, where indigenous ceramic sherds, used as gold melting crucibles, have been found (Miller, 1995). Miller (1995) furthermore points out that the exploitation of gold along the Limpopo river was well established by then, but was abruptly destroyed by conflicts in the region, the slave trade, the spread of disease and other factors.

Whiteside (1976) states that evidence of existence of pre-modern mining is report by J. G. S. Bronhorst, who accompanied Hendrik Potgieter (former leader of the Afrikaners) to Soutpansberg in 1836. According to Whiteside, Bronhorst and Potgieter encountered local people who showed them the gold, the mine from which gold was extracted and rings made out of gold.

Tin (Sn)

Ancient tin (Sn) mining is dated to the 15th and 17th centuries and seems to be confined to two possible tin sources in Zimbabwe and Rooiberg in the North West province (Miller, 1995). The tin was used to make bronze and bronze-like alloys, which were probably exported via the Indian Ocean trade. According to Du Toit and Pringle (1998), an old timber prop at Rooiberg was dated at 1515 AD, confirming the existence of tin mining in the area at least 500 years ago.

Miller (1995) points out at the strong archeological indications that the rise of major ancient trading towns such as Mapungubwe and Great Zimbabwe coincide with trade in metals mined in southern Africa. He furthermore states that tin, gold, copper and iron were traded in exchange for glass beads and other luxury goods through the Indian Ocean trade. After agriculture, mining, mineral processing and metals trade were the most important factors that drove the economy of as well shaping the social structure of pre-colonial settlement. However, according to Miller (1995), the decline in production of metals from the region and the

importation of iron goods, which coincided with the rapid colonisation of Africa, undermined local production of metal products.

2.2.3 Decline of indigenous mining

Prior to the discovery of diamonds, metal mining in southern Africa was not a permanent activity. As in modern day mining, sustainability of the mines was largely determined by factors such as access to markets, availability of the resource being mined, political and social stability and, most importantly the availability of labour. According to Miller (1995), several villages were built around mining activities – some of villages being seasonally settled and accommodating 50 to 100 miners and their families in a single season. Access to markets (mainly in Arabia and India) was critical for the survival of mining and trading activities in southern Africa.

The arrival of the Portuguese in the 16th century created turbulent times for southern Africa and resulted in most of the metal mining and trading activities being disrupted (Miller, 1995). According to Axelson (1973), the Portuguese trading activities were largely driven by the desire to control mining territories in southern Africa. They hoped to use the gold from the mines and ivory from Africa to buy spices in India for the markets in Europe (Axelson, 1973). The arrival of the Dutch and British, and the subsequent colonisation of southern Africa, finally put an end to mining and the legal trading of metals by indigenous people. Nonetheless, the arrival of the colonisers was followed by major mineral discoveries that required large scale mobilisation of labour throughout the southern African region.

2.3 Historical Developments and Labour Market of South Africa's

Modern Mining Industry

The current economic development and modern social structure of South Africa are without doubt, based on large-scale mining of minerals since the late 1800s. The impetus to the economic development process was initially driven by the mining of diamonds in Kimberly and the surrounding areas and later followed by

the discovery and subsequent development of gold and coal mining industries, as well as the recent exploitation of platinum group metals (PGMs). These developments laid the foundation for the evolution of the social fabric and labour market structure of the modern day industrialized South Africa. This section focuses on developments relating to the labour market during both the diamond and the gold rush eras.

2.3.1 Diamond rush and its labour market

The occurrence of diamonds in South Africa was first noticed in 1867 when a mineralogist in the then Cape Colony established that a stone found on a farm near the confluence of the Vaal and Orange rivers was, without doubt, a diamond (Worger, 1987). The stone was picked up by an inquisitive farm boy near Hopetown and was bought for £500 by Sir Philip Wodehouse (Van Rensburg and Pretorius, 1997; Lacour-Gayet, 1977). The discovery heralded a change in the world's attitude towards southern Africa.

Although several small diamonds were subsequently found, it was not until the discovery of 83.5 carats diamond in March 1869 that real diamond mining commenced in South Africa - marking the commencement of modern mining in South Africa (Worger, 1987). The diamond was discovered by a Griqua shepherd, who was offered, in exchange, five hundred ewes, ten oxen and a horse (Lacour-Gayet, 1977). News of the diamond rush spread across the world and attracted many fortune seekers from various parts of South Africa and Europe. Diamond mining was primarily alluvial digging along the banks of the Orange and Vaal rivers.

Stakeholder structure in the diamond diggings

The diamond rush created hostilities and adverse relationships amongst various stakeholders in the area. According to Worger (1987), Blacks who had found most of the diamonds, claimed ownership over the land and Boer farmers, were irritably hostile of the invading diggers. However, their objections failed to keep the diggers from invading their occupied land and by 1870 (three years after the

discovery of the first stone) some 5 000 diggers were actively prospecting for alluvial diamonds on 10 000 claims (Thompson, 2006; Worger, 1987). The diggers comprised people of various nationalities and ages. There were unskilled labourers (who were mostly Black), small diggers, claim holders, share workers (who rented out claims from claim holders), proprietors of farms (“landlords” who derived their income from rents paid by claim holders) and merchants (Worger, 1987).

The depletion of alluvial diamond resources on the Vaal and Orange rivers resulted in diggers moving on to try their luck on dry diggings. The number of diggings increased and by 1871 there were nearly fifty thousand diggers – 30 000 of whom were black and 20 000 white (Thompson, 2006; Worger, 1987). Many of the White diggers came from England, Europe, America, Australia and other parts of South Africa, whilst Blacks, some of whom held their own claims, came mainly from southern Africa. At the end of 1871, the British annexed Griqualand West to prevent Afrikaner republics from controlling both diamond mining and the merchants’ trade routes (Allen, 1992).

Worger (1987) reports that in 1872 there were at least 47 Black claim holders in the Dutoitspan and Bultfontein mines and by 1874, 120 of the 130 claim holders in Bultfontein mines (a relatively poor area) were Black – a situation that many White settlers and diggers were totally opposed to. Thompson (2006), furthermore states that, within a few years, professional geologists had recognised that the dry diggings were part of diamondiferous pipes extending far below the surface. These were later found to contain the largest concentration of gem diamonds yet discovered. The increasing population within the diggings eventually resulted in the creation of Kimberly as a city.

Labour market and its structure in diamond mines

With an increased number of operations in dry diggings, there was concern about labour shortages and reliability of available labour. Government and mine owners joined forces in trying to ensure constant supply of labour to the mines and a

concerted effort was put in place to recruit more black workers to the diamond fields. This effort bore fruit and the number of black workers on the mines increased. However, Worger (1987) states that the numbers of black workers were extremely erratic, fluctuating throughout the year because most black workers did not want to sever ties with their families and often insisted on returning home during harvest seasons. Furthermore, they did not like being at the mines during the harsh Kimberly winters and in winter time they migrated back to their respective homelands to avoid the cold and unpleasant conditions on the mines.

Black workers, of diverse tribes and nationalities, were recruited from different parts of southern Africa. Table 2.1 shows a typical breakdown of black workers in the diamond mining industry in terms of tribal origin from 1873 to 1876. The table furthermore shows that whilst different tribes worked in the diamond fields, the Pedi tribe contributed the largest proportion and accounted for more than half the black workforce. The reason behind the large numbers of Pedis working on the mines was that the Pedi king encouraged and persuaded his subjects to work on the mines so as to accumulate funds with which to acquire guns for protection against white settlers (Allen, 1992). Another reason for the dominance of the Pedis on the diamond fields was that the Pedis, Tsongas and Basotho had already been involved in migrant labour prior to 1870 (Wentzel and Tlabela, 2006) - it was therefore easier to attract young men from these communities. By the 1870s the Pedis had managed to accumulate about 6 000 guns and a considerable store of ammunition, which they used in challenging the Boers. According to Allen (1992), the Boers were rescued through the British annexation of the Transvaal in 1877. With regard to the Tsongas, who came mainly from southern Mozambique, their main reason for working on the mines was largely a desire to escape the hardships they faced as a result of a lack of resources to produce agricultural and pastoral surplus (Worger, 1987). In fact, according to Worger (1987), the Tsongas increasingly preferred working on the diamond fields rather than on the Boer farms or other industries in the former Natal.

Table 2.1: Percentage breakdown of the black mineworkers according to tribes, 1873 – 1876 (Source: Worger, 1987).

Tribes	1873	1874	1875	1876
Pedi	64	58	62	48
Tsonga	12	15	26	9
Sotho	9	5	3	14
Natal Zulu	5	4	1	7
Tlhaping	4	3	0	8
Griqua	1	0	0	0
Other	5	15	8	14

Diamond mining in Kimberly not only attracted miners and diggers, it also attracted many other fortune seekers such as traders and entrepreneurs. The economy of Kimberly grew and became the major contributor to economic growth in southern Africa. Despite the hardships associated with mining, the movement of people between Kimberley and rural communities injected much needed capital into those communities.

As demand for labour on the mines increased the diamond fields became a major competitor for black labour – a development that was totally opposed by farmers who were losing labour to the mines, and also feared the newly armed migrants who had acquired guns at the diamond fields. Hostility from the farmers increased to an extent that it became extremely dangerous for mine migrants to travel through territories controlled by Boer farmers (Allen, 1992). The return journey of the migrants (from Kimberly to their homelands) was more risky and hazardous, for the Boers would rob the migrants of their guns. The governments of Natal, Cape, Transvaal and Free State were also unhappy with the new competition they were facing in respect of black labour.

Despite the many measures put in place to increase labour supply in the diamond fields and the willingness of the Pedis and the Tsongas to work on the mines, supply of labour remained a serious problem for the diamond mines. As a result

black wages increased out of control and rose as much as five times between 1871 and 1875 (Worger, 1987). Whilst the issue of labour had already emerged as a critical component of diamond mining, mining at this stage was relatively simple – it involved small enterprises of individuals or groups who employed up to ten labourers per claim (Kallaway, 1970s). Kallaway furthermore states that large mining companies employing large numbers of employees, only emerged after 1876 when changes in legislation allowed miners to work more than two claims.

Not all diamond diggers became wealthy – most of them were struggling and constantly beleaguered by lack of profitability in most of their operations. Moreover increasing wages, coupled with the absenteeism of employees did little to help the situation. In response mine owners approached government to request that it restrict the movement of Blacks so as to improve reliability of labour supply and also reduce diamond theft. Although the British government refused to introduce racial laws, the then High Commissioner subtly responded by introducing a decree that effectively restricted Blacks from owning claims or trading in diamonds (Thompson, 2006). The decree, which can be regarded as the first pass law, restricted and controlled the movement of Blacks. On the other hand mine owners actively addressed the issue of labour shortage by, inter alia, employing recruiters to recruit labour in rural areas. All these measures failed to address the shortage of labour and the situation was to some extent saved by the 1882 depression. The depression resulted in a decline in diamond demand, diamond prices and several mines went bankrupt and closed their operations. Half the operators went insolvent and mines reduced the number of employees by almost 50 per cent between 1881 and 1883 (Worger, 1987).

Unfair treatment of the Black labour and shortage of labour on diamond mines

Blacks on the diamond fields were continuously subjected to cruel treatment, which exacerbated the shortage of labour as abused workers left the diamond fields or moved to other claim holders. The abuse of Blacks was not only confined to the mines, but extended to the entire town of Kimberly (Thompson, 2006; Worger, 1987). The unfair treatment of Blacks on the diamond fields is best

captured by Kallaway (1970s), who states that in every case after 1875 where a clash of interest occurred between Whites and Blacks, or between Mining companies and labour, the state took fairly partisan attitude – the state always supported white labour and mining magnates.

Despite all the measures and regulations to control Blacks and to ensure the mines had a stable supply of labour, diggers in the diamond fields continued to be beleaguered by a multiplicity of hardships resulting from high operational costs, deep workings, shortage of labour and capital and conflict over property rights (Worger, 1987). The diggers blamed Blacks for most of their hardships and requested government to tighten control on the movement of black people. However, the British government was always reluctant to introduce racial laws openly and, remarkably; the government once more resisted the call to blatantly introduce racial laws (Worger, 1987). The stance of the British did not stop mine owners from continuously requesting and pressurising government to restrict the movements of black workers and to impose racial laws.

Worger (1987), states that white diggers and merchants were not satisfied with the response from government and embarked on a massive armed rebellion that was referred to as the Black Flag rebellion in April, 1875. The ultimate objective of the diggers was to take over the government of Griqualand West (Allen, 1992). White diggers paraded through the streets of Kimberly and raising a black flag of anarchy (Worger, 1987). The strike turned violent, with white diggers going on the rampage, burning the tents of black claim holders and trying to hang black people suspected of stealing diamonds. However, by July 1875 British troops had arrested the ringleaders and managed to suppress the rebellion (Allen, 1992). In light of the pressure from white diggers, government introduced a series of legislations to address some of their concerns. As part of the new changes, government terminated the right of Black diggers to register as claim holders (Worger, 1987). Kallaway (1970s) points out that between 1871 – 1875 period, black claim holders were systematically undermined until they virtually

disappeared by 1875. Kallaway further states that from 1875 onwards, the “native problem” on the diamonds fields became a “labour problem”.

Despite the firm rejection by Britain to introduce racist laws, the police continuously enforced discriminatory practices on Blacks. Some of these practices involved banning Blacks from the town of Kimberly after sunset. These practices, together with many others, were later adopted by the Nationalist Party government during the apartheid years and in fact many apartheid discriminatory practices originated in the diamond fields. Gool (1983) states, the whole concept of a colour bar and apartheid originated amongst the British workers under the Union Jack at the diamond fields. The concept was then carried over into the mining areas of South Africa, and readily accepted by a segment of the Afrikaner population. Gool (1983) further states that the privileges and prejudice of European diamond diggers and workers were later transferred to the gold mines, where they were legislated. Diamond mines were also responsible for institutionalising the later practice of single sex hostels – introduced with the objective of improving security and tightening the movements of black labour. The hostels, which were at first unsuccessful, were introduced in 1879 (Allen, 1992). According to Gool (1983), these hostels were permanently guarded to ensure black workers were confined to the hostels and mines.

The diamond fields also made use of convict labour – which comprised powerless and rightless people (Kallaway, 1970s). De Beers capitalised on government offer to utilise convicts on the mines, and in 1884 the company built a convict station for 300 - 400 convicts and 25 guards (Kallaway, 1970s). According to Kallaway, the De Beers Company Convict Station was regarded as the best and safest prison and ensured that prisoners work from sunrise to sunset at its diamond mines. The company benefited as the cost to it were only housing, feeding and clothing of the convicts. The practice of utilising convict labour laid a firm foundation for successfully implementing the concept of single sex hostels on the mines – a concept that has now turned to be one of the main sensitive and topical issues in the mining industry.

Role and conditions of White labour in the diamond fields

The treatment and living conditions of Whites in the diamond fields was neither as perfect nor pleasant as one would expect. Moreover, like their Black counterparts their well-being and treatment evolved and changed with the evolution of the diamond mining industry. Whites were initially and primarily attracted to the diamond fields by a dream of being wealthy either through diamond digging or trading. Unfortunately, most of the diggers experienced extreme hardship and difficulties – consequently bankruptcy became the order of the day. According to Worger (1987), between the mid 1870s and mid 1880s, mining in the diamond fields gradually fell into the hands of large operators who introduced advanced technologies through the mechanisation of operations (Thompson, 2006). They also employed many of the bankrupt white diggers mainly as supervisors and recruited skilled employees from Britain.

Politics and wealth

As a result of the tough competition and conditions in the diamond fields, only a few individuals managed to amass great wealth (Thompson, 2006) and it seems that it was in fact politically connected people who managed to accumulate large wealth. Cecil John Rhodes, for example, was at some stage both a mining magnate and Prime Minister of Cape Colony (Macnab, 1987). In 1887, Cecil John Rhodes, together with other mining magnates, such as Charles Rudd (also a politician), acquired control of De Beers - the second most productive of the four mines operating (Thompson, 2006). Rhodes and his political/business partners succeeded in amalgamating several independent mines under the flag of De Beers Consolidated Mines Ltd in 1888 – a company which later held a monopoly over diamond production in the area (Macnab, 1987).

Separation of the white and the black miners in residence

Merging of small mining operations made it easy for mine owners to put in place systems that would tighten the monitoring and control of both black and white employees. Following the success of convict barracks labour, De Beers pulled all strings to ensure that employees were confined to designated sites. The company

was of the opinion that confinement would reduce the theft of diamonds and absenteeism. In this regard the company expedited the process of confining employees and by 1888, black mineworkers were confined to hostels – a situation that resulted in extreme hardships to local small merchants who suffered from loss of business (Worger, 1987).

Although the initial strategy of mine owners was to introduce closed compounds to both Whites and Blacks, white employees used their political power to avoid being housed in compounds (Allen, 1992). Nonetheless, white workers did not escape the desire of mine owners to control their movement, and De Beers established a village, some two kilometers from Kimberly, to house white employees – a development which ensured all employees were under total control and constant monitoring by mine owners.

Three-phase strategy to turn De Beers into a world class company

Cecil John Rhodes objective of turning De Beers into a dominant player in the diamond mining industry and of improving the profitability of its operations can be subdivided into three phases. The first phase involved improving certainty in respect of labour supply and reducing the theft of diamonds. This was achieved by confining employees to identified housing areas. The second phase entailed mechanisation of mining operations to reduce dependency on labour. Once the issues relating to labour had been brought under control, Rhodes focused on the third phase, involving productivity improvement and increasing the price of diamonds. In this regard he increased mechanisation on the mines and limited the supply of diamonds to artificially increase prices. This strategy had a devastating impact on the economy of Kimberly as thousand of workers lost their jobs. According to Worger (1987), about 380 Whites and 2 500 Blacks lost their jobs in 1888. By the end of 1888, Rhodes and his partners had increased their influence in the diamond fields to the extent that they had extensive control of the diamond industry and the movement of labour. They managed to control the diamond market by being involved in both mining and the marketing of diamonds – which, surprisingly, is still the core business model of the modern day De Beers.

The mighty De Beers was eventually taken head on by Ernest Oppenheimer, a German immigrant, who at some stage was also a politician, who served as a Mayor of Kimberly (Mark Solomon Jewellers, 2006). In 1917, Oppenheimer, formed the Anglo American Corporation (with aid of American capital), which embarked on a number of acquisitions in respect of gold mines and alluvial diamond deposits (Anglo American, 2006; Pienaar and Skinner, 1997). According to Worger (1987), he successfully beat De Beers in acquiring new concessions and in December 1929 was appointed chairperson of De Beers. He remained at the helm of company until his death in 1957, when his son Harry, took over leadership of the company (Boyd, 2006).

Unsustainable exploitation of diamond resources

There are many people who are of the opinion that Kimberly, like many other mineral rich towns and areas, did not benefit fully from the wealth generated in the town. Worger (1987) points out that most of the wealth generated in Kimberly ended up in the Rand where it was used as speculative money for developing gold mines. Some of the money was invested in the British South Africa Company, which was to exploit concessions in Mashonaland, Matebeleland and Europe.

Unfortunately diamond mining, like any other mining activity, has a finite life and the wealth extracted in Kimberly can never be returned. Some critics of mining go as far as saying that Kimberly is now only left with a “big hole” - waiting for tourists to pay a visit. Sadly, the grim situation will continue well into the future since, mining in and around the town is now deep into its downscaling phase. The decision to designate Kimberly the capital town of the Northern Cape was a good one, as it in fact saved this historic town from further economic decline.

2.3.2 Gold rush and its labour market

The occurrence of gold in South Africa can be divided into two major areas; namely:

- Outside the Witwatersrand Triad; and
- The Witwatersrand Triad

(a) Gold outside the Witwatersrand Triad

Modern gold mining in South Africa commenced during 1870-1880 outside the Witwatersrand Triad. The commencement of gold mining during the colonial times occurred between 1870 and 1871 in the Murchison and Giyane greenstone belt, where to date some 42 tons of gold have been produced (Ward and Wilson, 1998). During the same period, the first gold mine was opened by prospectors on the farm Eersteling 17 KS (C14) between Naboomspruit and Polokwane in the Limpopo province in 1871 (Whiteside et al, 1976).

Ward and Wilson (1998) point out that later in 1883 a gold-bearing reef was discovered in the Barberton area in Mpumalanga province. To-date a total of over 320 tons have been won from the Barberton gold field (Ward and Wilson, 1998). Other known important discoveries include the 1870s gold discoveries in Pilgrims Rest area also in the Mpumalanga. Although gold is still mined outside the Witwatersrand basin, total gold output is insignificant in comparison to the Witwatersrand gold bearing deposit.

Even though the discovery of gold occurrences outside the Witwatersrand was associated with gold rushes and the settlement of communities around the occurrences, it was not until the discovery of gold on the Witwatersrand that the real gold rush began. The Witwatersrand rush laid the foundation for the present social fabric, economic status and settlement patterns of South Africa.

(b) Gold in the Witwatersrand Triad

There are many views as to who first discovered gold in the Witwatersrand basin. Handley (2004) provides convincing argument to suggest that Fred Struben, a

prospector, could be the first person to discover gold in the Witwatersrand basin. On the other hand Whiteside et al (1976), states that it is generally agreed that George Walker and George Harrison made the discovery of the Witwatersrand gold in 1886. Cartwright (1973) recognises George Harrison as the main person who discovered the gold. The discovery was on the farm Langlaagte and the occurrence is preserved as the George Harrison Park some 5km west of Johannesburg (Trustwell, 1977). Despite the uncertainty about the real discoverer, the discovery led to the convergence of prospectors and the subsequent opening of the Main Conglomerate Formation in 1886 (DME, 1986).

Labour market and its structure in the Witwatersrand gold mines

Although many settlers and fortune seekers were attracted to the Witwatersrand gold fields during the 1880s, as in the early development of the diamond mining industry, the shortage of labour (exacerbated by an unreliable supply of labour) became the biggest challenge for the gold mining industry (Gool, 1983). As was the case during the early days of the diamond mining industry, one of the main causes of the shortage of labour was that most black people were reluctant to leave their land to work in the gold mines. The authorities of the day did not take kindly to the matter and introduced various measures to address the problem. Crush et al (1991) describes the period 1890 – 1920, as a very difficult period in the history of the black population as they were subjected to all kinds of coercive measures aimed at pushing them to work on the gold mines. The measures included, amongst others, land dispossession, colonial taxes and incentives such as advanced payment.

White labour was also a problem for the mining magnates, as it was extremely costly to employ Whites on the gold mines. According to Allen (1992), white labour was the most important single cost item in the production of gold in the Witwatersrand. Allen (1992) furthermore states that white labour in South Africa was almost twice the cost of similar labour in the Californian gold mines and was used less efficiently. However, despite these high costs, politicians continuously pressurised and argued with mine owners to employ more white people.

Effort by the Chamber of Mines to address labour shortage

The Chamber of Mines played a prominent role in seeking solutions to the labour problems that were constantly besieging the gold mines. The organisation continuously lobbied government to support its ideas of ensuring sustainable supply of labour to the mines, reducing desertion and reducing black wages. In 1893 the organisation submitted draft regulation that, inter alia, aimed at preventing large-scale desertion (Gool, 1983). Whilst the regulations were passed into law in 1895, the mining industry doubted the ability of the Kruger government in implementing the law (Gool, 1983; Jeeves, 1985).

Realising legislation was inefficient in terms of increasing labour supply, as well as reducing labour wages, the Chamber of Mines formed its own recruiting organisation, the Rand Native Labour Association (RNLA) in 1896 (Wilson, 1972). According to Wilson (1972), the association achieved some success, increasing black labour from 14 000 in 1890 to a record high of 88 000 in 1897 and at a considerably lower wage rate than it had been ten years previously. Notwithstanding this achievement, the shortage of labour continued to a point where employers started to compete amongst themselves, as well as against other economic sectors (eg farming), for labour.

Whilst the reluctance of Blacks to leave their land and sell their labour was the prime cause of the labour shortage on the mines, the shortage was exacerbated by factors such as the Anglo Boer War of 1899-1902, declining mine wages and deplorable working conditions which involved attacks on Blacks by white employees. Moodie and Ndatshe (1994) have discussed in more detail how Blacks were subject to constant assault by Whites on the mines. Realising the negative impact of continued shortage of labour, the Chamber approached the then government of Transvaal and requested it to play a more active role in the recruitment of labour – a request that was turned down by government (Wilson, 1972). Despondently, the Chamber re-organised their recruitment strategy and formed the Witwatersrand Native Labour Association in 1900 (WNLA) – a monopsony aimed at eliminating competition amongst employers for labour

(Allen, 1992,: Crush et al, 1991; Warwick, 1978; Wilson, 1972) and increasing availability of labour. The association was more successful in Mozambique where it became the sole labour recruiting agent. Despite this shortage of labour, the Chamber ironically continued to pursue its objective of decreasing wages. These lower wages did not help the situation at all and in fact continued to invite increased competition from other economic sectors, such as farming which in essence provided relatively better working conditions than on the mines.

Recruitment of Chinese labour

In its endeavour to find solutions to the shortage of labour in 1904, the mining industry decided to recruit Chinese labour from the south-east region of China (Guangdong province) to work on gold mines (Labour History, 2006; Macnab, 1987). White unions, who were unhappy with the importation of Chinese, pressed for a list of occupations from which Chinese would be excluded – the goal was achieved through the introduction of 1904 Labour Importation Ordinance (Kennedy, 1984). According to Nauright (2005), by 1905 some 60 000 Chinese were working in the gold mines. Macnab (1987) states that the Chinese managed to double the output on the mines within a year of their arrival. However, the arrival of Chinese workers was not welcomed by everybody. Their arrival created wide-spread unhappiness amongst white employees, who managed to pressurise the government to stop recruiting Chinese workers. As a result government stopped the recruitment of Chinese employees, at the end of 1906 and Chinese workers were repatriated (Wilson, 1972).

According to Jeeves (1985), the repatriation of Chinese workers increased the labour shortage and brought back competition for labour amongst employers – a situation that eventually spiraled out of control, resulting in the collapse of the WNLA within South African colonies. In order to address the shortage, mining companies appointed separate recruiting agents, which led to the sudden proliferation of independent white labour contractors, hundreds of white recruiters and thousands of runners (black agents subcontracted to recruit by recruiters) (Jeeves, 1985). The increase in the number of runners exacerbated the shortage of

labour on the mines, as most black people preferred to be runners rather than working on the mines – employment conditions of runners were better than those of miners.

Recruiting from the Eastern Cape

In the Eastern Cape activities of recruiters and runners, hardships related to the then economic depression and government policies to encourage migrancy resulted in increased labour supply to the gold mines. Like all other governments in southern Africa, the Cape government openly supported the migrant system as they saw the system as an important source of revenue for the Eastern Cape region. According to Jeeves (1985), the number of black mine workers from the Cape increased from 16 555 on 30 June 1907 to 45 769 by the end of June 1909. The situation marked the entrance of the Cape (specifically the former Transkei and Ciskei territories) as a major supplier of mine labour. Both Transkei and Ciskei became the second most important source of labour after Mozambique (Wilson, 1972).

The activities of recruiters and runners mushroomed throughout the Eastern Cape. Whilst the system of recruiters (mainly Whites) and runners (mainly Blacks) produced the desired results for mine owners – that of increasing the number of mineworkers on the mines, the system brought chaos to the mining industry. In response the then Transvaal government established the Government Native Labour Bureau (GNLB) in 1907 to: regulate and manage the supply of labour on the mines; to safeguard the interest of migrant workers on the mines, and; to assist the Cape government in encouraging Blacks to work on the gold mines (Jeeves, 1985).

Working conditions on the gold mines

Mine employees were continuously exposed to harsh and difficult working and living conditions created by mine bosses in their bid to maximise profits. Surprisingly, the government was concerned about the poor working and living conditions on the mines and felt there was a need to safeguard the interests of

employees in order to ensure continued mine labour supply. Mine owners on the other hand seemed not to realise the importance of improving working conditions on the mines and government often criticised them for this. According to Wilson (1972), working conditions on the mines were appalling and the death rate of recruited workers in 1903 was 80 per thousand. Wilson (1972) furthermore points out that black employees were also often assaulted by their white colleagues – a situation which contributed to the continuous shortage of labour.

The unhealthy conditions on the mines resulted in many black employees succumbing to tuberculosis and other lung disease (Crush et al, 1991). Occupation diseases exerted heavy toll on most black employees. Concerns and requests for improved working and living conditions on the mines came not only from government, but also from recruiters who wanted conditions to be more attractive to recruits so as to improve their competitive position in respect of the recruits.

Legislative effort by government to increase labour

The government also tried several strategies to improve the supply of black labour on the mines. One of its strategies involved limiting the economic and business activities of Blacks through legislation such as the Native Land Act of 1913 (Library of Congress, 1996). The Native Land Act prevented Blacks from farming and they were indirectly forced to seek formal employment on the mines. Consequence of the Act was that black people were allocated less than 10 per cent of South African land (Kariuki and Van der Walt, 2000), which prevented Blacks from making a living from farming and indirectly forced them to seek work at the gold mines.

Recruiting from neighbouring countries

Aggressive recruitment of South African Blacks to the gold mines did not provide the mining industry with sufficient labour to meet the needs of the mines. As a strategy to address the problem, mine owners decided to recruit labour in neighbouring countries. In this regard, in 1897 the Chamber of Mines entered into an arrangement with the Mozambican government to recruit labour from

Mozambique, the then colony of Portugal (Jeeves, 1985). The arrangement gave the Chamber of Mines rights to recruit labour in Mozambique.

Jeeves (1985) further points out that several agreements were entered into between the authorities in Mozambique and both the Transvaal government and the mining companies. One of the agreements entered into between the Transvaal government and the Portuguese government provided mines with permission to recruit in Mozambique in return for customs preferences for the Portuguese. Other agreements introduced the following provisions:

- Deferred payment system for Mozambique, and an extension of employees' contracts from twelve to eighteen months;
- Deferment of half of the wages for the first twelve months; and
- Subtraction of repatriation costs and advances paid from the cumulated deferred pay.

In 1933 the government under constant pressure from the Chamber of Mines, legalised the recruitment of labour from areas to the north of 22 degrees south (Wilson, 1972). The changes resulted in labour being recruited from Malawi, Tanzania, Zambia, Botswana, Namibia and Angola (Wilson, 1972). The Chamber of Mines also recruited labour from Lesotho and Swaziland. The recruitment of labour from neighbouring countries is currently still being practiced by mining houses. Unfortunately, the current downscaling of some mining operations has negatively impacted on these countries in terms of unemployment and loss of revenue.

Strikes during the early days of gold mining

Gold mining, being a labour intensive industry which also practiced repressive policies, has always been engulfed in strikes. Some 351 strikes took place in the gold mines between 1916 and 1935 (Labour History, 2006). Labour History provides details concerning some of the important strikes on the gold mines by white workers. The first notable strike occurred in 1907, when skilled white mine workers protested against an attempt by mine owners to increase working hours.

Although the strike was not wholly successful, it created nuclei for white trade movements to grow. By 1913, organised white workers had become a strong force, which struck for better wages and working conditions. The strength of white mineworkers troubled mine owners and an attempt was made to replace them with black workers. This failed as white unions continuously fought against the empowerment of Blacks.

Black workers also realised the need to organise themselves and in 1920 waged a massive strike that saw 70 000 black workers striking against terrible working conditions (Labour History, 2006). As part of their strategy to cut down on labour costs, the Chamber of Mines announced the introduction of certain reforms in respect of job colour bar – their plan being to replace some white semi-skilled workers with black workers, who were to be paid lower wages (Hirson, 1976). White mineworkers were vehemently opposed to this development and went on a violent three months strike in 1922 – the strike was to become known as The Rand Rebellion. The government responded by dispatching a force of 7 000 troops supported by bomber planes and armored vehicles (Davies, 1978). According to Davies (1978), 153 strikers were killed, over 500 wounded, 5 000 arrested, several hundreds were subjected to penalties ranging from fines, imprisonment and death.

Although Blacks had on several occasions waged a number of strikes it was not until 1946 that a significant Black strike took place (Naicker, 1976). According to Naicker (1976), a peaceful march ended up with 1 248 workers wounded and 9 (officially) killed.

2.4. Discussion

Although it is difficult to determine the exact beginning of mining in southern Africa, archaeological studies and radiocarbon dates have demonstrated that ancient mines in Swaziland date back to between 110 000 and 120 000 years ago (Beaumont, 1973; Morton 1996). There is also enough evidence to show that iron may have been worked in the upper Zambezi in the second century AD, in Zimbabwe in the second century, in Swaziland in the fifth century and in South Africa in the eleventh century (Axelson, 1973). Mining, and trade in minerals and other commodities (eg ivory) were the mainstay of economic activities of the south-east African coast for many years. In South Africa, evidence of gold trading and jewellery manufacturing is supported by the world acclaimed archaeological gold jewellery in the Mapungubwe near the Limpopo river in the Limpopo province.

Whilst there is lack of detailed information on pre-modern mining, there is no doubt that mining during pre-modern era experienced cyclic economic conditions involving the attraction of labour to mines and the subsequent shedding of labour during difficult economic conditions. The sustainability of mining operations was often disrupted or even destroyed by plague or war.

Modern large-scale mining in South Africa commenced with the discovery of diamonds in the Northern Cape. Diamond discovery attracted thousands of black and white fortune seekers, either as employees or employers, from southern Africa and abroad. The settlement of these people in the diamond field influenced the ultimate settlement pattern of South Africa and its social fabric. For instance, the current single sex hostel system in the mining industry was first introduced in the diamond mining industry as a way of ensuring a reliable supply of labour and of addressing the theft of diamonds. Segregation of people in terms of race was also pioneered in the diamond mining industry, where black and white employees were housed separately. Both single sex hostels and racial segregation were later introduced in the gold mining industry.

Settlement in and around the diamond and gold mining industries formed the nuclei of South Africa's urban development. Although many people migrated to the urban areas, there were always linkages in terms of social, economic and cultural ties between developing urban mining areas and rural communities – with rural areas acting as labour sending areas to the mines – a role which most of them still play today.

The development of the diamond and gold mining industries relied heavily on the supply of both skilled and unskilled labour, and whilst the supply of skilled labour was often not a serious problem, the constant supply of unskilled labour was always a predicament that posed persistent threat to the development of the mining industry. In the early days of modern mining, skilled labour was recruited from Britain, whilst unskilled labour came from southern Africa. To address the matter of labour shortage mine owners and government put several initiatives in place. A summary of selected initiatives is presented in Table 2.2.

Despite the various initiatives put in place to address the labour shortage, the problem continued for many years as most South African Blacks did not necessarily find working on the mines an attractive proposition. Moreover, the harsh treatment and conditions on the mines discouraged many Blacks from seeking employment on the diamond and gold mines. In addition most South African Blacks did not want to sever ties with their families and preferred to continue with subsistence farming during farming seasons. However, the introduction of the Native Land Act in 1913 as well as a number of other pieces of legislation made it impossible for Blacks to become economically independent and they were forced to seek formal employment on the mines – a situation which drastically improved the supply of labour to mines. The recruitment of labour from neighbouring countries also played a vital role in addressing labour shortage on gold mines.

It is ironic that, whilst in recent years the problem facing both the diamond and gold mining companies is retrenchments and downscaling, the problems faced by the pioneers of modern mining in these sectors was, for a long time assurance and

availability of labour. The following are some of the many reasons that help explain this dichotomy:

- The diamond and gold mining sectors are now mature and running out of reserves;
- There is abundance of labour in the region and a large number of people in the southern African region are unemployed – South African unemployment levels are estimated at between 25 and 40 per cent (the exact figure will depend on the definition used for unemployment);
- Most people can no longer survive from subsistence farming; and
- Lifestyles have changed and people now depend on formal employment to survive.

Table 2.2 Selected initiatives to address labour shortage during the early years of diamond and gold mining in South Africa (Source: see column three).

Year	Initiative	Mining Sector & References
1879	Government makes it compulsory for employers to provide board and lodging in compounds. The aim was to exert control over movements of black mineworkers.	Diamond mines (Allen, 1992)
1884	Utilisation of convict labour. First convict labour compound built by De Beers. This led to the introduction of single sex hostels to control movements of labour.	Diamond mines (Kallaway, 1970s)
1889	Formation of the Chamber of Mines to, inter alia, lobby government and address labour issues.	Diamond, gold and coal mines (Lang, 1986)
1895	Enactment of Pass Law drafted by the Chamber of Mines to discourage Blacks from breaking their employment contracts and stipulated that Natives on the Rand must be in the employ of a master and wear a metal badge.	Gold mines (Jeeves, 1985)
1896	Creation of Rand Native Labour Association (RNLA) to recruit mineworkers. Formalisation of relations between Chamber of Mines and recruiters.	Gold mines (Wilson, 1972)
1897	Agreement between the Chamber of Mines and Portuguese authorities to recruit labour in Mozambique. The agreement was later confirmed by a the 1901 <i>modus vivende</i> between Lord Milner (British Administrator during Anglo-Boer War) and Portuguese authorities.	Gold and diamond mines (Jeeves, 1985)
1900	Establishment of Witwatersrand Native Labour Association (WNLA) to monopsonise recruitment of labour outside South Africa and ex-British Protectorates.	Gold mines (Wilson 1972)
1904-1906	Recruitment of Chinese labour to work on the mines and address shortage of labour.	Gold mines (Macnab, 1987; Labour History, 2006 and Wilson, 1972)
1911	Implementation of the Native Regulation Act of 1911 which was used as a nationwide instrument for discriminating against black people on the mines.	Gold and diamond. mines (Allen, 1992)
1912	Establishment of Native Recruiting Corporation (NRC) to organise recruitment of Blacks within South Africa and three ex-British Protectorates.	Gold mines (Wilson, 1972)
1913	Enactment of the Land Act of 1913, which reduced Blacks land ownership to 13 % of all land and forced into reserved. A pool of labour was created from the reserves.	Gold and diamond mines (Library of Congress, 1996)
1913	State and industry set up South African Institute of Medical Research to investigate pneumonia which was killing mineworkers. Anti-pneumococcal vaccine was successfully developed in 1920 to control the disease.	Gold mines (Jeeves, 1985 and Wilson, 1972)
1933	Government allows recruitment from areas to the north of latitude 22 degrees south.	Gold mines (Wilson, 1972)
1948	Recruitment offices opened in Europe to recruit skilled white mineworkers.	Gold mines (Wilson, 1972)

2.5 Summary

It has been shown in this chapter that mining has always played an important role in the history of southern Africa and South Africa. It contributed in the trade and economic activities of southern Africa during the pre-colonial era as well as prior to modern mining, which commenced with the discovery of diamonds in the Northern Cape. However, pre-modern mining activities were often disrupted by unavailability of labour due to outbreaks of wars and diseases. Similarly, the early days of modern mining, which commenced with diamond mining in Kimberly and followed by gold mining in the Witwatersrand basin, were beset by shortage of labour.

The problem of labour shortage, during the early days of modern mining, was largely addressed through collaborative initiatives of government and mine owners. These initiatives, which are summarised in Table 2.2, included recruiting labour from neighbouring countries and abroad in China and Europe. Unfortunately some of the initiatives were discriminatory against black people. For example, the 1913 Land Act, indirectly forced Blacks to work on the mines by removing them from their productive agricultural land. Other initiatives such as the single sex hostels restricted the movements of black people within designated areas. Despite the implementation of the many initiatives to address labour shortage, the problem persisted and remained a challenge throughout the early days of modern mining. However, the labour shortage challenges did not obstruct the mining industry from evolving into a world-class mining industry. Chapters 3 and 4 will discuss in detail the current status of the mining industry in South Africa.

CHAPTER 3

STATUS OF SOUTH AFRICA'S MINING INDUSTRY AND LABOUR TRENDS

“The idea that mining and agriculture are yesterday’s industries is to basically throw away the two strongest suits we have in South Africa” Michael Power, Investec Asset Manager, 2004

3.1 Introduction

Over 100 years of modern mining in South Africa has resulted in the development of a world class competitive mining industry, which plays a vital role in the economy of the country. Van Rensburg and Pretorius (1977) have demonstrated the strategic importance of South Africa’s minerals and pointed out the importance of mining in respect of, inter alia, attraction of foreign investment. In this chapter, the current status of the industry will be analysed. The analysis will focus on governance structures and the role of stakeholders in the industry, the national and global role of the mining industry, as well as labour trends in respect of selected minerals.

3.2 Governance Structures and Stakeholders in South Africa’s Mining Industry

The South African mining industry consists of the following wide spectrum of stakeholders who play a variety of roles:

- Government;
- Government agencies;
- Labour unions;
- Business; and
- Communities.

3.2.1 Roles and functions of government

Government participation in the mining industry is primary led by the DME that centrally manages, regulates and promotes the South African mineral and mining

industry from its head office in Pretoria. However, the DME continuously consults with other departments, such as provincial environmental departments, Department of Land Affairs, Department of Environmental Affairs and Tourism, Department of Labour and Department of Water Affairs and Forestry. The DME is responsible for the administration of several mining related legislations and regulations, key of which are presented below:

- Mineral and Petroleum Resources Development Act 28 of 2002
- Mining Titles Registration Amendment Act 24 of 2003
- Mine Health and Safety Act 29 of 1996
- Precious Metals Act 37 of 2005
- Diamonds Amendment Act 29 of 2005
- Diamonds Second Amendment Act 30 of 2005
- Geoscience Act 100 of 2003
- Mineral Technology Act 30 of 1989

The DME has also established nine regional offices in each of the nine provinces, and is subdivided into the following divisions:

- Mining and Minerals: Mineral Policy and Promotion
- Mining and Minerals: Mineral Regulation
- Mining: Mine Health and Safety
- Energy: Hydrocarbons Division
- Electricity: Hydrocarbons Division
- Administration and Support Services

The Mineral Policy and Promotion branch is involved in mineral promotion, regulation and the management of the mining industry, whilst the Regulation branch is responsible for administering exploration and mining rights as well as regulating the industry in terms of complying with the MPRDA (Republic of South Africa, 2002a). The Mine Health and Safety branch is a statutory inspectorate, established in terms of the Mines Health and Safety Act and is responsible for regulating and inspecting health and safety issues on the mines (Republic of South Africa, 1996). Whereas the Minister and the Director General

are responsible for the overall policy direction of the department, the development of strategies relating to downscaling in the mining industry is the responsibility of the Mineral Policy and Promotion branch. In 2005, the DME was restructured to establish specialised directorates (business units) that would address, amongst others, downscaling in the mining industry. In this regard the Social Plan and Beneficiation directorates were established. Nonetheless, despite the initial lack of institutional support for downscaling within the DME, the department did play an important role in the GCC which was established to address retrenchments in the gold mines.

The legislation of mining policies is performed by Parliament which receives its recommendations from the Minerals and Energy Parliamentary Portfolio Committee (MEPPC). During the development of the MPRDA issues around downscaling were discussed extensively by the MEPPC. Strong presentations were made by unions and other interested parties to the committee.

3.2.2 Mining related government agencies

As part of promoting and facilitating the exploitation of minerals, government created the following mining related government agencies:

- CGS;
- Council for Mineral Technology (Mintek);
- Council for Scientific and Industrial Research (CSIR) – Miningtek;
- Mining Qualification Authority (MQA);
- Mine Health and Safety Council; and
- South African Diamond Board – recently changed to South African Diamond and Precious Metals Regulator.

Due to the ease of availability of data the CGS and Mintek are discussed in more detail.

The CGS

Overview: The CGS is the former Geological Survey of South Africa. It is the official custodian of South Africa's geoscientific information and carries out, amongst others, geological, geochemical and geophysical studies in order to develop a geoscientific knowledge infrastructure for the country. The CGS was established by the Act of parliament (Republic of South Africa, 1993). In terms of the Act the CGS is mandated to, amongst others:

- Undertake geoscientific research;
- Compile and develop a comprehensive geoscience knowledge;
- Serve as a national custodian of geoscientific information relating to the earth, marine environment and geomagnetic space;
- Study mineral resources; and
- Study the use of the surface of the land and, from a geoscientific viewpoint, advise government institutions and the general public on the judicious and safe use of mineral resources.

In 2005, the CGS employed a total of 310 employees, a drop of 35 percent from a high of 417 in 1999 (Figure 3.1). Figure 3.1 shows that the organization was also affected by the nationwide downscaling in the mining sector – employment dropped by 28 per cent between 1993 and 2002. Whilst one of the key mandates of the CGS is to undertake geoscientific research, the organisation hardly played any role in the management of downscaling in the mining industry. In fact, until recently, there was very little geoscientific research done that was related to downscaling in the mining industry. However, in the last two years, the organization has been involved in polluted mine water research programs, which entail, investigating treatment options for polluted mine water and identifying possible mine water decanting spots.

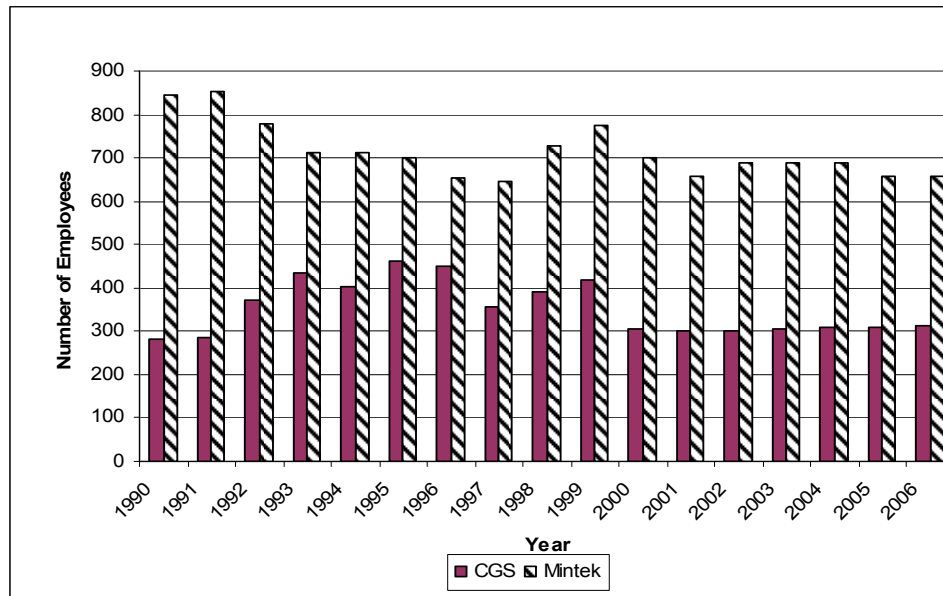


Figure: 3.1 Number of employees at CGS and Mintek: 1990-2006
(Data Source: CGS; Mintek).

Future Strategic Direction: A recently developed strategy of the CGS identified the following key strategic areas for the organization:

- **Fostering good science and technology:** The organisation recognizes that its future depends largely on fostering good science and technology and has therefore embarked on increasing the number of its research projects.
- **Market penetration:** CGS funding from government has been declining over the past few years, hence, as part of the new strategy, the organization intends to grow its commercial income.
- **Skills development and transformation:** The organization intends to broaden its skills base by accelerating the training of previously disadvantaged staff.
- **Development of skills in environmental management:** The organization realizes that environmental degradation resulting from nigh 100 years of mining has to be addressed.

In pursuance of the above objectives, the organisation was restructured to refocus on the following six scientific thrusts:

- Geoscience research and mapping;
- Geoscience applicable to the engineering and construction industries and mitigation of geoscience related hazards;
- Geoscience applicable to water;
- Geoscience education and information management; and
- Geoscience research applicable to environment waste and management and geochemical hazards.

What is important with the new strategy of the CGS is that the organisation has, for the first time in its history, identified environmental geosciences as a critical component of its research programs. The integration of the environmental issues into the organisation's strategy will allow it to actively participate in mine environmental issues and downscaling activities.

Mintek

Overview: Mintek is a mineral processing research institution established by an act of parliament in 1981 and its continued existence was promulgated in 1989 (Republic of South Africa, 1989). Its key mandate is to develop and commercialise mineral processing technology by manufacturing end products and undertaking feasibility and economic studies (Republic of South Africa, 1989). Its predecessor is the former Mineral Research Laboratory formed in 1934 with the objective of undertaking mineral processing on phosphate, vanadium, chromium and refractory gold ores. In 2005 the organisation employed some 690 people, a 19 per cent drop from a high of 852 employees in 1991 (Figure 3.1). Figure 3.1 shows that the nationwide downscaling that engulfed the mining industry from the late 1980's also affected Mintek, albeit marginally. This is not surprising, as most of Mintek's projects rely on the mining industry.

An analysis of Mintek's activities during the downscaling period (since 1987) shows that the organisation introduced a few projects aimed at addressing

problems associated with downscaling in the mining industry. According to Mintek's 1995 annual report, the organisation was involved in the following downscaling related projects:

- Research into the purification of polluted underground water;
- Research into the fabrication of gold to produce jewellery;
- Research into other uses of gold;
- Joint venture project between Harmony and Mintek on gold refining technology and value addition; and
- Mining and sustainable development - a recent project that aims at managing downscaling in the mining industry.

Future Strategic Direction

Following several interactions with Mintek's executives it is apparent that the future strategy of the organisation will be focused on the following:

- Commercialisation of new products and processes: the organisation key strategy is to enter into partnerships with private companies whereby it retains equity in the commercialised technology;
- Focusing on grey sky research and moving away from blue sky research: the organisation sees itself focusing on short term research projects that can be commercialised in 3 – 5 years;
- Biotechnology strategy: whilst Mintek has been one of the pioneers of biotechnology in South Africa, the organisation would like to increase its expertise in the biotechnology field;
- Advanced manufacturing: the organisation plans to focus on mineral processing and beneficiation of metals such as Ta, Ti and Al;
- Integrated Rural Development: as part of its contribution, the organisation is involved in small scale mining and mineral beneficiation projects to address rural development and poverty alleviation; and

- Addressing environmental issues relating to slime dams in the Ekurhuleni Metropolitan (East Rand).

Mining Qualification Authority (MQA)

The MQA is a sector education and training agency established in terms of the Mine Health and Safety Act to provide education and training standards or qualifications to employees in the mining sector (Republic of South Africa, 1996). Its focus is primarily on providing functional training, specifically in respect of artisans. However, it has played a critical role in providing portable skills to retrenched gold miners as well as to small-scale miners. It also created a partnership with the University of the Witwatersrand, University of Johannesburg and University of South Africa with regard to the provision of training for aspirant mining entrepreneurs.

Mine Health and Safety Council (MHSC)

The MHSC was also established in terms of the Mine Health and Safety Act to promote research in the mining industry as well as to provide advice to the Minister of Minerals and Energy on health and safety issues (Republic of South Africa, 1996). According to the MHSC website, the organisation sponsors a wide variety of research programs in, amongst others, the following areas:

- Behavioural safety;
- Rock falls;
- Explosions and fines;
- Airborne pollutants;
- Occupational diseases; and
- Physical hazards

South African Diamond Board

The Diamond Board was established to regulate the trade in rough diamonds in South Africa. The organisation charges levies for diamonds that are exported. The levies are in turn used to fund its activities. Surprisingly, the organisation never focused on developing initiatives that could assist the declining diamond mining

industry. It is thus not surprising that the government has decided to abolish the organisation and establish two separate organisations – one will be the State diamond trader, which will deal with the trade and promotion of beneficiation of diamonds, whilst the second organisation will focus on regulating the industry. In this regard the 1986 Diamond Act was amended to enable for the establishment of the South African Diamond and Precious Metals Regulator (replacing the Diamond Board) and the State Diamond Trader (Republic of South Africa, 2006a; Republic of South Africa 2006b). The two organisations were launched on 29 February 2008.

3.2.3 Unions in the mining industry

Most employees in South Africa's mining industry are represented by one of at least five labour unions. However, the NUM is by far the dominant player. The other two relatively large mining unions are the United Association of South Africa (UASA) and Solidarity.

The National Union of Mineworkers (NUM)

NUM was formed on 5 December 1982 at its launch in Klerksdorp (NUM, 2005). At that time its membership stood at 14 000 (NUM, 2005) and is now estimated at 211 000 (Virtual Metals Research and Consulting Limited, 2006). Its head office is in Johannesburg; however, local branches have been established in all nine provinces of South Africa. Whilst the head office plays a major role in retrenchment and downscaling matters, the leadership of local branches is also intimately involved in negotiations relating to retrenchments.

The NUM is one institution which has been advocating for a national strategy to be put in place to address the looming downscaling in the mining industry. It is against this background that in 1999, it called for the establishment of the GCC to address the issue of retrenchments in the mines. The organisation not only played a major role in the establishment of the GCC but also contributed immensely in the creation of a number of national initiatives that aimed at addressing downscaling on the mines. Its historic political links with the African National

Congress (ANC) has enabled the organisation to effectively lobby for the legislation of some of its proposals on downscaling, especially those relating to labour and retrenchments.

NUM Services and key activities

The primary services that the NUM provides to its members can be grouped into the following categories:

- Legal Services;
- Health and Safety;
- Collective Bargaining;
- Job Grading;
- Education and Training;
- Social Security;
- Housing.

Mineworkers Development Agency (MDA)

In addition to the above services, the NUM has established a development and job creation agency the MDA. According to Barton (1998), the MDA which was established in 1987 focuses on creating jobs and business opportunity in rural labour sending areas. Its projects involve the following:

- Social Plan and project management;
- Training and counseling;
- Institutional support;
- Business supply stores; and
- Marketing and product development.

United Association of South Africa (UASA)

Another union, though not dominant, is the UASA. It was formed in 1998 following the merger between three prominent mining unions historically known as the South African Technical Officials Association (SATO), the Underground Officials Association (UOA) and the Mine Surface Officials Association (MSOA) (UASA, 2005). When it was formed in 1998, UASA represented 39 000 members

and by 2001 it had grown its membership to almost 50 000 members. The organization has not openly stated its political inclination, however, its members are mostly white mine employees occupying skilled to semi-skilled positions on the mines.

Unlike the NUM, UASA played an insignificant role in addressing strategies that are needed to address downscaling and retrenchments in the mining industry - perhaps because they were never invited to participate in the many tripartite forums which were involved in downscaling issues.

Solidarity Union

Solidarity was established in 2001, with the incorporation of the South African Workers Union (SAWU), Denel Union, Transporters' Union and Forestry and Plant management Union with the Mine Workers' Union (Solidarity, 2005). The union currently has some 128 000 members, which it recruits from several sectors, such as the mining, steel, engineering, telecommunications, electrical, motor, rubber and armaments industries. The activities of the union can be subdivided into three tiers:

- Traditional trade union activities;
- Service delivery activities; and
- Development and job creation activities.

The first activity tier, that is, the traditional trade union activities, focuses on collective bargaining activities and affords members legal representations (Solidarity, 2005). The service and delivery tier provides services through the union's financial and benefits company. In this regard the organisation facilitates the provision of short term insurance and investment services to its members. The development and job creation tier is the labour brokerage and personnel agency, which assists members who have lost their employment to re-enter the job market through training and retraining.

Like UASA solidarity has not openly stated its political ideologies. However, most of its members are semi-skilled and skilled white mineworkers. It has mobilised its members around the threat posed by government affirmative action policies on white jobs. The union is relatively new and was therefore not yet established during the pinnacle of the gold crisis in the late 1990s. However, the organisation is now playing an active role in addressing downscaling issues. It has in recent years collaborated with the NUM in opposing retrenchments and downscaling at some of the gold mines.

3.2.4 Business

Overview

The business sector in the South African mining industry can be subdivided into:

- small-scale miners;
- junior (medium) miners;
- large-scale operators;
- Black Economic Empowerment (BEE) enterprises; and
- majors (large operators).

Small-scale miners

A multiplicity of definitions of small-scale mining exists and there is therefore no globally accepted definition. In South Africa, the 1997 Green Paper on Minerals and Policy, as well as the 1998 White Paper on Minerals and Energy Policy describe small-scale activities as ranging from small mining operations that provide subsistence living (artisanal mining) to “junior” companies for which revenue is such that subsistence living is not the prime motivator. The exact number of miners in this sector is difficult to determine as most operators operate in an intermittent fashion. However, the DME estimates about 3 000 small-scale miners in South Africa. This is a relatively small number compared to other southern African countries such as Zimbabwe, Zambia and Tanzania, which have hundreds of thousands of small-scale miners. The South African small-scale mining sector is extremely complex - operations comprise artisanal miners, commercial operators, illegal operators and legal operators. Although the majority

of small-scale mining operations are in the diamond fields of Kimberley and the Lichtenburg area (in the Northern Cape and North West provinces respectively) small-scale operations are found throughout the country.

Downscaling in South Africa's mines (both diamond and gold mines) and closure of some operations has caused an increase in small-scale operations, some of which are illegal. The most important commodities mined by these operators are diamonds, sand, aggregate, clay, gold and salt. Although there are no legal small-scale gold mining operations in South Africa, many abandoned gold mines in the Barberton area are currently being mined by illegal miners, most of whom are former mine employees retrenched from the mines due to downscaling. However, the sad part of the situation is criminal elements have infiltrated the small-scale miners and are illegally dealing in gold.

In a bid to address problems associated with small-scale mining the DME put in place two successive national initiatives. The first known as the National Small-Scale Mining Development Framework (NSMDF), was established in 1999. Its objective was to provide technical and financial assistance to small-scale miners. It was established to address the proliferation of artisanal small-scale miners, who were virtually non-existent during the Nationalist government period. The DME was also concerned that, with increasing downscaling in the mining industry, more and more unemployed people would resort to illegal artisanal mining. The strategy of the DME was to legalise illegal operations through the provision of technical and financial support.

The NSMDF had two vital components:

- Regional Regulatory Committees (RRCs), and
- The National Steering Committee of Service Providers to the Small-Scale Mining Sector (NSC).

The RRCs were managed from the DME regional offices located in the nine provinces. It comprised regulatory authorities which had to approve of and monitor a mining operation in its various aspects, such as environmental control,

health and safety precautions, land use, etc. DME regional directors chaired these committees.

The NSC was the second component of the NSMDF. The NSC consolidated institutional support necessary for the feasibility and planning stage of small-scale mining projects. It comprised nine technical and financial service providers; namely, the DME, the CGS, Mintek, CSIR-Miningtek, Industrial Development Corporation (IDC), Khula Enterprises, Ntsika, the South African Diamond Board, and the Minerals and Energy Policy Centre (MEPC). The NSC provided technical services in respect of geological, metallurgical, mining, business and management skills. The South African Diamond Board and the MEPC no longer exist.

Unfortunately the NSMDF could not successfully achieve its objectives due to a number of problems; for example, lack of suitable ore bodies (not enough reserves) and appropriate expertise to execute the projects. However, the NSMDF created an opportunity for government and other stakeholders to understand and identify the needs of small-scale miners. The experience led to the enhancement of the support mechanism for small-scale miners through the establishment of a new support system in 2005.

The new system, launched in May 2005 is known as the Small-Scale Mining Board. The Board, which is chaired by the DME works in partnership with the CGS and IDC. The CGS provides technical expertise whilst the IDC provides financial expertise. Whilst it is still too early to determine the success of the new initiatives, it is already apparent that with increased downscaling there would be an increase in the number of illegal small-scale miners who will need support from government.

Junior Mining Companies

International junior mining companies employ small numbers of staff and are mainly active in exploration phases and principally involved in high risk and high

reward projects. Most of these companies have their head offices in Canada and Australia. In South Africa, there are very few companies that could be classified as juniors and the sector is not well developed. Nonetheless there are a number of Canadian and Australian companies operating in the country. Some of these companies such as Rand Quest Resources (an Australian company exploring for gold) are directly benefiting from downscaling in South Africa's gold mining industry. The company is in the process of opening some of the Witwatersrand gold mines, which closed down as a result of downscaling.

Black Economic Empowerment (BEE)

BEE companies are for the most part represented by the newly formed South African Mining Development Association (SAMDA), which played a crucial role in providing support to the government on the Mineral and Petroleum Resources Development Bill. The formation of the organisation is interpreted by many as a strategy by BEE companies to ensure a strong voice ahead of the expected restructuring of the industry. The organisation is poised to play a crucial role in positioning BEE companies for imminent business opportunities. Some business opportunities for BEE companies are already emerging from the downscaling processes in the gold mining industry. For example African Rainbow Mining, a BEE company, was born out of the disposal of AngloGold's marginal mines.

Majors (Large Operators)

Large-scale operators are mainly represented by the Chamber of Mines, which was formed on 5 October 1889 (Lang, 1986). The organisation provides advisory services in respect of, amongst others, environmental issues, labour relations, and minerals and mining policies, and facilitates interaction amongst employers. According to information on the Chamber of Mines' website, its membership in 2006 was as follows: 9 gold mining companies, 9 coal mining companies, 4 diamond mining companies, 4 platinum-group metals companies and 2 associations representing quarries and clay operators. In addition there are a number of independent small mines such as Vametco Mineral Corporation (Pty) Ltd. Most of the current members of the Chamber of Mines have changed their

corporate profiles in recent years. Corporate restructuring and unbundling has resulted in many individually listed mines being de-listed and merged into larger single-listed companies on local and foreign stock exchanges (Engelbrecht, 2000).

In response to the changing political and economic environment in South Africa, the Chamber of Mines underwent changes with regard to its membership, role, management and employees. One of its important transformation strategies involved expansion of the organisation in terms of recruiting black entrepreneurs and executives. This resulted in the membership of the organisation changing, as evidenced by the appointment in 1999 of Patrice Motsepe, the owner of African Rainbow Mining (ARM), as the Deputy President of the Chamber of Mines and Lazarus Zim as the first black President of the Chamber of Mines. The Chamber of Mines' activities focus on the following areas:

- Socio-economic programs;
- Minerals and mining economics studies; and
- Physical environmental programs.

Socio-economic programs involve participating, lobbying and advising government on issues affecting Chamber of Mines members. However, as an organisation representing employers, the Chamber of Mines is often faced with the situation where they have to defend the rationale behind the decisions by companies to retrench employees. Together with the DME and the NUM, the organisation played a major role in the creation of the GCC and its successors, that is, the Sector Partnership Committee (SPC) and Advisory Board. The Chamber of Mines is also actively involved in minerals and mining economic analyses, done to enable it to provide advice to its members.

With regard to downscaling and mine environmental degradation, the Chamber of Mines and the DME are currently exploring ways of developing partnerships to address environmental legacies. The biggest challenge will be obtaining funds to rehabilitate abandoned mine operations and structures, such as mine tailings.

3.2.5 Communities

Mining affects communities in many ways and in recent years these communities have come to be recognised as an integral part of any mining business. In South Africa, mining communities are either rural or urban. Rural communities include farmers, labour sending communities and communities in the vicinity of mines. Labour sending areas are often not located in the vicinity of the mines but in former apartheid homelands and neighbouring states, such as rural areas of the Eastern Cape, Lesotho, Mozambique and Botswana.

As mining is a cyclic business, mining companies often downscale their operations and retrench employees during hard times, with the employees either returning to their original homes or seeking shelter in surrounding mining communities. The surrounding communities usually comprise former mine employees who are often destitute. Surprisingly most retrenchees prefer to stay in the surrounding communities rather than return to their homes. In South Africa, downscaling in the gold mining industry has had a negative impact on many mining communities and towns. Typical examples of South African towns affected by downscaling are Carletonville, Welkom and Randfontein. Whilst communities living within the vicinity of mines are often given prominence when it comes to the impact of downscaling, labour sending areas are equally affected as these areas often lose out on the money that could have been injected into them by wages earned by migrant workers.

3.3. Status of South Africa's Mining Industry

3.3.1 South Africa's mineral resource base

South Africa's mineral resources and reserves have been documented in several publications. The most important being the DME's annual publication, (entitled South Africa's Mineral Industry) which derives most of its geological information from the United States Geological Survey (USGS) reports. Whilst the information is reasonably acceptable, it must be taken into consideration that quantification of mineral resources and reserves is a difficult process. Resources and reserves are dynamic and depend on many factors, such as price, improved technology, local

currency exchange rates, inflation, taxation, freight, power rates and government policies.

Table 3.1 shows that South Africa hosts the world's largest reserves in some of the most important and "strategic" minerals. The country is ranked first in terms of reserves and resources of alumino-silicate (37,4 per cent), chrome ore (72,4 per cent), gold (40,1 per cent), manganese (80,0 per cent), platinum-group metals (87,7 per cent) and vanadium (31,0 per cent).

3.3.2 South Africa's current mineral production and sales

The diverse mineral resources base of South Africa transformed the country into one of the top producers and suppliers of minerals in the world. The country's role in world mineral production is provided in Table 3.2, which shows that in 2006, South Africa was the world's largest producer of PGMs, vanadium, chrome ore, gold, manganese ore and vermiculite (Mwape et al, 2007; Maseko, 2007). Although the country ranks high in terms of production of very important minerals, its mineral industry is export oriented and has a relatively small domestic market. However, a number of minerals show significant local sales, for example alumino silicates, chrome, coal, copper, iron ore, manganese and titanium (Table 3.2). The relatively high local sales of these minerals suggest a considerable amount of beneficiation of South Africa's minerals does take place. Nevertheless, local sales of minerals such as gold and PGMs are notably low, with about 2 per cent of gold production and 13,4 per cent of PGMs being sold locally.

According to data presented by Mwape et al (2007), the value of primary mineral sales for 2006 was R195 454 million. Gold had the highest sales share, at 32,5 per cent of total primary mineral sales in 2006, whilst PGMs were the second highest earner at 31,8 per cent, followed by coal at 18,4 per cent. The data demonstrates a fairly good spread of sales revenue amongst the top three minerals; namely, PGMs coal and gold. The spread puts the country in a very good situation in respect of any future market failure relating to any one of the three minerals.

Table 3.1 South Africa's selected mineral reserve base relative to the World, 2004 (Data Source: Mwape et al, 2005, Mwape et al, 2007).

Commodity	Resource (mass)	% word share	South Africa's Ranking	1 st Ranked Country	2 nd Ranked Country	3 rd Ranked Country
*Alumino-silicates	*51mt	*37,4	1	South Africa	China	USA
Antimony	200kt	6,4	4	China	Russia	Bolivia
Chrome ore	5 500mt	72,4	1	South Africa	Zimbabwe	Kazakhstan
Coal	27 981mt	6,1	8	USA	India	China
Copper	13mt	1,4	14	Chile	USA	China
Diamonds	10mkt	Not available	5	Russia	Botswana	DR Congo
Fluorspar	80mt	16,7	2	China	South Africa	Mexico
Gold	36 000t	40,1	1	South Africa	Australia	China
Iron ore	1 500mt	0,9	9	Russia	Australia	China
Lead	3mt	2,0	7	China	Australia	USA
Manganese ore	4 000mt	80,0	1	South Africa	Russia	Gabon
Phosphate rock	2 500mt	5,0	4	Morocco	China	USA
Platinum group metals	70 000t	87,7	1	South Africa	Russia	USA
Titanium minerals	220mt	18,3	2	China	South Africa	India
Uranium	341mt	7,2	5	Australia	Kazakhstan	Canada
Vanadium	12 000mt	31,0	1	China	South Africa	Russia
Vermiculite	80mt	38,0	2	USA	South Africa	Not available, possibly Russia
Zinc	15mt	3,3	8	China	USA	Australia
Zirconium minerals	14mt	19,4	2	Australia	South Africa	Ukraine

Note: * denotes 2004 data.

3.3.3 Historic trends of South Africa's mineral sales

Figure 3.2 shows that primary mineral sales, though cyclical, have been declining steadily since 1980. A detailed analysis of the chart reveals that sales declined between 1980 and 1982, but rose sharply to reach a peak of R187 726 million in 1985. However, sales subsequently dropped between 1985 and 1992, which was a difficult period for South Africa in respect of political stability. However, it seems political settlement concluded prior to the first democratic elections resulted in a stable mineral sales period. In fact there was a steady increase in sales post 1992 period and a more significant change occurred post 1999 period – a situation that can be ascribed largely to the recent relatively strong commodity prices.

Figure 3.2 also shows that processed mineral sales in real terms have been on a steady upward trend. This is due to a combination of two factors; namely, recent high commodity prices and increased beneficiation of minerals in the country. The upward trend in processed mineral sales, although not yet sufficient, bodes well for the future of South Africa's mineral industry.

3.3.4 Mining's role in the national economy

Contribution of mining to Gross Domestic Product (GDP) and Gross Domestic Fixed Investment (GDFI) (Figures 3.3 and 3.4)

The role of mining in the economy of South Africa is revealed in Figure 3.3, which shows that the contribution of mining to GDP has, in recent years, been declining from a record high of 21,5 per cent in 1980 to a low of 7,9 per cent in both 2006. The decline of mining's contribution to GDP can be attributed to the dominant role that other economic sectors, such as manufacturing, financial services, real estate and business services have begun to play in the South African economy. As other sectors of the economy assumed a progressively greater importance (eg financials), mining contribution progressively assumed a downward trend. However, of concern for the broader South African economy is the downward trend in both the agricultural and manufacturing sectors –

suggesting that South Africa is declining in respect of producing goods critical for the economic development of the country. The situation is of concern as it points out that the country has been struggling to develop secondary industries, critical for the economic development of a developing country like South Africa.

Table 3.2 South Africa's production of important minerals, 2006 (Data Source: Mwape et al, 2007; Maseko, 2007).

Commodity	Production Mass	% World Share of Production	% Local Sales	South Africa's Ranking	1 st Ranked Country	2 nd Ranked Country	3 rd Ranked Country
Aluminium	890kt	2,7	24,6	9	China	Russia	Canada
Alumino-silicates	228kt	36,4	41,2	1	South Africa	China	USA
Antimony	4 362t	3,2	2,1	7	China	Russia	Bolivia
Chrome ore	7 418kt	38,7	90,1	1	South Africa	Kazakhstan	India
Coal	244,8mt	4,5	72,0	5	China	USA	India
Copper	110kt	0,7	78,9	16	Chile	USA	Peru
Diamonds	15 152 kcar	9,3	Not available	5	Russia	Botswana	Australia
Gold	272,1t	11,1	2,1	1	South Africa	USA	China
Iron ore	41,3mt	2,8	34	7	Brazil	China	Australia
Manganese ore	5 213kt	13,3	45,4	2	China	South Africa	Australia
Platinum – group metals	307t	59,3	13,4	1	South Africa	Russia	Canada
Titanium minerals	950kt	19,8	97,1	2	Australia	South Africa	Canada
Vanadium	23kt	48,0	32,3	1	South Africa	Russia	China
Vermiculite	198kt	38,1	3,8	1	South Africa	USA	China

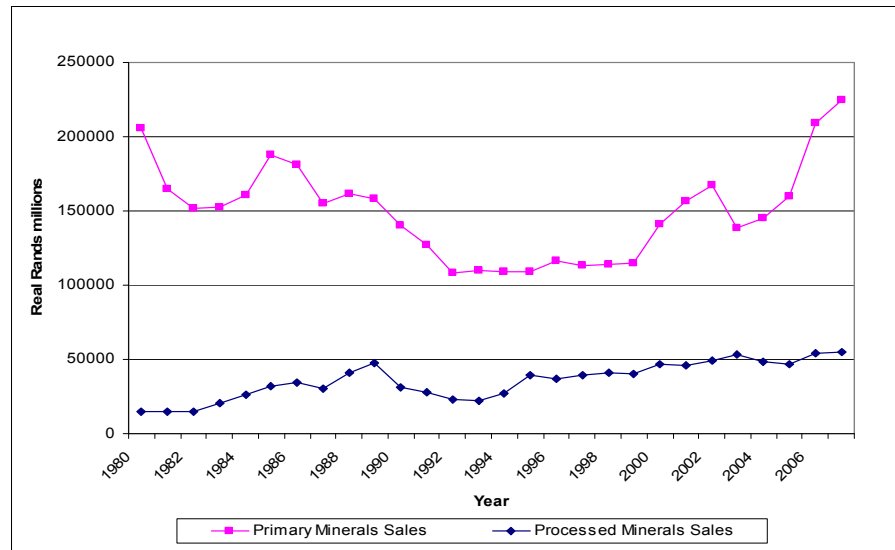


Figure 3.2 South Africa's mineral sales: 1980-2007, 100=2007
(2007 estimated; Data Source: DME).

The political uncertainty that prevailed during the late 1980s and early 1990s resulted in mining's contribution to GDFI declining from 14,8 per cent in 1987 to a low of 8,3 per cent in 1993 (Figure 3.4). Following the first democratic elections in 1994, mining's contribution to GDFI increased to 10,7 per cent. However, in recent years the GDFI has taken a plunge, dropping to a low of 6,1 per cent in 2005. Lazarus Zim, the 2006 President of the Chamber of Mines attributes the decline to concerns raised by the Chamber of Mines members about regulatory constraints and long periods for processing of applications. However, it is the author's view that the matter is not as simple as presented by the Chamber of Mines. There are multiplicities of factors that have resulted in decline in GDFI, including:

- A declining and mature gold mining industry – the industry has traditionally absorbed most of the fixed direct investment in mining;
- Declining gold reserves;
- Declining gold grades;

- Competition from other countries with shallow ore bodies; and
- The decline is relative to other sectors, which have been increasing in recent years.

Nonetheless this does not suggest that regulatory processes should not be improved to ensure the country is always competitive in terms of attracting mining investment. Failure by the country to attract investment can only perpetuate downscaling in the mining industry.

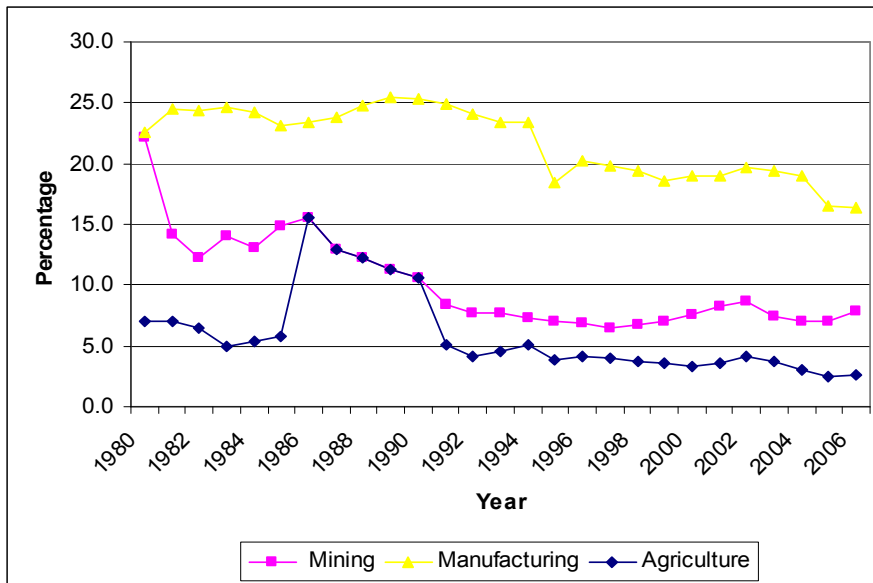


Figure 3.3 South Africa's selected distribution of Gross Domestic Product: 1980-2006 (Data Source: DME; Statistics South Africa, 2005; Statistics South Africa, 2006).

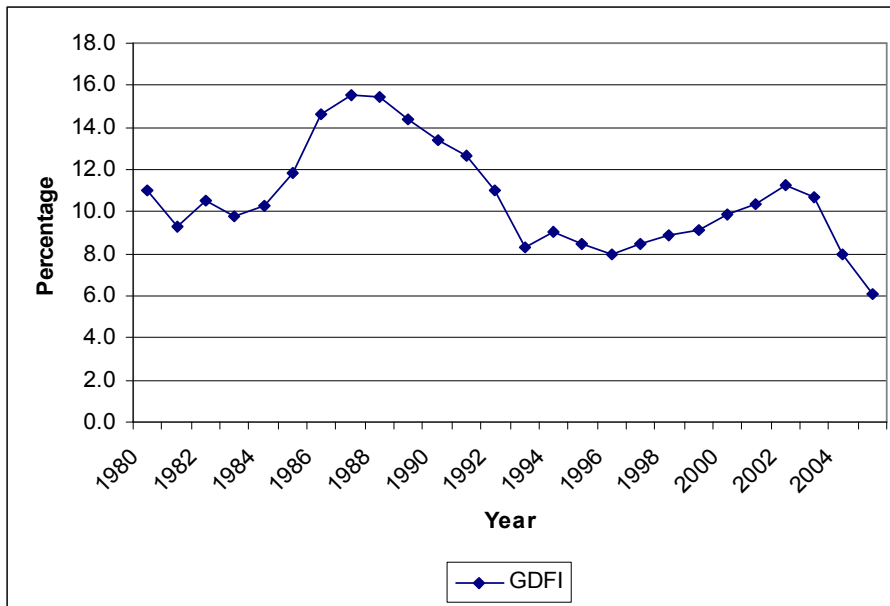


Figure 3.4 South Africa's mining contribution to Gross Domestic Fixed Investment: 1980-2006 (Data Source: DME).

Contribution of minerals to exports

Of concern is that the percentage mineral exports to total exports have been declining at a considerable rate since 1980 (Figure 3.5). Once more, this affirms that the relative importance of mining in South Africa is gradually declining. The scenario of a decline in the mining, agricultural and manufacturing sectors does not bode well for the country – it will have a devastating impact on the country especially in respect of employment creation as the country lacks sufficient skills to depend on the tertiary sector for economic development.

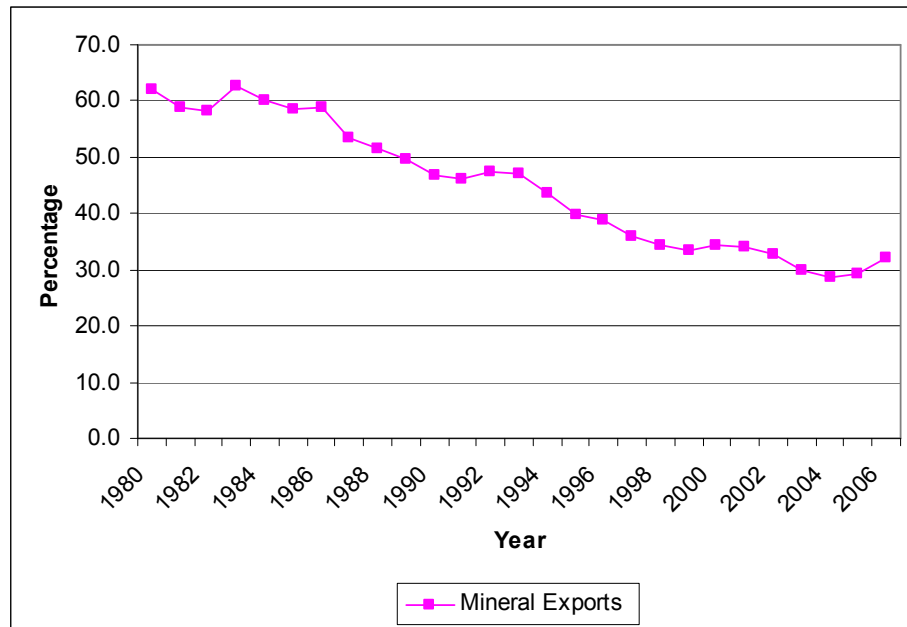


Figure 3.5 *South Africa's mineral exports to total exports: 1980-2006 (Data Source: DME).*

3.3.5 Mining's role in the provinces

Most mining activities in South Africa are concentrated within the northern part of the country. It is for this reason that the most important mining provinces are Gauteng, North West, Mpumalanga, Limpopo, the Free State and the Northern Cape (Figures 3.6). In 2006, the highest mineral sales contribution came from the North West province, which accounted for 27,8 per cent of all mineral sales. This was followed by Mpumalanga at 21,2 per cent, Limpopo (20,0 per cent), Gauteng (11,5 per cent) and the Northern Cape (9,1 per cent) (Figure 3.6).

Gauteng and the Free State are heavily dependent on gold mining as a major contributor to their economies; the North West province largely depends on PGMs and gold, whilst Mpumalanga hosts the largest coal resources in the country. The economies of the provinces of North-West, Northern Cape, Limpopo, Free State and Mpumalanga are mainly dependent on the contribution of their respective mining industries, whilst the Gauteng economy is supported by manufacturing and service industries in addition to mining. Unfortunately, whilst

mining contributed immensely to the economic development of most mining provinces, recent downscaling in the mining industry has negatively impacted on these provinces.

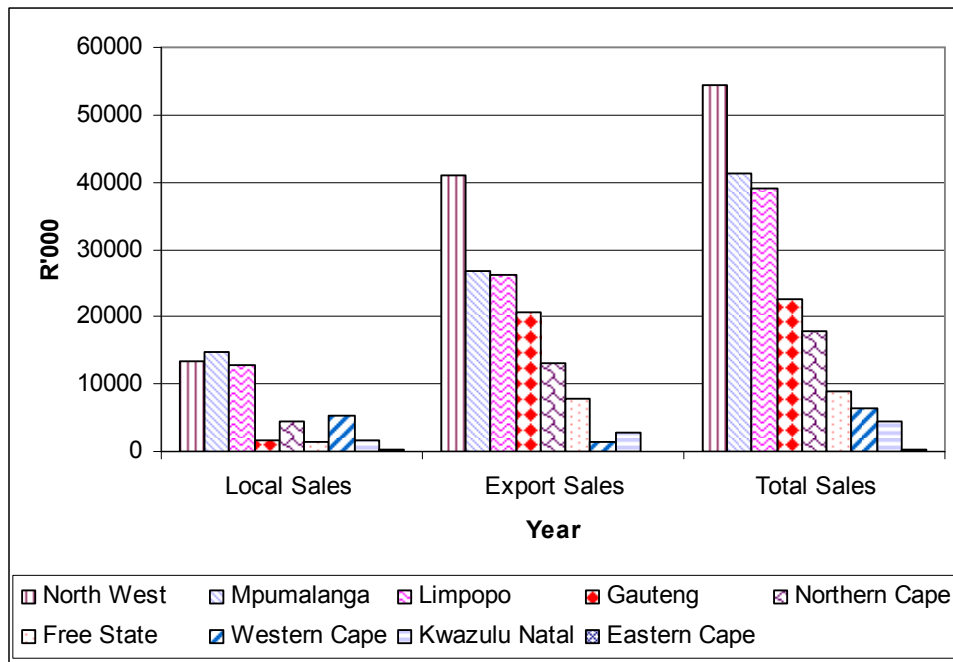


Figure 3.6 South Africa's mineral sales by province for 2006 (Data Source: Mwape et al, 2007).

3.3.6 Employment in the mining industry

The importance of mining to the South African economy can also be demonstrated by employment in the sector. During 2006 the industry employed 458 600 people, representing 2,7 per cent of the economically active population (Mwape et al, 2007). A large proportion of employees in the South African mining industry are employed in the PGMs and gold mining sectors, which, in 2006 employed 36,7 per cent and 34,9 per cent of employees in the industry respectively (Figure 3.7). The coal-mining sector, which over the past two decades has been experiencing mechanisation and shedding of jobs, is the third largest employer and employed 12,6 per cent of employees in the mining sector in 2006. The diamond mining industry, the fourth

largest employer, employed 4,4 percent, whilst the remaining sectors employed 11,4 percent.

Although the mining industry still employs a significant number of workers, there has been a substantial decline in the number of people employed in the industry. Figure 3.8 shows that total employment in the mining industry dropped by 43,11 per cent from 792 716 in 1980 to 458 600 in 2006. According to data from the DME, in 1980, the industry employed 9,40 per cent of economically active people, whilst in 2006 the industry employed only 2,7 per cent. It is important to note that the decline in employment not only occurred in the mining industry, but also in the manufacturing industry (Figure 3.8), with employment in the manufacturing industry dropping from 16,85 per cent of economically active people in 1980 to 8 per cent in 2006 – a worrying issue indeed.

A comparison of the four largest mining sectors in terms of employment shows that the gold mining industry is responsible for the loss of most jobs and downscaling in the industry (Table 3.3). The gold mining industry lost some 316 414 jobs between 1980 and 2006, whilst the coal mining industry lost some 59 707 jobs. Recent investments in the PGMs industry has resulted in a significant increase in employment - between 1980 and 2006 some 91 075 jobs were created in the industry.

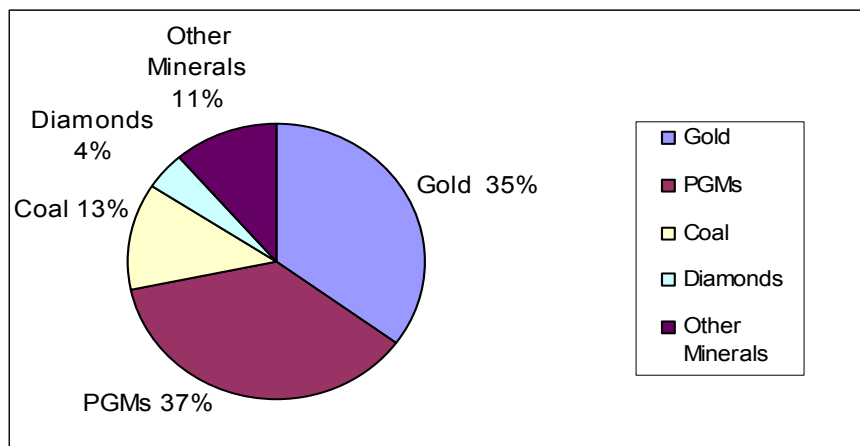


Figure 3.7 South Africa's mining industry: Employment by Sector for 2006
(Data Source: Mwape et al, 2007).

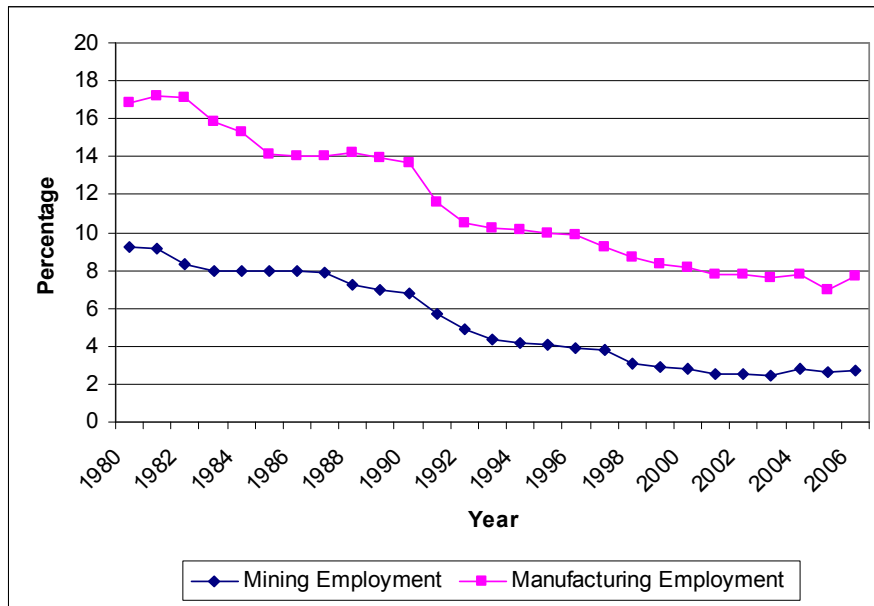


Figure 3.8 South Africa's employment in mining and manufacturing sectors as percentage of economically active population: 1980-2006 (Data Source: DME; Statistics South Africa, 2007).

South Africa's mining industry employment by province

Table 3.4 shows that most mine workers are employed in the North West, Gauteng, Free State, Mpumalanga and Limpopo provinces. According to Mwape et al (2007), in 2006 mines in these provinces employed 91,4 per cent of South Africa's mine workers, who earned 90,0 per cent of the total remuneration in the mining industry. The North West province had the largest number of mine employees, mainly employed in PGMs mines in the Rustenburg area but also in the Witwatersrand gold mines in Carletonville and Klerksdorp areas. In 2006, mines in the North West province employed some 157 565 people – representing 34,4 per cent of employment in South Africa's mines. Gauteng province, the second largest employer, employed 78 086 workers, comprising 17,0 per cent of employees in the mining sector.

A comparison of 1980 and 2006 labour figures show that only Limpopo and the Western Cape provinces showed an increase in the number of employees on the

mines (Table 3.4). The number of mine employees in these provinces increased by 58,50 per cent and 85,78 per cent respectively. The increase in employment in Limpopo can be attributed to new mining developments taking place in the northern and eastern limbs of the Bushveld Complex. With regard to the Western Cape, the increase is related to higher demand for construction materials, which have resulted in new quarries being opened (Jerry Mdaweni, Director at DME, personal communication). Kwazulu-Natal experienced closure of a number of mines, and was the hardest hit province in terms of percentage decline in employment on the mines. The number of mineworkers in Kwazulu-Natal dropped from 33 490 in 1980 to 9 198 in 2006. Unfortunately, closure of a number of coal mines resulted in some of the retrenched employees becoming involved in illegal small-scale mining operations, creating enormous problems for the DME in respect of managing illegal operations. The decline in employment in the Free State province is a consequence of massive downscaling in the gold mines of Welkom.

Table 3.3 Employment in the top four South Africa's mining sectors (Data Source: DME).

Mining Sector	1980	2004	2006	Loss/Gain (1980-2004)	Loss/Gain (1980-2006)
Gold	476 398	179 964	159 984	-296 434	-316 414
Coal	117 491	50 327	57 784	-67 164	-59 707
Diamond	23 372	21 186	20 115	-2 186	-3 257
PGMs	77 404	155 030	168 479	+77 626	+91 075

Table 3.4 Mining industry employees by province: Percentage employment change (Data Source: DME).

Province	Mine Employees 1980	Mine Employees 2004	Mine Employees 2006	Jobs lost/gained for 2004 & 2006 (2006 in brackets)	% Change in Employment for 2004 & 2006 (2006 in brackets)
Limpopo	39 966	61 014	63 347	21 048 (23 381)	+52,66 (58,50)
Gauteng	202 088	92 951	78 086	-109 137 (-124 002)	-54,00 (-61,36)
North-West	189 180	148 260	157 565	-40 920 (-31 615)	-21,63 (-16,71)
Northern Cape	45 565	26 434	26 380	-19 131 (-19 185)	-41,99 (-42,10)
Eastern Cape	1 301	1 234	964	-67 (337)	-5,15 (-25,90)
Western Cape	1 822	3 164	3 385	1 342 (1 563)	+73,66 (85,78)
Mpumalanga	116 102	57 236	73 608	58 866 (42 494)	-50,70 (-36,60)
Kwazulu-Natal	33 490	7 692	73 608	25 798 (24 292)	-77,03 (-72,54)
Free State	163 202	53 013	9 198	110 189 (116 594)	-67,52 (-71,44)

Labour sending areas

Employment data in respect of labour sending areas within South Africa and neighbouring countries, such as Mozambique, Botswana and Lesotho, is represented in Figures 3.9 and 3.10 and Table 3.5. With regard to South Africa, the Eastern Cape has traditionally been the biggest supplier of labour to the mines (Figure 3.9). Consequently, the negative impact of downscaling affected the Eastern Cape most in terms of employees who lost their jobs.

Whilst Table 3.5 and Figure 3.10 demonstrate that the majority of mineworkers have always been recruited from South Africa, the proportion of South African

recruits has dropped considerably since its peak in 1986. In 1986 recruits from South Africa were at an all time high of 288 772, with Lesotho being the second largest supplier of workers, providing 89 067 employees to the mines. In terms of job losses, South Africa suffered most – a total of 196 119 South Africans lost their jobs on South Africa's mines between 1980 and 2000; a 68 per cent drop from the 1986 figure. During the same period, Lesotho citizens on the mines declined by 34 760, representing a 39 per cent drop.

Whilst South African and Lesotho employees were considerably reduced on the mines, the number of Mozambican employees, who constituted the third largest number of employees actually increased during the 1986 - 2000 period. The reason for this increase is that employers often regarded Mozambican employees as more reliable workers who would be less likely to be involved in industrial unrest. As a result, Mozambican recruits increased from 44 225 in 1986 to 48 441 in 2000. Malawi was also hit hard in terms of job losses on the mines – the number of employees dropped by 99,9 per cent between 1986 and 2000. The decline in the number of Malawian mineworkers was caused by the request from the Chamber of Mines that all Malawian mineworkers be tested for HIV/AIDS before leaving Malawi for employment on the mines (Chirwa, 1998). According to Chirwa (1998), this request to test Malawian mineworkers for HIV/AIDS was a smokescreen to allow mines to retrench employees as the industry was going through difficult times. Chirwa (1998) furthermore states that the government of Malawi refused to test its people for HIV/AIDS and as a result 13 000 Malawian mineworkers were repatriated between 1988 and 1992.

**Table 3.5 South Africa's mines: Employment by country of origin
(Source: TEBA).**

Year	Lesotho	Botswana	Swaziland	Malawi	Zimbabwe	Mozambique	Namibia	South Africa
1980	24624	5838	2567	2095	2	12947	96	56486
1981	28132	5991	3101	4759	0	17987	249	73260
1982	28488	8013	3756	2051	1	14823	338	87206
1983	59191	16295	11421	12532	0	34958	303	222793
1984	72420	18430	11728	15876	4	40438	4	270608
1985	80888	18985	12412	17088	0	51879	1	285784
1986	89067	18641	14787	19068	2	44225	3	288772
1987	97976	17227	16626	17979	2	39973	2	273022
1988	95792	16925	16817	3459	2	35139	1	259037
1989	100440	16258	16892	14	1	46090	1	258645
1990	97834	14485	16290	13	3	44543	1	235163
1991	96717	11968	16921	10	4	48765	0	205450
1992	92722	11976	15770	11	1	50628	1	186614
1993	87651	11794	15402	10	3	47747	0	174420
1994	88035	10887	14732	9	2	52081	0	170806
1995	47917	4518	8454	25	1	46928	0	91419
1996	82564	9598	14088	16	2	59867	0	143969
1997	75677	8591	12088	26	2	57144	0	121156
1998	59759	7274	9646	22	1	53599	0	100841
1999	49142	5421	6501	18	3	46229	0	90605
2000	54307	5425	8274	15	2	48441	0	92653

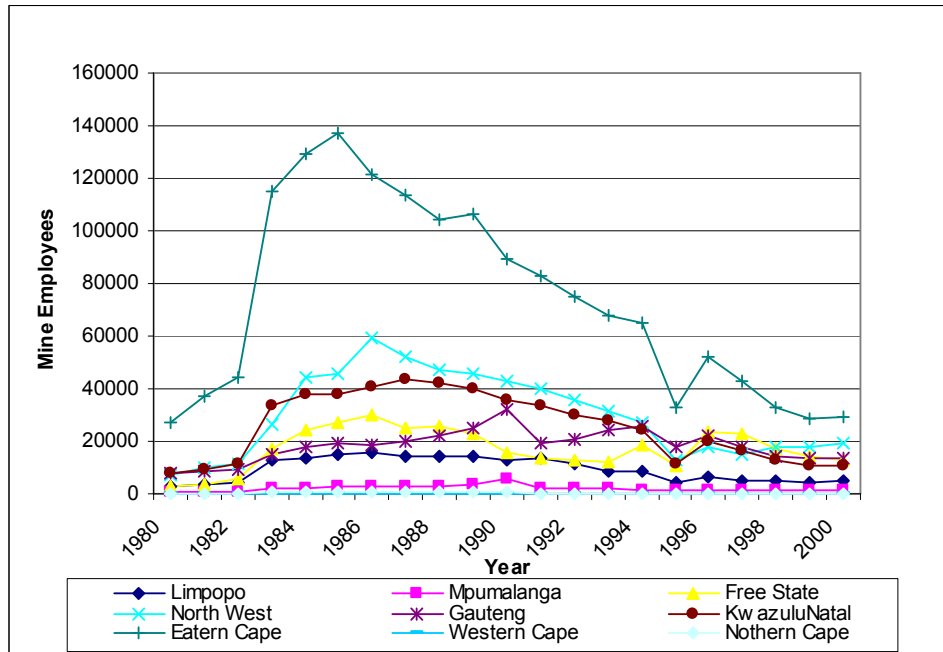


Figure 3.9 Origin of South Africa's mine employees in terms of provinces: 1980-2000 (Data Source: TEBA).

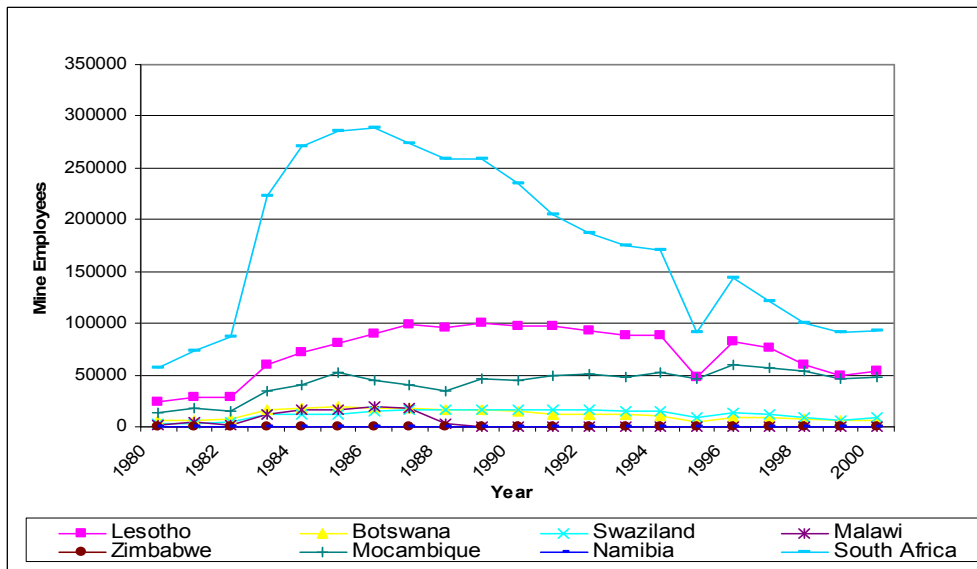


Figure 3.10 Origin of South Africa's mine employees in terms of countries: 1980-2000 (Data Source: TEBA).

Wages of Mine Employees and State Revenue

Total real annual average wages in South Africa's mines remained more or less stable throughout the 1986-2004 period. However, the reduction of number of employees and unionisation of workers during the 1980s provided workers with strong bargaining power to the extent that wages per employee rose by over 100 per cent between 1986 and 2004 (Figure 3.11). It is also significant to note that wages as a percentage of total mining revenue remained fairly constant during the 1986-2004 period – suggesting that a reduction in the number of employees did not necessarily reduce labour costs for the mines.

The mining industry's contribution to total government revenue has dropped considerably over the last two decades - from 12,5 per cent in 1986 to the current 1 per cent in 2004. Malherbe (2000) attributes the decline to the sliding scale of gold mine taxation. He further argues that during the 1990s the effective tax rate of both diamond and gold mines fell as profits fell.

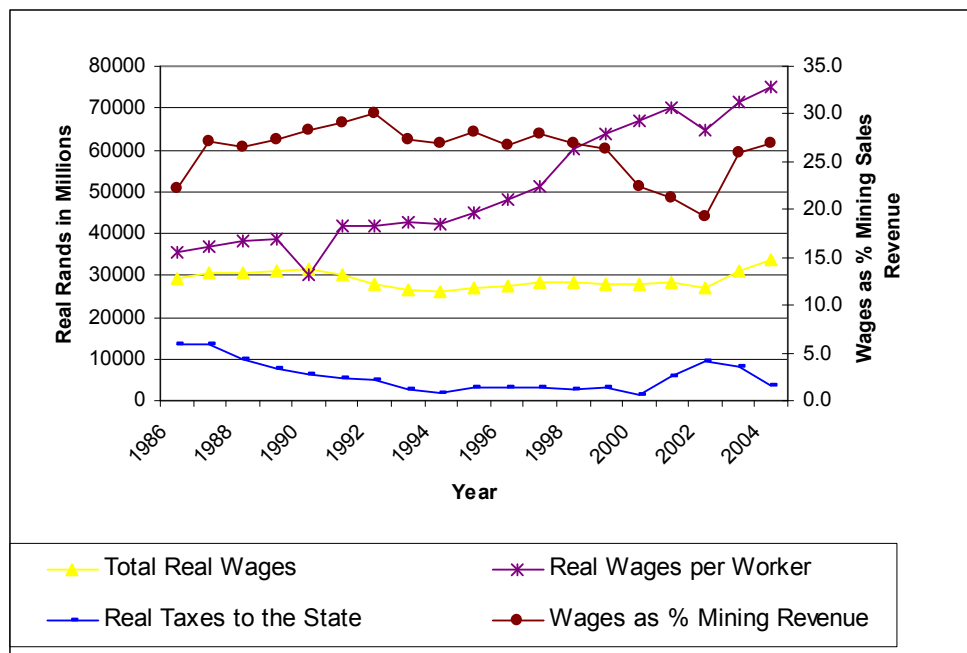


Figure 3.11 South Africa's mining annual average wages and state revenue: 1986-2004 (Data Source: DME: 100=2004).

3.4 Discussion

Stakeholders in the mining industry

The South African mining industry consists of six major stakeholders; namely, government, business, labour unions, government agencies, NGOs and communities. The lead agent in terms of administration, regulation and promotion is the DME, which administers and regulates the industry in consultation with other departments. In brief, State involvement is largely supportive in nature and aims at providing:

- a legislative framework and fiscal regime that would facilitate investment into exploration mining, processing, beneficiation and marketing of the country's minerals; and
- a well-organized infrastructure in the form of road, rail and harbour facilities, communications and health services and the supply of electricity and water.

In the past, the State neither interfered nor intervened in retrenchment and downscaling matters. However, in recent years the State has realised the need for its intervention and, as a result, the DME restructured itself in 2003 to, inter alia, deal with and regulate downscaling issues through the recently legislated Labour and Social Plan requirement. In this regard, a dedicated Directorate in the DME was created to focus on labour and downscaling issues.

In order to promote the development of the mining industry through targeted research, government has established the CGS, CSIR and Mintek. These organisations are respectively tasked to undertake research in the fields of exploration, mining and mineral processing. However, analysis of the activities of the three organizations over the past two decades suggests the three organizations did not sufficiently address the issues of downscaling. In fact, most of the current problems, especially those relating to the environment, should have been part and parcel of the research programs of these institutions. It is, however, comforting to notice that the DME has now decided to provide funds for the three organisations to undertake research related to downscaling. Ironically, the research institutions

were also affected by downscaling that took place in the mining industry. This was expected as the research programs of these organisations are closely related to mining activities.

The most important trade union in the mining industry is the NUM. Whilst available public information points out that membership of the union grew from 14 000 in 1982 to about 211 000 in 2006, there is no doubt that the organisation (which grew its membership substantially in the 1980s) lost members as a result of downscaling during the 1990s and early 2000s. It was of no surprise to notice the prominent role that the NUM played in addressing downscaling in the mining industry.

Downscaling in South Africa's mining industry has resulted in the closure of a number of shafts and mines – the consequence of which was the retrenchment of semi-skilled and skilled miners. Some retrenched miners who, in many cases, had years of mining experience re-opened certain closed operations and operated illegal mines. The political changes that took place post-1994, with the election of the first democratic government, also opened opportunities for new mining entrepreneurs to enter the industry.

In response to the increasing problems related to small-scale mining, the DME established a support system known as the NSMDF, which was intended to provide financial and technical assistance to small-scale miners. The support system provided an opportunity for stakeholders to understand problems associated with small-scale mining. Most of the problems are related to the lack of sufficient reserves, resulting in difficulties in developing a viable business plan. However, the complex community ownership structures of projects also brought challenges for the NSMDF as communities often disagreed internally on many issues. The complexity involved in the structuring of the projects in terms of shareholding and management also resulted in many projects failing. Table 3.6 shows selected projects that were funded by the NSMDF.

The following are some of the problems encountered by the NSMDF:

- Lack of viable ore bodies – most small-scale mining projects lack enough reserves to be capitalised into viable projects.
- Lack of markets for minerals – most of the projects (eg industrial minerals projects) lack markets.
- Conflicts amongst communities – community projects are often fraught with in-fighting amongst members.
- Lack of technical support and entrepreneurs – most projects lacked people with appropriate technical skills and entrepreneurship.

Table 3.6 Key small-scale mining projects (Source: DME unpublished data).

Project Name	Type of commodity	Funds (Rands)	Structure of the project	Remarks
Esizweni	Clay brick	6 million	A community project. 50:50 Joint Venture with Corrobrick.	The project is likely to succeed as it is supported by Corrobrick, which has guaranteed to buy all the bricks.
Barberton	Gold in shear zones. The project was launched in 2001. The project commenced by mining old dumps and reopening closed shafts	2.5 million	A community project. 60:40 Joint Venture between ERPM and a Community Trust.	Not enough reserves could be proved. Lack of appropriate skills to identify and quantify the reserves.
Verveldien	Alluvial diamond processing.	3 million	A community project. It was owned 100 per cent by the community through a trust.	The project collapsed at its exploration phase as no sufficient reserves could be proved. Intervention by communities also created problems in terms of project management.

Although the newly created Small-Scale Mining Board was established to overcome some of the problems encountered in the NSMDF, it is still too early to assess its successes as it was only launched in 2005. Nonetheless, the increase in the number of small-scale mining projects continues and the challenge for government is to ensure these operations are within the legal framework and are given support.

The recent legislative changes relating to BEE, together with the restructuring that led to downscaling, have resulted in a number of BEE companies entering the mining industry – ARM was one such company that benefited from downscaling in the gold mining industry when AngloGold (as part of its empowerment program) sold some of its marginal gold mines to ARM. In addition, the principle of “use it or lose it” released previously hoarded mineral rights to new entrants, thereby providing opportunities for junior companies from Australia and Canada to enter the South African mining industry. Whilst the introduction of BEE addresses the issue of introducing Blacks into the mining industry, it does not, at this stage, address problems associated with downscaling of the mining industry. The development and promotion of junior mining companies, which focus on exploration, could be an important element in the broader strategy to address downscaling.

Large mining companies are represented by the Chamber of Mines, which has played a pivotal role throughout the history of mining in the country. The organization has also been affected by downscaling in the mining industry - it employed about 1 500 workers in the 1970s, but now employs only about 200 people. The organization’s key activities include lobbying government on behalf of affiliated companies and undertaking mining research programs. The organization also participates in tripartite committees that involve government and labour unions and played a critical role in national structures established to address downscaling. Some of these structures include the GCC, SPC and, most recently, the Advisory Board.

South Africa's Mineral Resources

Although modern mining in South Africa has been in existence for nigh 100 years, the country still possess some of the world diverse and largest resources of important minerals, for example, gold, manganese, PGMs, titanium, vanadium and chrome ore. The diverse and extensive minerals endowment makes the country one of the leading producers of minerals such as alumino-silicates, chrome ore, ferrochrome, gold, manganese and PGMs. The challenge for the country is to ensure these resources are utilised in a sustainable manner as mineral resources are non-renewable.

Mineral sales and exports

Information from the DME shows that in real terms South Africa's mineral sales declined marginally between 1980 and 2006 (Figure 3.2). Nevertheless, recent strong commodity prices have resulted in sales showing a strong increase. The market for South Africa's minerals is mainly overseas, with Europe being the most important destination and accounting for 90 per cent of mineral export sales (Mwape et al, 2005; Mwape et al, 2007). Most minerals are exported in their "raw" state – a situation which has led to outcries from government and certain stakeholders, who believe that further downstream beneficiation of minerals, is necessary to maximise benefits for South Africa.

The current view of government and labour unions is that the status quo in respect of mineral exports is tantamount to a systematic transfer of resources and wealth from South Africa to developed world. This view is not only harboured within South Africa, but is also the viewpoint of most African governments and other developing countries. At the recent launch of the African Mining Partnership (a Ministerial forum of African mining Ministers) in February 2004, the African mining Ministers reiterated the need to address the export of unbeneficiated minerals. Unhappiness about the export of "raw" minerals is bound to spread throughout developing mining countries, and will most definitely affected the manner in which minerals are exploited in these countries in the future. There is

also a belief that increased beneficiation can play a role in addressing the negative impact of downscaling by creating jobs.

Location of major mining activities

Most of South Africa's mineral wealth is located in the northern part of the country, which is underlain mainly by relatively older rocks. For example, the country's most important gold, coal, diamond and PGMs deposits are located in the Limpopo, North West, Mpumalanga and Northern Cape provinces. Based on the distribution of mineral resources it is apparent that any downscaling that occurs in the mining industry will negatively affect provinces that fall within the northern part of the country as these are the provinces likely to contain large mines.

Table 3.4 clearly demonstrates the above situation. The Eastern Cape and Western Cape show small numbers of mine employees whilst provinces such as the North West, Gauteng, Limpopo and Free State reveal far larger numbers of mine employees. However, South Africa is in a unique situation as its mine labour force originates from rural areas as well as from neighbouring states such as Mozambique. The result is that the economic activities of the mining districts are intimately linked to labour sending areas. Hence downscaling on the mines not only affects the surrounding economies, but also those of labour sending areas. The most important labour sending areas are Mozambique and the former Eastern Cape – these areas are already experiencing serious negative impact resulting from downscaling.

Importance of contribution of mining to South Africa's economy

The contribution of mining to South Africa's economy is best demonstrated by the number of direct jobs created by the industry. According to information from the DME, in 2006 the industry employed an average of 458 600 people, equal to 2,7 per cent of the economically active population. If it is assumed that 1 employee has an average 5 dependants, then mining in South Africa would be directly supporting 2 293 000 people. In terms of the latest population figures from

Statistics South Africa, the country's population is 48 million (Statistics South Africa, 2008). Therefore it can be deduced that mining directly supports approximately 5 per cent of the South African population.

The loss of jobs in the mining industry has principally affected the gold and coal mining sectors. In the gold mining industry, loss of jobs is attributed to, amongst others, the relative maturity of the industry and declining profitability. Whilst the coal mining industry has also been losing jobs at an alarming rate, this is not related to curtailment of operations, but rather to the mechanisation that is taking place in the industry. In contrast the PGMs industry, which is the second largest employer, is still in its growth phase and currently expanding in terms of operations and number of employees.

In recent years the contribution of mining to both the GDP and GDFI has been declining at disturbing rate (Figures 3.3 and 3.4). There are several views regarding the cause of the decline in GDP and GDFI, some of people in the industry attributes the decline to the bottleneck in processing prospecting and mining rights. Whilst this view is debatable, the unprecedented changes introduced by new legislation were bound to create teething problems, which have since been addressed by the government. In addition rapid expansion of other economic sectors, such as Finance, has resulted in a decline in the relative contribution of mining to GDP and GDFI.

3.5 Summary

In summary the nigh 100 years of mining in South Africa has created a competitive and well managed mining industry, which consists of several role players participating in the management and promotion of the industry. Whilst the country produces about 59 types of minerals, gold, PGMS and coal are the most dominant minerals in terms of employment and sales. The country possesses the largest resources and reserves of some of the most important minerals in the world such as PGMs, manganese and gold.

Mining has contributed immensely towards economic and socio-economic development of the country. However, in recent years, the relative importance of the industry has been declining as evident from the declining contribution to GDP and GDFI. In addition employment levels have also begun to show a downward trend after reaching relatively high levels during the early 1980s (Figure 3.8). The decline in employment is mainly driven by the gold mining industry, which has traditionally been the largest employer. The industry has lost over 300 000 jobs between 1980 and 2006 – some 241 000 of these jobs were lost in mines operating in the Gauteng and Free State provinces (Table 3.4). The loss of jobs has impacted negatively, in respect of declining economic activities and unemployment, on South Africa's mining areas (eg Matjhabeng/Welkom), labour sending areas (eg Eastern Cape) and neighbouring countries (eg Lesotho).

CHAPTER 4

THE SOUTH AFRICAN GOLD MINING INDUSTRY: CURRENT STATUS

“Unfortunately, in our case, particularly in South Africa, both because the ore bodies we are mining here are mature, and because in many cases we are using long-walling mining methods, we really have very limited opportunity to flex the grade. We’ve got to mine, generally speaking, what we get and what we can take.” Bobby Godsell, 2004

4.1 South Africa’s Gold Occurrences

Gold in South Africa occurs in a broad range of geological terrains, ranging from Swazian (+/- 3000 million years) to Permian (+/- 225-250 million years). Some of the important occurrences are presented below (Ward and Wilson, 1998):

- Barberton greenstone belt (Mpumalanga Province)
- Transvaal Drakensberg gold fields (Mpumalanga Province)
- Bushveld Complex (North West, Limpopo and Gauteng Provinces)
- Murchison Greenstone belt (Limpopo Province)
- Giyane greenstone belt (Limpopo Province)
- Pietersburg greenstone belt (Limpopo Province)
- Amalia-Kraaipan greenstone belt (North West Province)
- Transvaal supergroup (North West and Gauteng Provinces)
- Witwatersrand basin (Gauteng, North West and Free State Provinces)
- Numerous deposits in Kwazulu-Natal, Western, Eastern and Northern Cape Provinces

However, the most important gold occurrence, which produce the bulk of the South Africa’s gold, is the Witwatersrand basin. In these occurrences, gold is produced from primary gold ore hosted in conglomerate beds and re-treatment plants. More than 98 per cent of the primary gold recovered in South Africa originates from mining operations in the Witwatersrand basin (De Klerk, 2001).

Despite relatively small outcrop areas, extensive drilling and exploration has succeeded in defining the extent and structure of the Witwatersrand basin (Lurie, 1989). The structure is that of an elongated basin underlying the northern Free State province, parts of Gauteng and North West provinces. Figure 4.1 shows the seven gold fields hosting the Witwatersrand gold resources (Antrobus, 1986). These are Evander, East Rand, Central Rand, West Rand, West Wits Line, Klerksdorp, and Orange Free State gold fields.

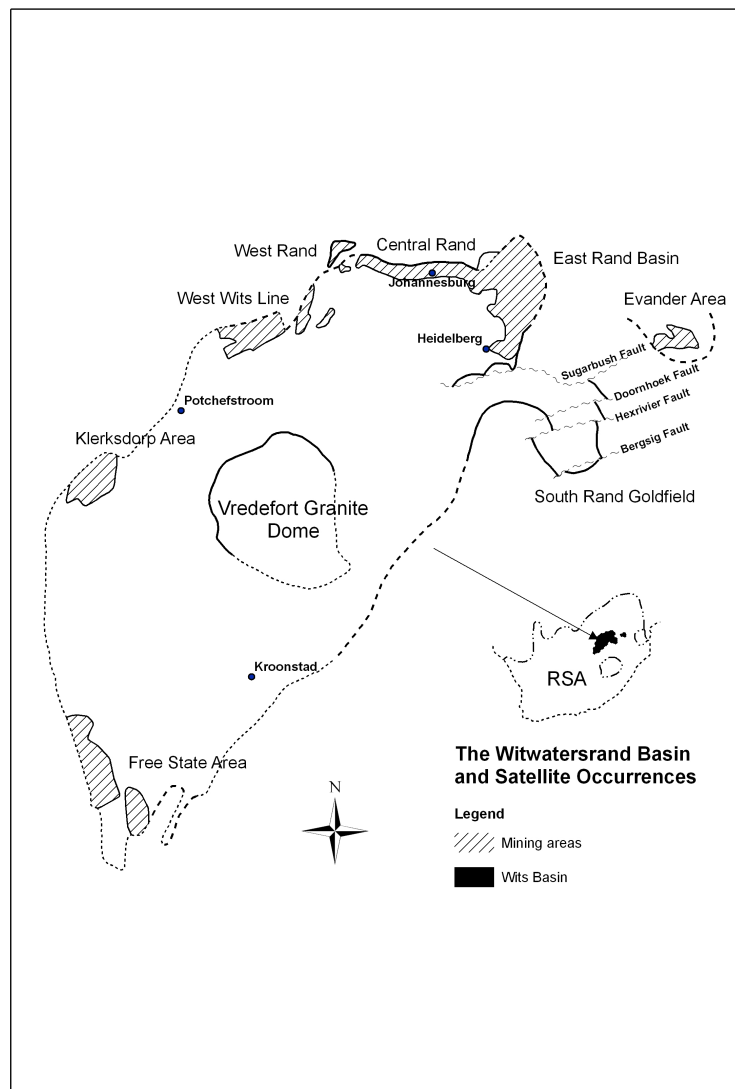


Figure 4.1 Gold fields in the Witwatersrand Basin
(Source: Antrobus, 1986).

4.2 Gold Resources

Wilson (1998) states that the deposition of sediments between 3 074 and 2 714 Ma. in the Witwatersrand basin created the largest repository of gold, containing an estimated 82 000 tons of gold at economically viable grades. According to Mwape et al (2007), South Africa still possesses the largest gold reserves in the world. Mwape et al (2007) estimate South Africa's gold reserves at 36 000 tons, which is in line with the annual USGS estimates (USGS, 2006). The reserves constitute 36 per cent of world gold resources. However, this estimate has been questioned by Davis (2006), who is of the opinion that the figure is on the high side. Davis (2006) estimates reserves and resources at 5 000 tons and 26 000 tons respectively. He furthermore shows that the life of operating mines is likely to last up to 2030 given current gold reserves (Figure 4.2). The forecast by Davis suggests that non-Chamber mines will increase in number as large companies close down due to depletion of reserves. Notwithstanding, the different views and figures on reserves and resources the country still possesses the largest known gold ore body in the world.

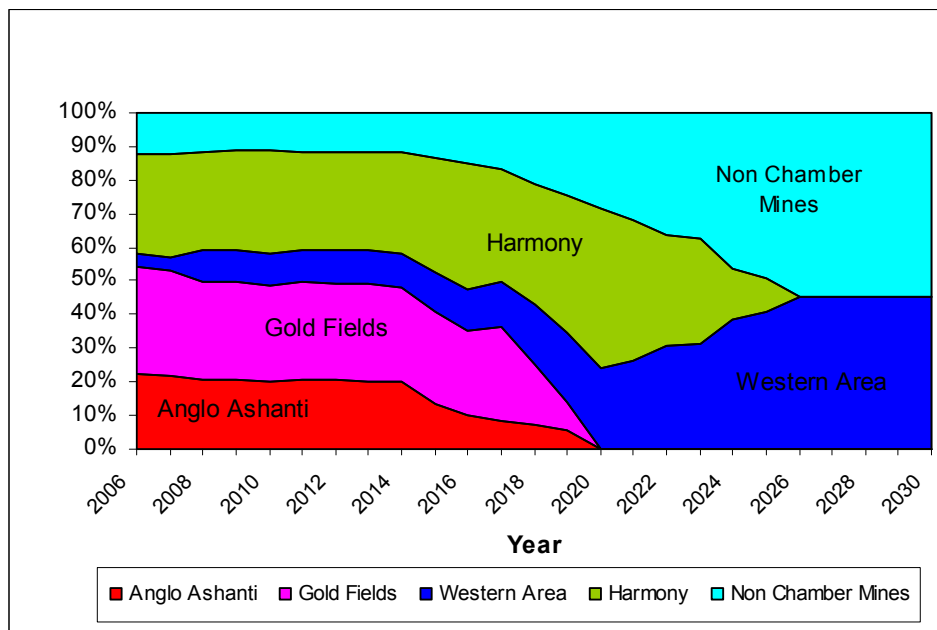


Figure 4.2 South Africa's gold mines: Life of mines (Source: Davis, 2006).

4.3 Gold Production

4.3.1 South Africa's gold production

Statistics from the DME shows that South Africa's gold production has been declining over the last three decades (Figure 4.3). The country has for many years ranked number one in terms of gold production – the situation has since changed and the unpublished 2007 data from the DME indicates that the country is now ranked second after China. In 2006, South Africa produced 272,1 tons of gold, which was about 11,1 per cent of world production (Conradie, 2007). The country last produced at these levels of production in the early 1890s – in 1894 a total of 272,7 tons of gold were produced (Chamber of Mines, 2008).

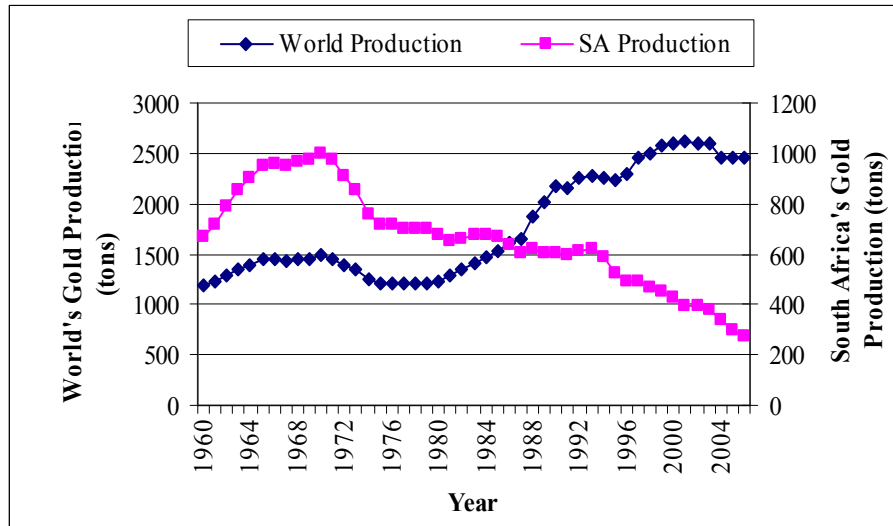


Figure 4.3 South Africa's and World's annual gold production: 1960-2006 (Data Source: Chamber of Mines and DME).

Some 93 per cent of the currently produced gold in South Africa comes from mines and re-treatment plants situated in the seven gold fields of the Witwatersrand basin (Figure 4.1 and Table 4.1). Most of the gold is produced from the West Wits Line gold field, which in 2004 produced 118.2 tons of gold. The second most important gold field is the Free State, which produced 80.7 tons of gold in 2004. Table 4.1 shows that gold production in all seven gold fields has

been declining at an alarming rate. A comparison of 1984 and 2004 figures reveals that all seven gold fields have experienced a significant decline in gold production. The West Wits Line production dropped by 46,1 per cent, whilst the Free State gold field production declined from 181.6 tons in 1984 to 80.7 tons - representing a 55,6 per cent drop. The East Rand and the Evander gold fields experienced the sharpest decline - at 58,8 per cent and 68,23 per cent respectively. In line with the countrywide decline of mining operations, other sources of gold production, which include non Witwatersrand gold and re-treatment of slime dumps, also decreased by 6,9 per cent.

Table 4.1 South Africa's gold production by gold field (tons) (Data Source: DME, 2003 and Conradie, 2005).

Gold Field	1984	2004	% Change in production
West Wits Line	219,3	118,2	-46,1
Free State	181,6	80,7	-55,6
Klerksdorp	154,7	71,2	-54,0
West Rand	36,8	25,1	-31,8
Evander	36,2	11,5	-68,23
East Rand	31,1	12,8	-58,8
Central Rand	12,6	7,5	-40,5
Other	9,1	6,9	-24,2

4.3.2 World gold production vs South Africa's gold production

It is ironic that whilst South Africa's gold production has been declining at an alarming rate, world production has increased considerably in recent years (Figure 4.3). The paradox is attributed to, amongst others, the discovery of relatively shallow deposits in countries such as Australia, Ghana, Canada, China, the USA,

Chile and Peru. China, Chile and Peru, experienced a remarkable increase in production between 1970 and 2006 (Table 4.2). On the other hand, the South African industry has been experiencing difficult times in respect of, amongst others, ever increasing costs, increasing mining depths and declining profits – consequently, the industry had to downscale.

Table 4.2 Gold production of selected countries (tons) (Data Source: DME and Conradie, 2005; Conradie 2007).

Year	South Africa	USA	Australia	Canada	China	Peru	Ghana	Chile
1970	1000	54	54	75	2	3	22	2
2004	343	252	261	130	212	173	63	40
2006	272	252	245	104	247	203	70	40
% Change (1970-2004)	-66%	+367%	+383%	+73%	+10500%	+5667%	+186%	+1900%
% Change (1970-2006)	-73%	+367%	+354%	+39%	+12250%	+6667%	+218%	+1900%

4.4 Economic Contribution of Gold Mining

The gold mining industry plays a pivotal role in the economy of South Africa and the fortunes of many economic sectors, and indeed the well-being of ordinary South African citizens, is linked to the industry. Of great importance is the direct and indirect contribution of the industry to employment creation, contribution to GDP and foreign exchange earnings.

4.4.1 Employment in the gold mining industry

The overall drop in production in the industry has prompted several companies to restructure their operations and retrench thousands of employees. Figure 4.4 shows that both employment and gold production decreased considerably between 1960 and 2006. As earlier stated, this unpleasant environment was largely caused by, inter alia, depressed gold prices, declining grades, increasing costs and

declining profits. The situation prompted stakeholders to establish several initiatives such as the GCC. These initiatives will be discussed in more detail later in this study.

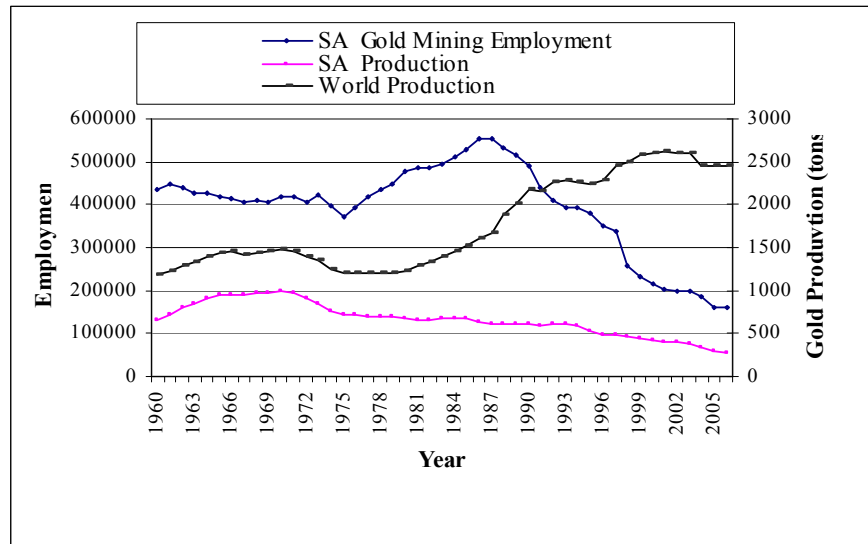


Figure 4.4 Employment (South Africa) and annual gold production (South Africa and World): 1960-2006 (Data Source: DME).

4.4.2 Beneficiaries of gold mining proceeds

Malherbe (2000) has shown how the value generated in gold mining is divided between employees, shareholders and government. According to Malherbe, labour is the most important beneficiary of gold mining activity and during the period 1990-1998, 62 per cent of all value generated went to labour. Statistics from the DME shows that employees still benefit to some extent from gold mining. In 2006, gross remuneration paid to gold mining employees amounted to R12 869 million, 33 per cent of the total mining remuneration. However, employees are not the only stakeholders that benefit from gold mining – other beneficiaries are capital expenditure, government and shareholders. Figure 4.5 shows the second most important beneficiary of gold mining activities as capital expenditure (at 15 per cent), which is followed by 14 per cent in respect of attributable profits for shareholders and 7 per cent for government mining taxes. The abovementioned

data indicates that downscaling in the gold mining industry will most likely negatively impact labour the most in terms of loss of earnings.

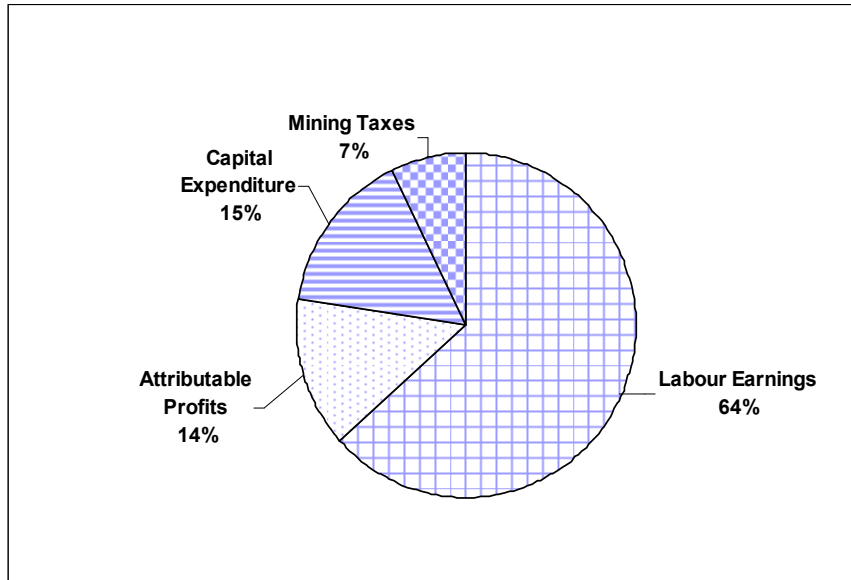


Figure 4.5 Distribution of gold mining value added: 1990-1998
(Source: Malherbe, 2000).

4.4.3 Foreign exchange earnings, Gross Domestic Product and multiplier effects

In its recent 2006 publication, Virtual Metals Research and Consulting Limited states that contribution of gold to export earnings has dropped significantly from 50 per cent in 1980 to 10 per cent in 2004. Similarly, the direct contribution of gold to GDP dropped from a high of 16,3 per cent in 1980 to 2 per cent in 2002. However, taking into consideration the indirect contribution to the economy and the multiplier effects, gold mining's total contribution to GDP is closer to 4,4 per cent (Chamber of Mines, 2004). According to the Chamber of Mines, these multiplier effects include:

- backward linkages, which arise from the purchase of goods and services by the gold mining industry (gold mines

consume 15 per cent of all electricity generated in South Africa);

- forward linkages, arising from the use of mineral products in other domestic industries, such as jewellery fabrication and gold refinery;
- social multipliers, which arise from the role of mining in the development of human resources and infrastructure such as schools, colleges, clinics, roads and housing;
- subsistence multipliers – between seven and ten people rely on each mineworker for their daily survival;
- the primary income multiplier, which arises from household expenditure of primary income derived from mining;
- the employment multiplier, which arises from employment created in other industries as a result of gold mining;
- the income terms-of-trade multiplier which arises from the positive impact gold export earnings have on the balance of payments, foreign reserves, monetary policy and, ultimately, upon general levels of business activities; and
- capital formation multipliers, which arise from mining's influence in attracting foreign capital to the country.

4.5 Transformation in the Gold Mining Industry

Transformation in terms of BEE is driven largely by the new Mineral and Petroleum Resources Development Act as well as the Mining Charter (Republic of South Africa, 2002a; Department of Minerals and Energy, 2004). The new Act aims at, amongst others, facilitating the participation of previously disadvantaged South Africans in the mining industry. According to Virtual Metals Research and Consulting Limited (2006), a total of 26 gold mining BEE transactions amounting to some R17,2 billion, occurred between 1999 and 2004. The most important BEE companies in the gold mining industry are, ARM (in partnership with Harmony), Mvelaphanda (in partnership with Gold Fields), Khumo Bathong (in partnership with Durban Roodepoort Deep Gold Mine (DRDGold)) and African

Vanguard (in partnership with Harmony). There is no doubt that BEE companies benefited from downscaling as they acquired some of the marginal operations being off loaded by large mining companies.

4.6 Environmental Impact and Downscaling in the Gold Mines

The impact of the gold mining industry on the physical environment has been highlighted by many stakeholders. However, recent downscaling has exposed some of the negative environmental consequences of nigh 100 years of gold mining. It is not the objective of this study to quantify the impact of gold mining on the environment, however, critical issues relating to this matter will be highlighted. The most significant physical environmental impact are:

- Water pollution;
- Dust pollution;
- Aesthetic intrusion; and
- Land degradation.

4.6.1 Water pollution

The need to access deeper ore bodies below the water table resulted in large quantities of ground water being pumped to surface. It is currently estimated that the total amount of water pumped is approximately 450 megaliters per day (Mr Leon Croukamp, CGS, personal communication). The interaction of water, oxygen and mineral sulphides has resulted in the oxidation of sulphides and the production of Acid Mine Drainage (ADM). Almost all the Witwatersrand mines are affected by ADM and contribute to the pollution of both subsurface and surface water.

The danger of mine polluted water has been explicitly highlighted by Mawson (2005) in his article which appeared in Mining Weekly of 3-9 June 2005. He points out that the impending gold mine closures could mean far more to South Africa than thousands of unemployed workers. He further highlights that the challenge of acid mine water looms large and could have devastating consequences for the environment and South Africa's citizens unless an integrated

management solution is found. The author supports this view and in fact believes that polluted mine water will soon be the biggest crisis to emanate from gold mining activities. Signs of this crisis can be seen in Figure 4.6, which shows that the closure of mines in and around central Johannesburg has resulted in polluted mine groundwater rising to the surface.

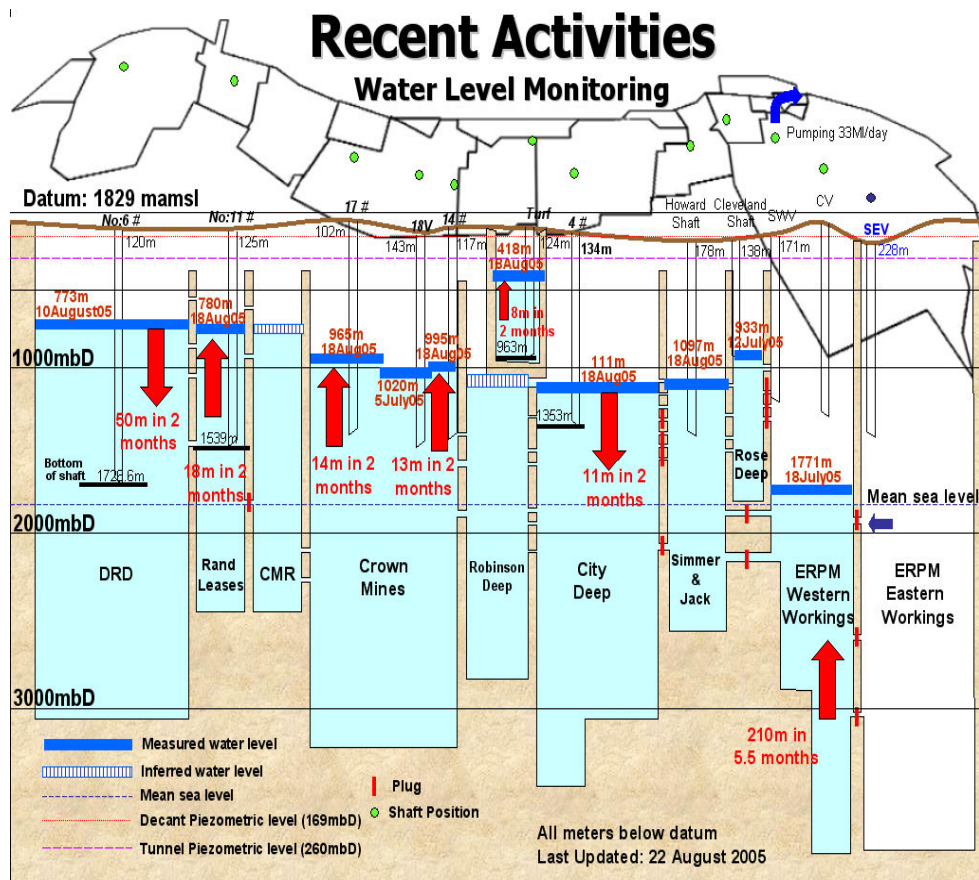


Figure 4.6 Ground water levels in the Central basin of the Witwatersrand basin (Source: Shango Solutions and CGS).

There is already evidence that some of the water has begun to decant in some parts of the Witwatersrand basin and Coetzee et al (2002) have reported on the discharge of mine water into the environment from a borehole and an old shaft in the Krugersdorp district. The discharge water is entering the Krugersdorp Game Reserve and also threatening the world renowned Cradle of Humankind World Heritage Site. Plate 4.1 shows hippos in a polluted dam, which has a pH level of 4.

According to Coetzee et al. (2002), analysis of the decanting water at a number of points in the system indicates that its water contains unacceptable levels of large numbers of macro constituents such as iron, sulphate, zinc and aluminium, and trace elements such as uranium, nickel, cadmium, lead and manganese. In addition the water, which is acidic, has pH levels of 3. It is of concern that most of the decanting in the Central Basin, directly below the Central Business District (CBD) of Johannesburg, will happen at any time. The impact of acid water on the CBD buildings is highlighted in a newspaper article by Dr A Turton from the CSIR (Tempelhoff, 2007). In the article, Dr Turton points out that the acid water has the potential to destabilise the foundations of some buildings within the next decade.



*Plate 4.1 Hippos in the “Dry Dam” in Krugersdorp Game Reserve
(Source: CGS).*

4.6.2 Dust pollution

Over one hundred years of gold mining in South Africa has produced large amounts of tailing, which now cover vast areas of land. Most of these dumps, situated in and around densely settled areas, contain elevated levels of radioactive and chemo-toxic heavy metals (Winde et al, 2004). Unfortunately the majority of the dumps are not rehabilitated or are poorly rehabilitated; resulting in dust pollution taking place and threatening the health of several communities that have settled around these dumps (Plate 4.2). Although the legislation of the country provides that polluters be held responsible for polluting the environment, some of the dumps are ownerless and the government has to “adopt” these dumps. The problem relating to dust pollution is bound to continue as more and more mines, as well as shafts, close down. Unfortunately conflict has already started to occur amongst mining companies, government and communities affected by the dust.

4.6.3 Other types of environmental degradation

In addition to water and air pollution, gold mining in the Witwatersrand has created many sinkholes in and around mining areas. Almost all sinkholes occurring in mining areas are a consequence of de-watering in land areas underlain by dolomitic rocks. Plate 4.3 shows an example of a mining related sinkhole in the West Rand area. Unfortunately, the frequency of occurrence of these sinkholes is expected to continue well into the future, even after the closure of mines during the re-watering stages.

Mining in the Witwatersrand gold mines is associated with seismicity that often causes damage to properties in and around mining areas. However, recent downscaling in the gold mining industry has already resulted in a decline in the frequency of seismicity, as demonstrated in Figure 4.7, which shows that seismic events in the Central Rand, East Rand and West Rand have declined considerably as a result of downscaling in these gold fields.



Plate 4.2 Unrehabilitated slime dam (Source: Leon Croukamp, CGS).

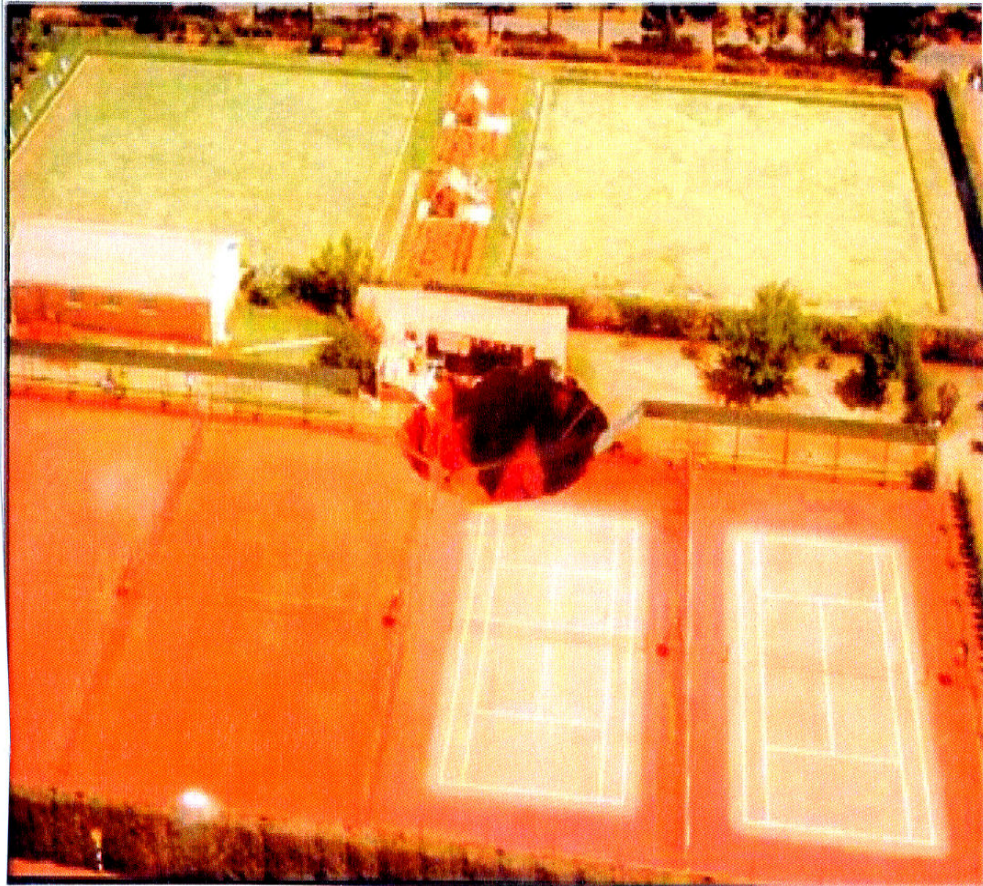


Plate 4.3 Sinkhole in the West Rand gold field (Source: CGS)

Gold mining has also left behind many hundreds of abandoned mine workings, including shafts, adits and trenches. Many of these workings pose dangerous conditions for people and animals. A 2006 internal report of the CGS states that 535 holes have been located throughout the Witwatersrand basin. The challenge for the country is to ensure that communities are protected from the dangers these holes pose.

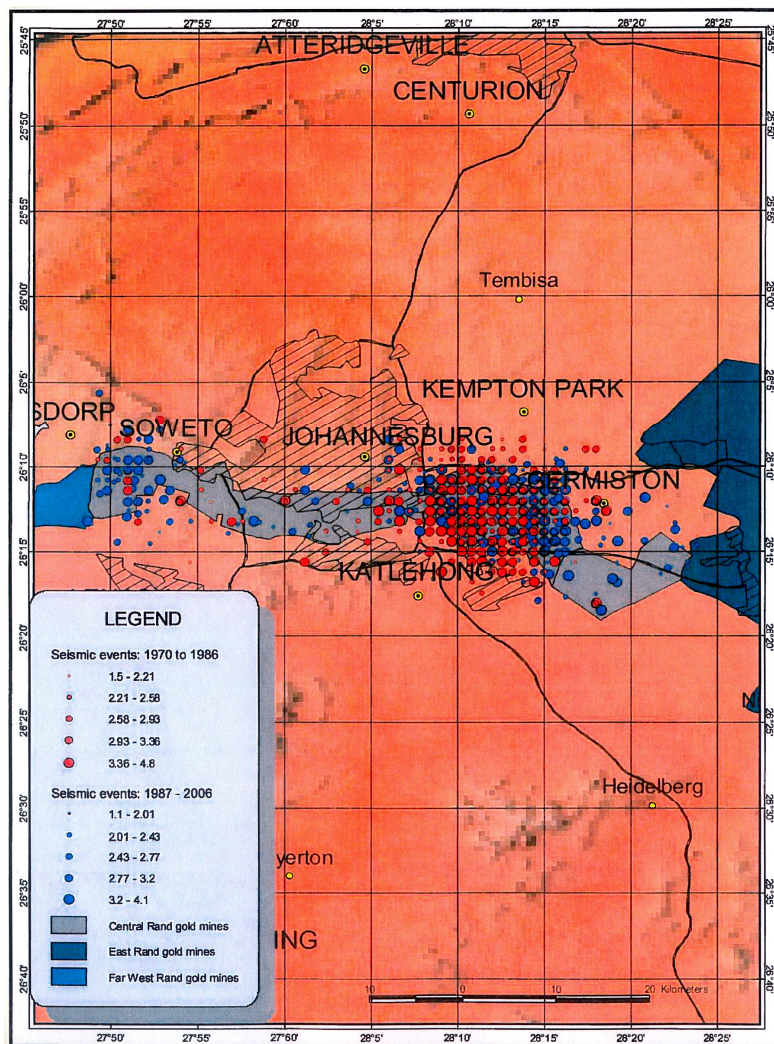


Figure 4.7 Seismic epicentres located in the Witwatersrand gold mines for the period July – September 2006 (Source: CGS, 2006b).

4.7 Discussion

Although gold in South Africa occurs in several geological terrains, the most important terrain is the Witwatersrand basin. Since the discovery of gold in the basin in 1886, some 50 046 tons of gold have been mined. There are different views about the extent of the remaining resources and reserves – estimates of the resources range between 26 000 tons and 36 000 tons. Notwithstanding the wide range of estimated resources, future production and reserves will depend on a number of factors including, new discoveries, gold price and costs of mining. Although the discovery of large sections of the Witwatersrand basin could be attributed to unforeseen discoveries, a large segment of the basin and associated economic reefs were discovered through extensive geoscientific investigation and sizeable financial commitment by South Africa's traditional mining companies – a situation that is still needed for the successful exploitation of remaining resources.

South Africa's gold industry has been going through difficult times, as is evident from the consistent decline in gold production from its unprecedented peak of 1 000 tons in 1970 to 272 tons in 2006. Paradoxically, global gold production has increased considerably during the same period – production increased from 1 480 tons in 1970 to 2 451 tons in 2006. The increase in global gold production is attributed to increased gold production from several countries, which can be grouped as follows:

- Former communist countries, eg China;
- Traditional western mining countries, eg Australia, Canada and United States of America (USA); and
- Developing countries, eg Peru, Chile and Ghana.

In China the gradual liberalisation of communism, coupled with increased geochemical survey investigations by government-sponsored Chinese Geological Surveys, has resulted in numerous gold mines being discovered. The discoveries have in turn increased gold production in China. In Australia, Canada and the USA, the continued enabling investment climates have resulted in increased investment into the gold mining industries of these

countries. The vibrant junior mining sectors in both Australia and Canada have also contributed considerably in attracting exploration investment into the countries' gold mining industries. According to Natural Resources Canada (2007), in 2006 junior companies were responsible for over 60 per cent of Canada's total exploration and deposit appraisal expenditure. With regard to developing countries such as Chile, Peru and Ghana, the increase in gold production is attributed to the implementation of mining code reforms which were aimed at attracting exploration investment.

Although the contribution of gold mining to GDP and export earnings has been declining from their all time high in 1980, the industry still plays a vital role in the economy of South Africa. Gold mining accounts for 10 per cent of foreign exchange earnings and contributes to the economy through several multiplier effects.

The industry has also responded positively to new challenges facing the country, especially in respect of transformation, which has to some extent changed the ownership patterns of the South African mining industry. To-date, a total of R17 billion worth of BEE transactions have taken place – this represents some 22 per cent of total transactions that took place in the gold mining industry between 1999 and 2004. Downscaling in the industry has, without doubt, benefited the transformation process through the sale of marginal operations to BEE companies – for example ARM benefited immensely from buying marginal mines. This trend is expected to continue well into the future.

Despite the fact that the industry played, and still plays, an important role in the economy of South Africa, it is shrouded in controversies with respect to environmental degradation. Unfortunately these environmental problems, which are the result of more than 100 years of mining, are located within some of the most important metropolitan areas of South Africa. The challenge for the industry is to find solutions to these environmental problems which are bound to increase

with increasing downscaling. The most important issue is the currently decanting polluted groundwater.

4.8 Summary

Although there are several gold occurrences in South Africa, the Witwatersrand basin is the most important in terms of gold mining activities, gold resources and employment. About 93 per cent of the currently produced gold in South Africa comes from mining activities situated in the seven gold fields of the Witwatersrand basin, which still contains the largest known gold resource in the world. Despite the country's possession of the largest known gold resources, the gold mining industry has been downscaling over a number of years. Production and employment have been declining since reaching their respective peaks (Figure 4.4). The decline in production is best represented by Table 4.1, which shows significant decline in gold production in all the gold fields. Many mining towns in the gold fields (eg Welkom in the Free State gold field and Evander in the Evander gold field) were adversely affected by declining economic activities.

Regrettably, downscaling, which is a consequence of a number of factors, is impacting negatively on the environment in respect of, inter alia, groundwater pollution, decanting of groundwater and dust pollution. The influence of the various factors on employment and therefore downscaling will be discussed in Chapters 5 and 6.

CHAPTER 5

ANALYSIS OF EVENTS AND FACTORS THAT LED TO DOWNSCALING AND THE GOLD CRISIS

“The profound changes that the gold-mining industry has experienced have been caused by both local and international conditions. Cost increases in the industry have been significant, while both the tonnage and the grade of the ore have declined. Recent statistics indicate that this trend is continuing.” Peter Gastrow, 2001

5.1 Introduction

A multiplicity of business factors led to downscaling and the crisis in the gold mining industry in South Africa and almost all of these factors are related to the performance and profitability of individual gold mines. Although a number of researchers (eg Kemp, 2000; Rahn, 1973; Camerer, 1964) have looked at these factors from various points of view and with different objectives, there is very little literature that endeavours to examine the impact of the respective business factors on employment and associated downscaling in the mining industry. Kemp (2000) selected the following 18 business factors to compare the performance of selected mines:

- Area mined;
- Total ore milled;
- Underground ore milled;
- Gold recovered;
- Recovered grade;
- Underground recovered grade;
- Stopping width;
- Area mined per meter developed;
- Pay ore reserves;
- Production efficiency;

- Productivity gold recovered per total employee costed;
- Area mined per total employee costed;
- Total working costs (rand/m²);
- Total working costs (rand/gram);
- Underground working costs (rand/ton);
- Underground working costs (rand/m²); and
- Underground working costs (rand/gram).

Although Kemp (2000) successfully used the above factors to benchmark selected mines, he did not show how these factors impact on employment. Rahn (1973), in his analysis of the effects of a changing gold price on the South African gold mining industry, used the following factors:

- Ore potential;
- Available tons for mining;
- Gold production;
- Revenue;
- State taxes and aid; and
- Dividends.

In his study, Rahn (1973) compared potential output, annual revenue, lease and tax payments, and dividends for five different gold prices using the gold price received by the mines of \$50 per ounce; and further calculations for \$60, \$70, \$100 and \$150. Unfortunately, Rahn's study did not investigate the impact of the gold price on employment. Camerer (1964), in his investigation of economic consequences resulting from mine closure in marginal mine regions, discussed how the following factors could affect the closure of mines.

External Factors:

- Price of gold;
- Effect of inflation; and

- Government subsidies.

Internal Factors

- Size of the reserve;
- Rate of extraction; and
- Tonnage milled.

Camerer (1964) further discussed the role of the above factors in the gold mining industry and furthermore forecast that employment levels on marginal mines would decline steadily between 1964 and 1974. However, there is no supporting evidence on the procedure that was followed to forecast employment. The estimated employment figures were provided by the Inspector of Mines from the then Department of Minerals and Energy Affairs.

In this chapter, an analysis of the following selected critical business factors leading up to downscaling and the gold crisis in the South African gold mining industry will be undertaken:

- Employment;
- Gold price;
- Ore Milled;
- Ore treated;
- Gold produced;
- Gold grades;
- Working revenue;
- Working costs;
- Working profit;
- Productivity;
- Gold holdings by institutions; and
- Hedging by producers.

The relationship between employment and the aforementioned factors will also be investigated in order to assess the role that respective factors played in downscaling and the gold crisis. The investigation will include graphic analysis and calculation correlation coefficients in respect of employment (respondent variable) and the above business factors (predictor variables).

Rationale for choosing the factors

The choice of the above factors, for the purpose of this study, was guided by the ease of availability of historic data and information needed for the assessment of relationships and correlations between the selected factors and employment over a forty-four year period. In order to investigate the critical factors impacting on employment and therefore downscaling in the gold mining industry as widely as possible; a large number of variables were selected. The theoretical importance of these factors in the gold mining industry is summarised below.

a) Employment

The South African gold mining industry is labour intensive and therefore labour plays an important role in the success of the industry. The critical role of labour in the industry has been discussed in Chapter 2, where it was shown that labour has, for many years, played a vital role in the fortunes and woes of the industry. Unlike in the coal mining industry, which is mechanised, employment levels serve as an important tool in monitoring the expansion and contraction/downscaling of the gold mining industry. In this study it is postulated that employment is affected by the following factors:

b) Gold Price

The gold mining industry sells a commodity, which is assigned a value by the market. It is this value that will determine the sustainability of the industry in terms of economic viability. Changes in the price of gold impact negatively or positively on gold mining operations in respect of perceptions from existing and potential investors, and direct revenue for the mines – this in turn affects the level of employment in the industry. The relationship between the gold price and

employment was highlighted by stakeholders (government, labour unions and employers) who blamed the low gold prices of the 1990s for the retrenchments and downscaling in the industry. It is against this background that it was considered important to use the gold price as a predictor of employment.

c) Ore milled and ore treated

The quantities of ore milled and ore treated are some of the most important factors in the gold mining industry in terms of measuring production on a mine. These factors can also provide a good indication of expansion and contraction of mining operations. In the light of the labour intensive nature of the South African gold mining industry, it was therefore postulated that there is a strong relationship between employment and the two factors.

d) Gold produced and gold grades

The primary business of gold mining is to produce gold, which (from a geological point of view) depends, amongst others, on grades of the ore being mined. The production of this gold requires the employment of people, whose numbers may increase or decrease depending on the amount of gold being produced, and availability of appropriate gold grades. It was therefore regarded important to include gold production and gold grades as some of the critical factors in examining downscaling in the gold mining industry.

e) Working revenue, working costs and working profit

Working revenue, working costs and working profits are some of the most important financial parameters in a gold mining operation. The factors can impact positively or negatively on employment and can therefore play an influential role in the downscaling of the industry. Consequently, it was regarded as important to include these factors in the analysis of downscaling in the gold mining industry by investigating their relationship with employment.

f) Productivity

Productivity can impact negatively or positively on the operations of the gold mining industry. Lower productivity often results in lower gold production, which may result in lower employment levels. Productivity is also related to employment in the sense that improvement in single factor productivity is often achieved through reduction of the number of employees, which in turn may contribute towards downscaling in the industry. Hence the inclusion of productivity as one of the critical factors in the analysis of downscaling in the gold mining industry.

g) Gold holdings by institutions and hedging by producers

According to GFMS Limited (2005), there are some 29 000 tons of gold reserves held by official institutions such as central banks and international financial institutions such as the International Monetary Fund (IMF). These reserves play a very important role in the gold market in terms of supply of gold. Some stakeholders in the industry are of the opinion that the sale of some of the reserves by the institutions plays a role in depressing the gold price and contributes towards downscaling of the gold mining industry of South Africa. It was for this reason that it was regarded important to investigate the relationship between gold mining and gold holdings by institutions.

During the author's involvement in the Gold Crisis Committee, many arguments took place about the merits and demerits of gold hedging by gold producers. The issue is not discussed in detail in this study but it is highlighted and briefly touched on.

5.2 Employment Trends in South Africa's Gold Mining Industry:

1960-2004

Employment in South Africa's gold mining industry has declined considerably over the last four decades. It dropped from 437 265 in 1960 to 186 132 in 2004 – representing a 57 per cent decline (Figure 5.1). This massive decline in employment is significant as it signals that the industry has entered a period that could eventually lead to its demise.

A historic analysis of employment in South Africa's gold mining industry, between 1960 and 2004, reveals that the gold mining industry can be subdivided into the following three major periods (between 1960 and 2004) (Figure 5.1):

- Period 1 - Stable Period (1960-1975);
- Period 2 - Expansion Period (1975-1987); and
- Period 3 - Downscaling and Crisis Period (1987-2004).

The above-mentioned three periods show distinct employment characteristics, and are largely a consequence of global and national socio-economic events. Some of the most important events are captured in Figure 5.1, and will be discussed in detail in section 5.3.

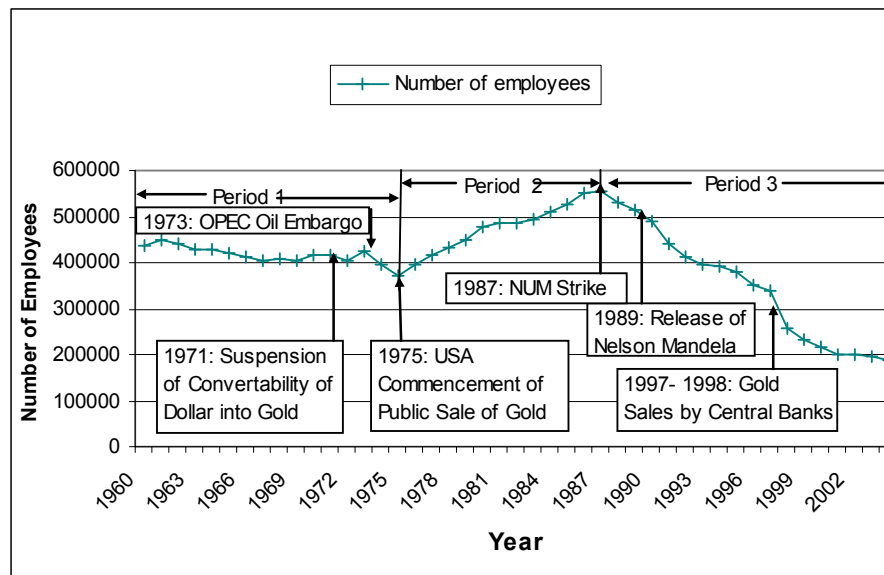


Figure 5. 1 Annual average employment, gold mining periods and major national and global events (Data Source: DME; Amey, 2006, Burranelli, 1979; Mandela, 1994).

5.3 Role of Selected Business Factors in South Africa's Gold Mines

(Note Figures 5.2 – 5.29 on pages 180 - 194)

5.3.1 Analysis of correlation of business factors with employment

As part of the investigation of the role and influence of business factors on employment, correlation coefficients analyses were undertaken. In this regard, Statistical Analysis System (SAS) software was used to perform Pearson moment correlation coefficient between employment and the above business factors – output of the data is presented in Appendices C1-C2, which should be read with Appendices A and B). The Pearson Product Moment correlation coefficient measures the strength of the linear relationship between two variables and takes on the values from -1.0 to 1.0 (Winks Statistics Software, 2008). It was therefore used in this study to measure the strength of the linear relationship between employment and the predictor variables. A strong positive correlation between employment and individual business factors will be represented by values that are closer to 1, whilst a strong negative correlation will be represented by values that are closer to -1 (Appendices C1- C2). A correlation of 0 denotes no linear association between employment and the respective factors. The correlation coefficient is considered significant if the p-value is less than 0.05.

For the Overall Period (1960-2004), the significant correlations are between: employment (Y) and nominal rand gold price per ounce (X_2); nominal rand revenue per ton milled (X_4); real rand revenue per ton milled (X_5); nominal rand working costs per ton milled (X_7); real rand working profits per ton milled (X_{10}); ore milled in tons (X_{11}); ore treated in tons (X_{12}); gold production per kilogram (X_{13}); official institutional gold holdings (X_{14}); productivity in terms of gold produced per employee (X_{15}); productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}) (Appendix C1). The insignificant correlations are a result of various factors such as abnormal fluctuations of individual variables relative to employment. For example, between 1975 and 1987 the dollar gold price was extremely irregular relative to employment levels (Figure 5.3).

With regard to Period 1 (1960-1975), significant correlations are between: employment (Y) and dollar gold price per ounce (X_1); nominal rand gold price per ounce (X_2); real rand gold price per ounce (X_3); nominal rand revenue per ton milled (X_4); real rand revenue per ton milled (X_5); nominal rand working costs per ton milled (X_7); real rand working costs per ton milled (X_8); nominal rand working profits per ton milled (X_9); real rand working profits per ton milled (X_{10}); ore milled in tons (X_{11}), productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}) (Appendix C1). The insignificant correlations between: employment (Y) and gold grades (X_6); ore treated in tons (X_{12}); gold production per kilogram (X_{13}); and productivity in terms of gold produced per employee (X_{15}) can be ascribed to the poor relationships resulting from the cyclical behaviour of the four variables relative to employment trends during Period 1 (Figures 5.9, 5.11, 5.13 and 5.27). The insignificant correlation between employment and official gold holdings (X_{14}) seems to be also related to the poor relationship between employment and official gold holdings – official gold holdings are more or less constant whilst employment declined marginally during Period 1 (Figure 5.28).

During Period 2 (1975-1887), significant correlations are between: employment (Y) and dollar gold price per ounce (X_1); nominal rand gold price per ounce (X_2); real rand gold price per ounce (X_3); nominal rand revenue per ton milled (X_4); gold grades (X_6); nominal rand working costs per ton milled (X_7); real rand working costs per ton milled (X_8); nominal rand working profits per ton milled (X_9); ore milled in tons (X_{11}), ore treated in tons (X_{12}); gold production in kilograms (X_{13}); official gold holdings in tons (X_{14}); productivity in terms of gold produced per employee (X_{15}); productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}) (Appendix C2). The correlations between employment and real rand revenue (X_5) and real rand working profit (X_{10}) are not significant seemingly due to the poor relationships and erratic nature of the latter variables relative to employment.

During Period 3 (1987-2004), significant correlations are between: employment (Y) and dollar gold price per ounce (X₁); nominal rand gold price per ounce (X₂); nominal rand revenue per ton milled (X₄); real rand revenue per ton milled (X₅); gold grades (X₆); nominal rand working costs per ton milled (X₇); real rand working profits per ton milled (X₁₀); ore milled in tons (X₁₁); ore treated in tons (X₁₂); gold production in kilograms (X₁₃); official gold holdings (X₁₄); productivity in terms of gold produced per employee (X₁₅); productivity in terms of ore milled per employee (X₁₆); and productivity in terms of ore treated per employee (X₁₇) (Appendix C2). The correlation between employment and real rand gold price (X₃); real rand working costs per ton milled (X₈); and nominal rand working profits (X₉) are not significant, seemingly due to the cyclical and erratic nature of the two variables relative to employment during Period 3 (Figures 5.6, 5.21 and 5.23).

Whilst correlation coefficients may provide an indication of the influence of individual factors on employment, the analyses are not conclusive as there are other aspects (such as the multiple effects and lag effects) that need to be taken into consideration. The multiple effect aspect will be addressed in Chapter 6, wherein regression analyses will be done to determine the influence of multiple factors on employment. With regard to the lag effect, a theoretical explanation, based on graphic observations, is accounted below.

5.3.2 Overall trend between 1960 and 2004

Gold price

The price of gold in respect of the dollar and nominal and real rand gold prices has increased significantly since the 1971 de-linking of the dollar to gold (Figures, 5.2, 5.3 and 5.4). The annual average dollar gold price increased from \$35.27 per ounce in 1960 to \$409.33 per ounce in 2004, whilst real rand gold price increased from R966.00 per ounce in 1960 to R2 639.75 per ounce in 2004 (Figure 5.2). On the other hand, the nominal rand price increased from R25.12 per ounce to R2 639.75 per ounce during the same period (Figure 5.4). However, Figure 5.2 indicates that real rand gold prices and dollar gold prices follow three distinct

trends, which approximately coincide with the three employment periods in Figure 5.1, namely; Period 1 (1960-1975), Period 2 (1975-1987) and Period 3 (1987-2004).

Figures 5.3 and 5.4 furthermore show that whilst gold prices increased considerably between 1960 and 2004, employment levels dropped significantly. The dollar, nominal and real rand gold prices increased by 1 062 per cent, 10 408 per cent and 173 per cent respectively, whilst employment dropped by 57 per cent. However, the relationship between employment and the gold price was not as simple as presented above – it differed profoundly throughout the three major periods as demonstrated by Figures 5.3 and 5.4. The relationship is further captured by the three distinct periods revealed in the scatterplot of Figure 5.5. Whilst Period 1 (1960-1975) was a fairly stable period, in respect of both employment and the gold price, the period reveals a negative correlation. Period 2 (1976-1987) reveals a positive correlation between employment and the gold price, whilst Period 3 (1988-2004) shows a negative correlation.

Ore milled

Although both ore milled and employment show an overall decline between 1960 and 2004 (Figure 5.7), ore milled declined by a mere 8 per cent, against the 57 per cent decline in employment. This implies that productivity on the mines improved considerably, especially during Period 3 – employment decreased by 66 per cent, whilst ore milled decreased by 45 per cent. Figure 5.7 also shows that ore milled tracks employment, suggesting that the quantity of ore milled was influenced by the level of employment.

Figure 5.8 shows three groups of data sets, namely; 1960-1975, 1976-1987 and 1988-2004. They coincide with the three gold mining periods identified in Figure 5.1. The correlation between ore milled and employment is significant in all four periods (Overall period, Periods 1, 2 and 3) – an indication of the strong relationship that exists between ore milled and employment in the gold mining industry. The 1960-1975 data reveals a significant negative correlation between

employment and ore milled ($r = -0.72$) - suggesting that mining companies addressed the problem of static gold prices of the pre-1975 period by increasing productivity. Conversely, the 1976-1987 and 1988-2004 data sets show strong positive correlations (respectively $r = 0.98$ and $r = 0.94$) - supporting the assertion that due to the labour intensive nature of South Africa's gold mining industry, the quantity of ore milled is strongly related to the number of employees in the industry.

Ore treated

Ore treated and employment shows an overall decline between 1960 and 2004. Ore treated declined from 66 988 to 49 000 between 1960 and 2004 – representing a 27 per cent decline, whilst employment declined by 57 per cent (Figure 5.9). As with ore milled, the three gold mining periods are revealed in the ore treated-employment scatterplot (Figure 5.10). The ore treated curve in Figure 5.9 tracks behind the employment curve – suggesting that as with ore milled, ore treated is closely related to the number of employees in the industry. Figure 5.9 reveals that trends in respect of ore treated can be subdivided into three periods, which, incidentally, coincide with the three employment periods (Period 1, Period 2 and Period 3).

Corresponding data groups exhibited in Figure 5.10 show that groups 1976-1987 and 1988-2004 exhibit a strong positive correlation (respectively $r = 0.98$ and $r = 0.94$ – once more affirming that the quantity of ore treated is strongly related to employment levels in the industry. The negative correlation shown by the 1960-1975 data ($r = -0.48$) is related to the drive by the mines to improve productivity during the relatively static gold price eras. It has to be noted that the overall decline in ore treated is in line with the overall downscaling that is currently taking place.

Gold production

Gold production dropped from 665 tons in 1960 to 341 tons in 2004, representing a 49 per cent decline - against a 57 per cent decline in employment (Figure 5.11).

However, it must be noted that production initially increased between 1960 and 1970 before commencing its downward decline during the last three decades. The overall decline in gold production is attributed to the consistently declining gold grades.

For the overall period (1960-2004), the relationship between gold production and employment shows a positive correlation ($r = 0.50$), which suggests that gold production played a role in determining the employment levels. However, as with other business factors (such as the gold price), the relationship differs from one period to another. Figure 5.12 shows three groups of data sets, which reflect the three gold mining periods. The 1960 – 1975 data (Period 1) demonstrates a period of relatively high employment and gold production, as well as poor correlation between employment and gold production. The increase in gold production during Period 1 was a consequence of relatively high grades and increasing productivity in terms of ore treated and ore milled. The 1976–1987 data reveals a negative correlation ($r = -0.86$) – a result of marginal decline in gold production and sharp increase in employment. In contrast, the 1988-2004 data demonstrate a strong positive correlation ($r = 0.94$) between employment and gold production - a scenario that was expected as mining companies had to address declining gold production (a consequence of declining grades) through downscaling.

Gold grades

Figure 5.13 reveals that the average grades of ore mined in South Africa's gold mines have been declining at a disquieting rate since 1971. Whilst gold grades increased from 10.07 g/t in 1960 to 13.68 g/t in 1966, grades leveled off between 1966 and 1971 before dropping to 4.10 g/t in 2004. Gold grades show an overall decline of 59 per cent between 1960 and 2004, which is remarkably similar to the 57 per cent decline in employment over the same period – suggesting that gold grades (critical in determining the amount of gold produced) played a vital role in determining the level of employment on the gold mines. However, the correlation between employment and gold grades is insignificant over the overall period (1960 – 2004), despite strong positive correlations in Period 3 ($r = 0.78$). The

insignificance seems to be caused by the changes in relative correlations between employment and gold grades across the three periods (Figure 5.13).

Figure 5.14 shows three groups of data sets: 1960-1975; 1976-1987; and 1988-2004. The correlation between employment and gold grades behaves in a manner similar to the correlation between employment and gold production. During Period 2, gold mines tried to counter the effects of declining gold grades by increasing employment with the aim of escalating tonnages – hence the strong negative correlation between employment and grades ($r = -0.98$), as well as between gold production and employment ($r = -0.86$). The 1988-2004 data reveals a sharp decline in employment and associated declining trends of grades and gold production - resulting in relatively strong correlations (respectively $r = 0.78$ and $r = 0.94$; Figures 5.13 and 5.14 and Appendix C2). The positive correlations between employment and gold grades, and gold production demonstrate the critical importance of gold production and gold grades in respect of employment levels during Period 3.

Working revenue

The overall nominal working revenue increased considerably between 1960 and 2004 (Figure 5.15). It increased from R8.16 per ton in 1960 to R393.53 per ton in 2004, whilst employment dropped from 437 265 to 186 132 during the same period. The inverse relationship is shown by Figure 5.15 and the negative correlation of -0.63 (Appendix C1). The relationship between nominal revenue and employment during the three gold mining periods is best demonstrated by Figure 5.16. The years 1960–1975 show fairly stable nominal revenue and marginal changes in employment levels resulting in a strong negative correlation ($r = -0.70$). The 1976-1987 data show a strong positive correlation between employment and nominal rand revenue ($r = 0.97$), whilst the years 1988-2004 show a negative correlation ($r = -0.90$). The negative correlation in Period 3 suggests that care must be taken when the influence of revenue on employment is being investigated - nominal rands have not factored the effects of inflation.

In contrast to nominal rand revenue, the relationship between employment and real rand revenue (X_5) show a positive correlation over the overall period (1960-2004, $r = 0.47$). Figures 5.17 and 5.18 show real revenue was relatively stable during Period 1 and a negative correlation exists with employment ($r = -0.60$). The stability was the result of the prevailing relatively stable real gold prices during most of that period. The sharp increase in revenue during Period 2 resulted in increased employment levels. However, due to the extreme fluctuation of revenue the correlation with employment is not significant ($p = 0.47$, Appendix C2). However the sudden decline in gold prices during Period 3 resulted in real revenue declining as well as employment – resulting in a positive correlation between employment and real revenue ($r = 0.62$; $p = 0.01$).

Working costs

Figure 5.19 reveals an overall inverse relationship between nominal working costs and employment. Nominal working costs increased from a low of R5.13 per ton milled in 1960 to R393.52 per ton in 2004, whilst employment dropped from 437 265 to 186 132 – suggesting that reduction in labour did not necessarily result in containment of nominal costs. Figure 5.20 reveals three prominent groupings; 1960–1975 ($r = -0.81$), 1976-1987 ($r = 0.95$) and 1988–2004 ($r = -0.93$). Despite the strong correlation between employment and nominal costs, care must be taken when analysing the influence of nominal costs on employment, as inflation has not been taken into consideration.

As with nominal working costs, real working costs show an overall increase between 1960 and 2004 (Figure 5.21). Real working costs increased from R197.31 per ton in 1960 to R393.52 per ton in 2004 – representing an increase of 99 per cent. The overall increase in working costs, especially during Period 2, was largely driven by increasing labour costs, which constitute a significant portion of working costs (Figure 5.22). Percentage of labour costs to total working costs increased from 39,26 per cent in 1994 to 65,43 per cent in 2004. The significant increase in labour costs between 1993 and 2004 was the cause of rapidly increasing salaries, which was largely driven by the growing strength of the

unions, who invariably negotiated and pushed for higher salaries. The strong relationship between employment and real working costs is best demonstrated by the positive correlations between the two variables during Period 2 ($r = 0.79$).

Working Profits

The importance of using deflated rand values is demonstrated by nominal and real working profits curves (Figures 5.23 and 5.24). Whilst nominal profits show an irregular upward trend (before dropping in recent years) for most of Periods 2 and 3, real profits show a fairly consistent downward trend. In fact, a graphic analysis of the two figures shows that real profits are better indicators of employment levels than nominal profits. The correlation between real profits and employment is 0.53 – a value which supports the view that real profits are critical in influencing employment levels. Real working profits curve behaves in a manner similar to employment and gold price curves in Figures 5.2 and 5.3. This clearly suggests that profitability of the mines is largely driven by the level of the gold price and that it impacts directly on employment levels. However, it should be noted that, due to the cyclical nature of real profits (X_{10}) relative to employment during Period 2, the correlation between the two variables is insignificant ($p=0.70$, Figure 5.24). The depressed real profits that persisted during Period 3 seem to have played a critical role in terms of retrenchments and downscaling. The strength of the relationship between employment and real profits is demonstrated by the positive correlation between the two variable during Period 3 ($r = 0.62$; $p = 0.01$).

Productivity

Table 5.1 shows that productivity, in terms of ore milled, ore treated, and gold produced per employee, increased considerably between 1960 and 2004: by more than hundred per cent (117%), about three quarters (72%) and more than one fifth (21%) respectively (Figures 5.25, 5.26 and 5.27). Unlike in the coal mining industry, which achieved its productivity improvements through large-scale mechanisation, productivity in the gold mining industry was achieved through the implementation of new business processes and management systems as well as

reduction of labour. The relationship between employment and productivity in respect of gold produced during Period 1 reveals an insignificant correlation ($p = 0.08$), seemingly due to the two inverse relationships between the two variables (Figure 5.27), whilst Periods 2 and 3 show strong negative correlations (respectively $r = -0.99$ and $r = -0.96$).

Table 5.1 Productivity in South Africa's gold mines (Data Source: DME; Chamber of Mines).

Year	Productivity in terms of ore milled	Productivity in terms of ore treated	Productivity in terms of gold produced
1960	147.84 tons per employee	153.20 tons per employee	1.52 kg per employee
2004	320.75 tons per employee	263.25 tons per employee	1.84 kg per employee
% Change	117% increase	72% increase	21% increase

Official sector gold holdings

Both employment and institutional gold holdings show an overall decline and a positive correlation during 1960-2004 (Figure 5.28). Gold holdings declined from 35 893 tons in 1960 to 29 100 tons in 2004 - representing a 19 per cent decline, whilst employment declined by 57 per cent during the same period. Although

gold holdings and employment in South Africa's gold mines show an overall decline, there is no conclusive evidence to suggest that reduction in gold holdings contributed to downscaling in the industry.

However, employment and gold holdings (X_{14}) show an insignificant correlation during Period 1 ($p = 0.85$). On the other hand, a significant and strong negative correlation exists during Period 2 ($r = -0.83$) - a situation which does not support the view that official gold holdings sales impact negatively on employment. The strong positive correlation ($r = 0.87$) between employment and gold holdings sales during Period 3 does not necessarily suggest that dependency exists. The simultaneous decline in gold holdings and employment seems to be rather coincidental as the rate of gold holdings decline continued to be constant throughout the period under study and no significant change happened in 1987 when downscaling commenced (Figure 5.28).

5.3.3 Period 1 - Stable Period (1960-1975)

Employment

Although employment was relatively stable during Period 1, a marginal decline in employment can be observed in Figure 5.1. Employment declined from 437 265 in 1960 to 370 595 in 1975, which represents a 15 per cent drop in employment. The relative stability in employment is ascribed to the relatively stable gold price prior to 1971. Prior to 1971, the gold price was relatively stable, resulting in a relatively stable and predictable business environment.

Gold price

Although the dollar gold price and employment levels were relatively stable during Period 1, two distinct sub-periods can be observed, namely: 1960-1971 and 1971-1975 (Figure 5.3). As previously stated, the stability within Period 1 is ascribed to the linkage of the dollar to gold, in that the dollar could be converted into gold at a fixed rate on demand (Amey, 2006). The practice of converting the dollar into gold is explained in more detail by Bordo (1981), who states that between 1946 and 1971 world countries operated under the Bretton Woods

System. In terms of this system, the USA government promised to redeem other central banks' holdings of dollar for gold at a fixed price of \$35 per ounce. However, successive actions by both Britain and the USA affected the price of gold and its role in the world economy.

Williams (1995) points out that in 1966 Britain decided to devalue its currency and closed the gold market for two weeks. These actions by Britain saw a new gold market emerging and the gold price moved to above US\$35 per ounce. In the USA persistent balance of payment deficit resulted in USA gold reserves being reduced and, as a consequence, on 15 August 1971 the then president of the USA (President Richard Nixon) proclaimed that holders of the US dollar would no longer be paid gold on demand (Bordo, 1981). Since 15 August 1971, the stability of the gold price virtually disappeared and new political and economic events began to affect the price of gold directly.

The 1971 de-linking of the dollar to gold led to further increases in the gold price. Furthermore, the 1973 OPEC Oil Embargo, created uncertainty in the global economic environment and also with the gold price, which became unstable. The gold mining industry went into a flux creating uncertainty and the desire to improve productivity; as a result employment was reduced between 1971 and 1975.

The stable nominal and real rand gold prices during 1960-1971, suggest that the exchange rate, as well as inflation, were relatively stable during this period (Figure 5.4 and 5.6). However, the de-linking of the dollar to gold, coupled with the 1973 OPEC oil crisis, resulted in an unstable dollar and nominal and real rand prices during the 1971-1975 period. Nonetheless, the overall stable gold prices during Period 1 (1960-1975) created a stable economic condition and hence the relatively stable employment levels.

Ore milled

Although an inverse relationship (negative correlation) exists between employment and ore milled during Period 1 (1960-1975), the environment was

relatively stable in respect of both factors (Figures 5.7 and 5.8). The negative correlation ($r = -0.72$) suggests that the industry addressed the problem of fixed gold prices through productivity improvement, which was largely achieved through reduction of labour force and increased tonnage of ore milled.

Ore Treated

As with ore milled, an inverse relationship exists between ore treated and employment during Period 1 (1960-1975) - suggesting an overall improvement in productivity during this period (Figures 5.9 and 5.10). Despite the negative correlation ($r = -0.48$), it can also be observed that ore treated was relatively stable during Period 1. The stability is ascribed to the relatively predictable business environment that prevailed pre-1975 – the gold price was fairly constant.

Gold Production

Trends in gold production during Period 1 can be subdivided into three sub-periods, namely: 1960-1965, 1965-1971 and 1971-1975 (Figure 5. 11). Despite declining employment, production increased between 1960 and 1965 – suggesting improvement in productivity during these years. The leveling off of ore grades during 1965-1971 resulted in relatively constant gold production and employment levels. This was followed by a decline in gold grades, which in turn dragged along gold production and employment during the 1971-1975 sub-period. The relationship between employment and gold production is not significant ($p = 0.55$) due to the two negative correlations between employment and gold production in Period 1 (Figure 5.11).

Gold grades

The relationship between employment and gold grades behaved in a similar manner to that of employment and gold production during Period 1 (Figures 5.11 and 5.13). As with the correlation between employment and gold production, the correlation between employment and gold grades is not significant ($p = 0.71$). Similarly, as with gold production and employment, the relationship between gold grades and employment can be subdivided into three sub-periods during Period 1:

1960-1965; 1965-1971; and 1971-1975 (Figure 5.13). Although an inverse relationship exists between employment and gold grades during 1960-1965, grades behaved in a cyclical manner between 1960 and 1975. They increased from 10.07 g/t in 1960 to reach a high of 13.68 g/t in 1966, and leveled off between 1967 and 1971. Subsequent to the leveling off, both gold grades and employment began to decline until 1975, when the industry decided to increase employment levels.

Working revenue

As a result of a relatively static gold price during Period 1, as well as the linkage that existed between the dollar and gold until 1971, nominal working revenues remained relatively constant for most of the period (Figures 5.15 and 5.16). As expected, the relatively constant nominal revenues were accompanied by marginally declining, but fairly stable, employment levels. Similarly, real working revenue was relatively stable between 1960 and 1971, but subsequently increased between 1971 and 1975 (Figure 5.17). The increase was in response to increasing gold prices following the de-linking of the dollar to gold. This sudden increase in the gold price seems to have resulted in the negative correlation between employment (which was in an overall downward decline) and both nominal and real revenue (respectively $r = -0.70$ and $r = -0.60$). Such relationships do not necessarily suggest that increase in revenue resulted in a decrease in employment – it is rather, the result of concerted effort by the industry to improve productivity and reduce costs. The impact of increasing revenue on employment is best identified in Period 2 (Figure 5.17).

Working costs

Although nominal and real rand working costs seemed to be fairly stable during sub-period 1960-1971, both experienced marginal increases (Figure 5.19 and 5.21). Nominal working costs increased from R5.13 per ton in 1960 to R7.88 per ton in 1971 – representing a 54 per cent rise - whilst real working costs increased from R197.31 to R231.76 – an 18 per cent increase. In response to increasing costs the industry decided to reduce employment levels - hence the inverse

relationship between employment and working costs during Period 1 (nominal: $r = -0.81$ and real: $r = -0.83$). The 1971 de-linking of the dollar to gold created an unstable period associated with increasing costs. In a bid to reduce costs and increase productivity, as well as profits, the industry reduced labour during sub-period 1971-1975.

Working profits

Although marginal increases occurred in respect of nominal and real and working profits, both factors were relatively stable during Period 1 (Figure 5.23 and 5.24). Likewise, despite the marginal decline in employment during Period 1, the period was fairly stable in terms of employment levels. The de-linking of the dollar to gold resulted in higher gold prices during sub-period 1971-1975 (Figures 5.23 and 5.24). The higher gold prices were accompanied by increasing profits, which were in turn tracked by increasing employment levels between 1972 and 1973. However, the closure of selected marginal mines and the desire to improve productivity by the industry resulted in a decline in employment during 1973-1975. The tracking of profits by employment suggests that management decisions on employment levels were primarily dictated by profitability of operations. The strong relationship between employment and nominal profits, and real profits, during Period 1 is demonstrated by negative correlations (respectively $r = -0.63$ and $r = -0.53$).

Productivity

The relationship between employment and productivity, in respect of both ore milled and ore treated, exhibits an inverse relationship during Period 1 (Figures 5.25 and 5.26). This suggests that productivity improvement was attained largely through reduction of labour, especially during sub-period 1960-1971. The ending of the convertibility of the dollar to gold in 1971, which was coincidentally associated with the commencement of the decline of gold grades, was followed by the 1971-1975 drive to improve productivity and to reduce labour. The industry did succeed in improving productivity in respect of ore milled and ore treated, but

failed in respect of gold produced – once more confirming that the economies of scale strategy did not produce desired results.

A startlingly different picture is revealed by productivity in respect of gold produced per employee during Period 1. Increasing gold grades and gold production (Figures 5.11 and 5.13), together with reduction in employment, resulted in a significant improvement in productivity during 1960-1966. However, constant gold grades and gold production, coupled with stable employment levels, resulted in relatively stable productivity during 1966-1971 (Figure 5. 27). Nevertheless, period 1971-1975 saw a decline in productivity, in line with declining gold grades and gold production – reasserting the view that improvements in productivity, in respect of ore milled and treated, did not in any way improve gold production, nor address the problem of declining grades.

The strong relationship between employment and productivity in terms of ore milled, and ore treated during Period 1, is demonstrated by the strong negative correlations (respectively $r = - 0.92$ and $r = - 0.88$) – a clear indication that improvements in productivity, in respect of ore milled and ore treated, contributed to loss of jobs during Period 1.

Official sector gold holdings

Figure 5.28 shows that Period 1 can be subdivided into two sub-periods: namely, 1960-1966 and 1966-1975. The sub-period 1960-1966 saw gold holdings increase from 35 893 tons in 1960 to 38 284 in 1966 - a 7 per cent increase. However, employment declined by 5 per cent during the same period. The increase in gold holdings between 1960 and 1966 was a consequence of the growing prosperity of European nations, who gradually increased their reserves after the Second World War (Green, 1999). According to Green (1999), central banks were major buyers of new mine production and absorbed about 45 per cent of new supply between 1948 and 1964. The inverse relationship between employment and gold holdings demonstrates that the demand for gold by central banks did not increase employment in the South African mines, despite increases in production during

1960 -1966. The correlation between employment and gold holdings over the entire Period 1 (1960-1975) is not significant ($p = 0.85$) – it seems the gold holdings behaved independently of employment during Period 1 (Figure 5.28).

5.3.4 Period 2 – Expansion Period (1975-1987)

Employment

Following the de-linking of the dollar to gold in 1971, the price of gold increased remarkably and led the industry into believing that problems relating to declining gold grades could be addressed through economies of scale – hence the rapid increase in employment. As a result, employment increased from 370 595 in 1975 to 553 549 in 1987 – representing a 49 per cent increase (Figure 5.1). Although increases in employment contributed positively to the socio-economic needs of the country and those of neighbouring countries, regrettably, it was not a sustainable strategy. The strategy of addressing the problem through economies of scale was abandoned in 1987 when the industry decided to downscale operations.

Gold price

The significant increase in the gold price during Period 2 (1975-1987) resulted in a substantial increase in employment levels (Figure 5.3, 5.4 and 5.6). The dollar gold price increased sharply from US\$161 in 1975 to US\$613 in 1980, before dropping and fluctuating between US\$317 and US\$459. Although there is some variation between nominal and real rand gold prices, both reached their respective peaks in 1980. If the high gold prices of 1980-1981 are regarded as anomalous, the peaks for the dollar and real gold prices would be 1987 and 1986 respectively - and not 1980 as is commonly accepted (Figure 5.2). Incidentally, the 1987 dollar gold price peak and the 1986 real rand gold price peak seem to, more or less, coincide with the unprecedented 1987 employment peak – suggesting that both the dollar and real rand gold prices played a vital role in determining employment levels (Figures 5.3 and 5.5).

A thorough analysis of real rand gold prices and employment trends reveals that a lag effect exists in respect of the two variables (Figure 5.6). The post-1987

decrease in employment was preceded by decline in real and gold prices that commenced after 1986 (Figure 5.6). This is not surprising as industry does not, necessarily respond, immediately to changes in gold prices.

Many global factors and events contributed to the sharp increase in the gold price during Period 2. According to a 2006 Finfacts Ireland article, the de-linking of the dollar to gold resulted in the subsequent free floating of both the dollar and gold and in January 1980 the gold price reached U\$850. The price was also propelled by the international crisis arising from the 1979 Soviet invasion of Afghanistan and the Iranian Islamic Revolution in 1979. A summary of some of the most important events that affected the gold price is presented in Table 5.2.

Ore milled and ore treated

The relatively high gold prices experienced during Period 2, resulted in the industry increasing employment levels as part of their strategy to counter declining gold grades and gold production through increased tonnage of ore milled and ore treated. As a result, a massive increase in employment, ore milled and ore treated occurred during Period 2 (Figures 5.7 and 5.9). The situation is best demonstrated by Figures 5.8 and 5.10, which show a strong positive correlation between employment and both ore milled ($r = 0.98$) and ore treated ($r = 0.98$) during period 1976-1987. It seems that the industry was under a false notion that improvement in economies of scale would address the issue of declining gold grades.

It should also be noted that the relationship between ore milled and ore treated graphically reveals a lag of approximately 2 – 3 years (Figures 5.7 and 5.9). This is due to the fact that the decision by the industry to reduce employment results in reduction in ore milled and ore treated.

Gold production

An inverse relationship occurred between employment and gold production during 1975-1987 (Figure 5.11). During this period, gold production declined by

16 per cent whilst employment increased by 33 per cent. This relationship, which is further shown by the negative correlation of group 1976-1987 ($r = -0.86$, Figure 5.12), is ironic in the sense that one would have expected that declining gold production would inevitably result in reduction in employment. However, it seems that industry responded to declining gold production by throwing labour at the problem, hoping that gold production would improve. As stated earlier, the intention was to address the problem through economies of scale. Nonetheless, this set the industry up for failure when gold production did not improve. The problem in respect of declining gold production lies with declining gold grades.

Gold grades

The continued decline in gold grades during Period 2 became a serious problem for the gold mining industry as it was an uncontrollable factor (Figure 5.13). Either the industry was caught unprepared or it preferred to underplay the problem, ignoring the problem of low grades in the hope that circumstances would improve. The former appears to provide an explanation: almost all mines were employing longwall mining methods during Period 2, making it difficult to selectively mine higher grades.

In response to this problem, the industry increased employment, in the belief that the problem could be addressed by increasing tonnage. The consequence was that massive increases in employment occurred between 1975 and 1987, despite a continued decline in gold grades and associated gold production. The conundrum is further demonstrated by Figure 5.14, which shows a strong negative correlation in respect of group 1976-1987 data ($r = -0.98$).

Table 5.2 Events that affected the gold price (Source: Amey, cited 2006; Burranelli, 1979).

1971	USA President suspends conversion of foreign officially held dollars into gold.
1972	Official USA gold price increased to \$38 per ounce and thereby devalues the dollar.
1972	On February 13 the USA devalues the dollar again and increases the official USA gold price to \$42. All currencies are allowed to float freely without regard to the price of gold. By June, the London gold price reaches \$120 dollars. OPEC oil embargo begins.
1974	USA citizens permitted to own gold bullion and coins for the first time in 40 years.
1975	USA Treasury begins public sales of gold stock.
1976	IMF begins 5-year gold sales program. IMF auctions and lower USA inflation drive prices down.
1977	Hiatus in USA Treasury gold sales sees the recommencement of rising gold prices.
1978	USA Treasury resumes its gold sales, however, demand from the Middle East pushes price upwards.
1979	Soviet Union invades Afghanistan. Revolution in Iran.
1980	Gold price peaks at historic high of \$850 per ounce on January 21. IMF completes 5-year gold sales program. A total of 25 million ounces sold to IMF members and 25 million ounces at a series of public auctions for the benefit of developing member countries.
1982-1988	Fluctuating world currency exchange rates. Increasing concern about USA trade and budget deficits and banking.
1989-1991	Conflict in the Persian Gulf and the breaking up of the Soviet Union. Erosion of gold's role as a safe haven for investors, generally weak economic conditions worldwide.
1997-1998	Central banks of several countries sell large amounts of gold holdings to meet common-currency criteria for the European Union or to demonetise. At the same time, the IMF issues a communiqué that it intends to sell some of its gold holdings to fund HIPC.

Working Revenue

As stated earlier, the de-linking of the dollar to gold dramatically increased the gold price - hence the increase in nominal rand revenue during Period 2 (Figure 5.15). Unprecedented high gold prices that occurred in 1980 are reflected by associated anomalous nominal revenues – nominal revenue jumped from R72 per ton in 1979 to R120 per ton in 1980 before dropping to R95 per ton in 1981. The increase in both employment and nominal revenue during Period 2 is also clearly demonstrated by Figures 5.15 and 5.16, with the latter revealing a strong positive correlation between employment and nominal rand revenue in respect of the 1976-1987 group ($r = 0.97$).

Similarly, both real working revenue and employment increased considerably during Period 2 (Figure 5.17). Relatively high real revenues, which were a direct result of high gold prices and not improved productivity, led to industry complacency in managing employment levels – hence the enormous increase in employment during Period 2. Although the correlation between employment and real revenue reveals an insignificant relationship ($p = 0.47$), the latter increased during Period 2 and in fact preceded a decline in employment (Figure 5.17). This clearly suggests that correlations should not be used in isolation in determining the influence of a business factor on employment.

During Period 2 increasing gold prices protected the industry from the realities and consequences of the already declining gold grades. The hype and excitement associated with high gold prices and revenues is best captured by the following statement in the Department of Minerals and Energy Affairs' 1980 Annual Report: "The continued increase in the price of gold stimulated prospecting activity. Early in the year the Deelkraal Mine commenced production and many old mines announced expansion during the year."

Working costs

The industry decision to increase labour during Period 2 invariably increased both nominal and real working costs, as is evident from Figures 5.19 and 5.21 and the

positive correlation exhibited (nominal: $r = 0.95$ and real: $r = 0.79$). The strong relationship between employment and working costs is best demonstrated by real working costs, which dropped at the same time as employment (Figure 5. 21).

Working Profits

The sharp increase in the gold price, during the 1971-1980 period, resulted in nominal profits increasing from R3.03 per ton milled (1960) to a high of R85.03 per ton milled (1980) (Figure 5.23). However, following a brief decline, nominal profits increased again, reaching a peak in 1986. Similarly, real working profits rose steeply during Period 2, reaching highs of over R800 per ton in 1980 (Figure 5.24). However, profits dropped sharply before stabilising between 1982 and 1986. It is once more ironic that whilst real working profit dropped significantly between 1980 and 1987, employment levels continued to rise. The only explanation for this paradox is that the industry continued to increase labour in the hope that an increase in ore milled and ore treated would address the problem of declining profits.

An overall analysis of Period 2 shows that both nominal and real profits show upward trends. However, the upward trend is more apparent for nominal profits than for real profits because of the fluctuation of the latter (Figures 5.23 and 5.24). Similarly, the correlation between employment and nominal profits is significant, whilst that of real profit is not (respectively $p = 0.001$ and 0.70). The latter relationship seems to be related to the cyclical nature of real profits relative to employment during period 2 (Figure 5.24). It can be noted that a reduction in employment is preceded by a reduction in nominal and real profits prior to the major downscaling that occurred after 1987 – a clear indication that profits can influence employment levels.

Productivity

Period 2 witnessed a rise in both productivity, in respect of ore milled and ore treated, primarily due to an industry drive to address declining grades and gold production through increased tonnage (Figures 5.25 and 5.26). The correlation of

the two factors with employment is 0.63 and 0.84 respectively. However, it is important to note that the rate of productivity improvement was much higher in respect of ore treated than ore milled, suggesting that increases in ore treated did not necessarily improve ore milled. Paradoxically, productivity in respect of gold produced continued to decline throughout Period 2, implying that the strategy of increasing tonnage milled and treated could not improve gold content in ores and gold production.

Official sector gold holdings

An inverse relationship is revealed between employment and gold holdings during the 1975-1986 period - gold holdings declined slightly whilst employment increased significantly ($r = -0.83$, Figure 5.28). The slight decline in gold holdings is ascribed to the fact that following the de-linking of the dollar to gold, many central banks and related institutions believed that gold's monetary role was declining and that it was no longer an important store of neither value nor an important hedge against inflation. This perception prevailed, despite rising gold prices between 1975 and 1980. The post-1980 decline in gold price did not help the situation, as it entrenched the belief that gold was no longer an important store of value – hence the continued off-loading of gold by official gold holding institutions.

Nevertheless, the decline in gold holdings did not negatively affect employment on South Africa's gold mines - gold holdings declined from 36 674 tons in 1975 to 35 612 in 1987, whilst employment increased from 370 595 (1975) to 553 549 (1987). This suggests that gold sales by central banks did not impact negatively on employment in South African mines during Period 2.

5.3.5 Period 3 – Downscaling and Crisis Period (1987-2004)

Socio-political Issues

Many reasons can be advanced to explain the sudden 1987/1988 commencement of downscaling in the gold mining industry (Figure 5.1). Nevertheless, it is apparent that a combination of events relating to economic and socio-political

factors dictated the decision to downscale. The political instability that engulfed the country during the late 1980s spilled over into the labour-intensive mining industry and gave birth to the NUM in 1982. The birth of the NUM was part of the nationwide growth of organised labour. Macun and Wood (2000) detail how South Africa's labour union membership increased at unprecedented rates throughout the 1980s. The highly politicised NUM became a force to be reckoned with and in 1987 it initiated an unprecedented 21-day wage strike. The strike created instability in the industry and could have precipitated the commencement of job losses which began in 1987 (Roger Baxter, Chamber of Mines Chief Economics, personal communication).

There is no doubt that the historic statement made by former president F W de Klerk on 2 February 1989, which he committed the then ruling party to power sharing, and the subsequent release of Nelson Mandela, also created uncertainty in the industry. The combination of this uncertainty, coupled with the massive restructuring of the entire mining industry during the mid 1990s to late 1990s impacted negatively on the industry. The industry suffered loss in terms of fixed direct investment and GDFI dropped from a high of R16 020 million in 1989 to a low of R8 560 million in 1993 (Figure 5.29). The inception of a new democratic political dispensation in the country immediately reversed the situation and GDFI began to increase steadily. However, as previously stated (Chapter 3), the relative contribution of mining to the national GDFI has recently been declining due to increased investment in other sectors. Nevertheless, it can be noted from Figure 5.29 that employment in the gold mining industry continued to decline, despite increasing GDFI. This is attributed to the fact that most of the investment was channeled into the PGM projects and not into the gold mining industry.

Employment

Although the crisis in the gold mining industry was first highlighted by the NUM in late 1996-1997, it in fact commenced a decade prior to that when employment in the gold mining industry began to decline after reaching a peak of 553 549 in 1987 (Figure 5.1). Employment dropped from 553 549 in 1987 to 186 132 in 2004

– representing a 66% decline in employment. The entire 1987-2004 period should therefore be regarded as a crisis period.

An analysis of employment trends during the downscaling and crisis period (Period 3) reveals four sub-periods, namely: 1987-1993, 1993-1997, 1997-2001, and 2001-2004. The rate of decline in employment varied from one sub-period to the other and a summary of these declines is presented in Table 5.3. Although jobs were continuously lost between 1987 and 2004, sub-periods 1987-1993 and 1997-2001 experienced significant declines in employment. Employment dropped by 28 per cent between 1987 and 1997, and by 40 per cent between 1997 and 2001. The loss of jobs during the 1997 – 2001 period was of great concern to employees, employers and government, to the extent that a gold crisis summit was held, resulting in the creation of the GCC.

Table 5.3 Employment changes during the downscaling and crisis period (1987-2004) (Data Source: DME).

Year	Jobs lost	Percentage decline in employment
1987-1993	159 041	28%
1993-1997	55 850	14%
1997-2001	136 960	40%
2001-2004	15 566	7%

Gold price

Trends in respect of the dollar gold price and employment during Period 3 can be subdivided into three sub-periods: 1987-1997; 1997-2001; and 2001-2004 (Figure 5.3). Whilst employment and dollar gold prices declined during 1987-1997 and 1997-2001, a different scenario can be observed during 2001-2004, when employment continued to decline whilst prices increased. This clearly demonstrates that, despite recent increases in the dollar gold prices, mining companies continued to reduce their workforce. Furthermore it should be noted that the sharp decline in gold price that occurred between 1997 and 2001 resulted in a massive decline in employment levels during the same period – employment

dropped by 40 per cent during that period. The above situation suggests that despite the recent inverse relationship between employment and the dollar gold price, the latter seems to have played an important role in determining the level of employment for most of Period 3. In fact, this view is supported by the overall positive correlation between employment and dollar gold price ($r = 0.62$).

With regard to the relationship between nominal rand gold price and employment, employment dropped considerably during Period 3, despite an increasing nominal rand gold price (Figure 5.4). This dichotomy shows the importance of using real rand and dollar prices when comparing historic data in assessing the performance of the gold mining industry. The drop in nominal rand gold price that occurred between 2001 and 2004 was caused by both the strengthening of the rand against the dollar and prevailing low inflation rates. However, the decline did not necessarily impact negatively on employment as the rate of decline in respect of employment was not exacerbated. Whilst nominal rand gold prices could have contributed to employment increases prior to 1987, it played little or no role in influencing employment during the post-1987 period.

Following the dramatic increase in both employment and real gold price during Period 2, both parameters declined during the earlier periods of downscaling (i.e. from 1987-1992). The relationship indicates that, unlike the nominal rand gold price, real gold prices were closely linked to employment in the earlier years of downscaling. Figure 5.6 further shows that real gold prices did not necessarily decline between 1992 and 2004 and that there was in fact a marginal increase during the period. There is therefore, no conclusive evidence that the massive retrenchments that occurred post-1992 could have been caused by declining real gold prices. In fact, the correlation between employment and real rand gold price is not significant during Period 3 ($p = 0.65$).

Based on the discussion above, it seems that of the three gold prices, the dollar gold price is the most reliable indicator of employment during Period 3 – with a positive correlation of 0.62. This suggests that the industry is more likely to react

to changes in dollar price than to rand prices, despite the well-known importance of rand prices in the operations of local mines.

Ore milled

Gold grades continued to decline unabated during Period 3 (Figure 5.13). Faced with the continued problem of declining gold grades, the industry abandoned its strategy of addressing declining gold grades through economies of scale in 1987, and immediately commenced downscaling. Employment was significantly reduced and ore milled, which tracked employment, declined to a low of 59 702 kt in 2004, after reaching a high of 113 690 kt in 1989 – representing a decline of 48 per cent. Simultaneously, labour was reduced by 60 per cent between 1987 and 2004. The relationship between employment and ore milled reveals a strong positive correlation of 0.94 – supporting the view that employment and ore milled are strongly associated.

Ore treated

The relationship between ore treated and employment behaved in the same way as that of ore milled and employment during Period 3. Both employment and ore treated declined and a positive correlation is revealed in Figure 5.10. Figure 5.9 also shows that employment, which declined by 66 per cent between 1987 and 2004, dropped more or less in tandem with ore treated – demonstrating the influence of employment levels on ore treated. The relationship between employment and ore treated reveals a strong positive correlation of 0.94 – also supporting the view that ore treated and employment are strongly associated.

Gold production

The decision by the industry to commence with downscaling and shedding of jobs resulted in employment dropping in line with declining gold production during Period 3 (Figure 5.11). This relationship is further demonstrated in Figure 5.12 (positive correlation of group 1988-2004). Production declined by 43 per cent, whilst employment declined by 66 per cent. As a result of relatively low gold grades, the decline in both gold production and employment are expected to

continue well into the future. The influence of gold production on employment is further demonstrated by the strong positive correlation that exists between the two variables ($r = 0.94$): a relationship that indicates that gold production strongly influences employment levels.

Gold grades

As part of the strategy to address declining gold grades, the industry introduced, amongst others, selective mining methods during the late 1980s. The strategy paid off, as is evident in Figures 5.13 and 5.14 - the rate of gold grades decline was substantially reduced during Period 3. Figure 5.14 shows that group 1988-2004 data exhibits fairly constant gold grades over a wide range of declining employment levels. Figure 5.13 also shows that the gold grade curve flattened between 1987 and 2004 – suggesting the industry managed to exert control on the problem of declining grades during this period. Nonetheless, a positive correlation exists between employment and gold grades ($r = 0.78$) - the relationship that provides additional support to the view that gold grades strongly influence employment levels. The same can not be said for Periods 1 and 2, when inverse relationships and other business factors played a major role in determining employment levels.

Working revenue

Nominal rand working revenue continued to increase during Period 3, whilst employment persisted with its decline. The situation is best demonstrated respectively by the inverse relationship and negative correlation that exists between employment and nominal rand revenue in Figures 5.15 and 5.16 (group 1988-2004). Although the scatterplot of real revenue and employment (Figure 5.18) does not clearly reveal the three periods shown in Figure 5.16, a positive correlation between employment and real revenue occurs in respect of 1988-1992 data. This positive correlation suggests that it was real revenue that drove the decision to reduce labour and downscale and not nominal revenue.

Real rand working revenue reveals two sub-periods during Period 3: 1987-1992; and 1992-2004 (Figure 5.17). During 1987-1992, real rand working revenue dropped more or less in tandem with employment, suggesting that declining real rand revenue was critical in influencing the level of employment in the industry. However, various management changes that were introduced during the early 1990s (including productivity improvement) stabilised real revenue and resulted in a fairly constant, but cyclical, working revenue environment during sub-period 1992-2004 (Figure 5.17). Ironically, part of this sub-period was the era of massive retrenchments when the industry complained about low gold prices.

Based on the deflated revenue data, it can be concluded that declining revenue during the early years of Period 3 acted as a catalyst for downscaling. The relationship that occurred during the early years of Period 3 is shown by the positive correlation that exists between employment and real revenue ($r = 0.62$). Despite this positive correlation, there was no significant drop in revenue during recent years and there is, therefore, no substantial evidence to suggest that declining revenue resulted in the massive job losses that took place during the 1993-2004 sub-period. However, an analysis of the entire Period 3 reveals downward trends in respect of both employment and real revenue. In addition a decline in employment after 1987 was preceded by a decline in real revenue (Figure 5.17). The above scenario points out that despite a lack of evidence that employment was influenced by real revenue in recent years, there is a satisfactory indication suggesting that real revenue played a critical role in respect of employment over the entire Period 3 – correlation is relatively strong at 0.62 and there is a downward decline in respect of both employment and real revenue trends (Figure 5.17).

Working costs

Despite job cuts that took place during the post-1987 period, nominal working costs continued to increase year after year until being briefly contained between 1998 and 2001 (Figure 5.19). In contrast, the decision to reduce labour bore fruit in respect of real working costs, with costs being contained as early as 1987

(Figure 5.21). This battle to contain costs continued throughout Period 3 (although cyclical in nature) and there is no doubt that containment of costs is still a major problem facing the industry. The increase in costs was, inter alia, largely caused by increasing labour costs in the form of salaries: hence the strategy to reduce costs through reduction of employees. However, this is always a temporary measure as salary increases soon catch up. The correlation between employment and real working costs was insignificant during Period 3 ($p = 0.67$) – this is largely due to cyclical nature of the costs during the period. Nonetheless, the early years of the period show that declining working costs were associated with reduction in employment (Figure 5.21). The subsequent years were marked by a somewhat weak relationship between employment and real working costs. This suggests that a decline in real working costs was associated with reduction in employment – however, such a scenario only happened in the early years of Period 3, which were from 1987-1992 - thereby suggesting that there were other factors affecting real working costs. Some of the factors could include rising wages and other operational costs.

Working profits

Declining employment and erratic working profits experienced during Period 3 suggest that in recent years the industry has also been battling to maintain profitability in its mines. According to the 1989 Chamber of Mines Annual Report, during 1989, six of the 33 gold mines that were members of the Chamber of Mines were in a loss-making position and the situation was expected to eventually affect up to 20 mines. Despite the erratic and cyclical behaviour of profits, the overall trend of working profits was more or less constant and depressed during most of Period 3 (1987-2004, Figures 5.23 and 5.24). However, the correlation between employment and real profits is insignificant, seemingly largely due to the erratic nature of the profits during the period. It can also be observed that an approximately 2-year lag exists in respect of employment and real profits (Figure 5.24). This is expected as the industry would not necessarily react immediately to drop in profits.

Depressed profits resulted in the industry shedding thousands of jobs during Period 3. The shedding of jobs was driven mainly by the desire to improve profits and productivity through the utilisation of a more skilful and multi-skilled labour force. This assertion is supported by the following statement in the Chamber of Mines' 2001 Annual Report: "Most of the decline in employment can be attributed to natural attrition as the industry moved from a mass employer of limited contract, unskilled labour, to an employer of permanent, mostly semi-skilled to skilled labour."

Productivity

A significant productivity improvement occurred in respect of ore milled, ore treated and gold produced during Period 3 (Figures 5.25, 5.26 and 5.27). These productivity improvements were directly related to the decision by mining companies to reduce the labour force in response to, amongst others, declining ore grades. The strong relationship between productivity and employment is revealed by the relatively strong negative correlations between employment and respective productive measures (productivity in respect of gold production: $r = -.96$, productivity in respect of ore milled: $r = -0.92$ and productivity in respect of ore treated: $r = -0.71$). It is also important to note that during 1997-2001, productivity in terms of ore treated, ore milled and gold produced increased sharply due to the massive job losses and structural management changes that took place during that period. However, the recent productivity decline in all three cases suggests that the industry has entered a critical situation, in that reduction of labour alone no longer improves productivity.

Official sector gold holdings and hedging

The depressed dollar gold price, coupled with the perception that the importance of gold as a store of value may be declining, resulted in continued sales of gold reserves during the early years of Period 3. However, the continued decline in gold holdings is now largely driven by the world-wide demand for gold, especially by the jewellery industry. Gold holding institutions seem to prefer to cash in and make the best out of the recently relatively higher gold prices.

In 2004, gold holdings by institutions (Central banks, International Monetary Fund (IMF) and World Bank etc) stood at 29 100 tons - representing 19,01 per cent of the total above-ground gold stocks of 153 000 tons (GFMS Limited, 2005). Many role players (government, industry and unions) in the gold mining industry expressed the view that speculation around the sale of gold holdings and actual sales impact negatively on the price of gold and could indirectly affect employment levels, as was the case in the late 1990s.

The following events, were sighted by most role players who participated in the GCC, as a demonstration of the negative impact of central banks' and other official gold holding institutions' actions on the gold price in early 1999:

- The 7th May 1999 announcement by the United Kingdom (UK) government about their intention to sell over half the UK's gold reserves, together with the proclamation by both the IMF and the Swiss National Bank of their intention to reduce their gold holdings resulted in speculative activities, which in turn dropped the gold price.
- The gold price fell from US\$290 on 7 May 1999 to US\$259 per ounce by 23 June 1999 - a decline of some 10,7 per cent.

Whilst most central banks' sales were motivated by a desire to reduce their gold holdings, the IMF's intention was to sell some ten per cent of its gold holdings to assist in the reduction of the debt levels of Highly Indebted Poorest Countries (HIPC's). Although the IMF and other world institutions had previously implemented several initiatives to reduce the debt of HIPC's, progress had not been satisfactory and it therefore believed that the sale of some of its gold reserves would be a more effective way of financing the debt. Van Trotsenburg and MacArthur (1999) have explained the HIPC's debt problem in detail and highlighted that, world-wide, 41 HIPC's owed some US\$170 billion (1996 dollar) in external public debt. Furthermore, Van Trotsenburg and MacArthur (1999)

stated that the debt of HIPC's was, on average, more than four times their annual export earnings and well exceeded their annual Gross Domestic Product (GNP). However, the use of IMF gold sales to finance the debt of HIPC's came under serious criticism, both in South Africa and abroad. The view was that the sale of IMF gold reserves would lead to further deterioration in the gold price, which in turn would impact negatively on some of those HIPC's who rely on gold mining for their well-being. According to a Chamber of Mines press release dated 9 July 2004, of the 41 HIPC's, over 30 were gold producers, the majority of whom depended significantly on their gold mining industry to derive crucial foreign exchange earnings. Appearing before a sub-committee of the US House of Representatives Committee on Banking and Financial Services in Washington, George Milling-Stanley (Manager, Gold Market Analysis, at the World Bank) argued that: "It would be a cruel irony if assistance that is being offered to the world's poorest countries in fact did further damage to these already troubled economies and deterred investment in gold mining which is potentially of enormous benefit to these nations" (World Gold Council, 1999).

Figure 5.28 shows that gold holdings have been declining at a steady rate since 1966. The decline continued well into Period 3, as evident by the 30 per cent drop in gold holdings between 1987 and 2004. The reduction in gold holdings seems to have coincided with the decline in employment – hence resulting in a strong positive correlation between employment and gold holdings ($r = 0.87$). Despite the positive correlation and the comments from some role players, attributing the late 1990s depressed gold prices and associated job losses to sales of gold holdings by central banks, there is no clear evidence attributing the then depressed gold price and loss of jobs to gold sales, as gold prices have recently been rising despite continued sales of gold holdings by central banks.

There are two divergent views about the role that hedging by gold producers plays in the gold market. One view is that it is an essential tool for managing risks associated with uncertainty around the future of gold prices and also allows companies to enhance their future earnings by benefiting from contango on future

gold sales (Australian Security Exchange, 2008). The other view is that hedging depresses gold prices due to the effect of spot sales (Australian Security Exchange, 2008). Hathaway (2000) supports the latter view and points out that hedging plays a role in depressing the gold price. He furthermore supports this view by pointing out that in 2000 producer hedging accelerated future supply and added as much as two years to future production.

Van Eeden (2003) also supports this view by stating that hedging causes the gold price to weaken as it increases supply when borrowed gold is suddenly sold into the spot market. He further points out that there is a belief that de-hedging strengthens the gold price because it either decreases supply when mining houses deliver production to repay loans rather than selling the gold onto the market, or the mining companies purchase gold in the market to repay their loans. In a World Gold Council sponsored publication on hedging, Cox and Emsley (1998) agree that the significance of “accelerated selling” caused by hedging cannot be completely discounted. However, they point out that the issue of hedging should be looked at in the context of a gold market that often involves simultaneous selling of gold by a multitude of role players such as central banks, investors and speculators. Cox and Emsley (1998) further suggest that producers’ hedging activities play an insignificant role in the gold market because of its relatively small size.

The above arguments suggest that the effect of hedging on the gold price needs to be investigated in more detail. Nonetheless, if the view that hedging has a negative influence on the gold price is accepted, it can be assumed that the practice indirectly contributed to the downscaling in the gold mining industry of South Africa.

5.4 Discussion

The gold mining industry has, for many years, played a vital role in the South African economy. However, in recent years the industry reached its peak, in terms of growth, and has now entered a downscaling period (Figure 5.1). Whilst gold

production reached its peak in 1971 (Figure 5.11), actual downscaling in the industry commenced after 1987 when employment levels began to drop from a high of 553 549 in 1987. The industry has since been shedding jobs and also downscaling its operations.

Socio-political issues

Although downscaling is a consequence of a combination of several business factors, the situation was exacerbated by socio-political events prevailing in South Africa during the 1980s and the 1990s (Figure 5.1). The 1980s political instability, coupled with the unprecedented NUM industrial strike in the mining industry in 1987 acted as a catalyst for downscaling. The country was in political turmoil and the government imposed a State of Emergency in both 1987 and 1988 (Mandela, 1994). The situation was furthermore aggravated by the uncertainty and political void created between 1989 and 1994 - the period between the release of Nelson Mandela and the first democratic elections.

Investment in the mining industry

The pre-1994 political uncertainty resulted in companies cutting down on new investment and embarking on labour reduction. This notion is supported by Figure 5.29, which shows that real GDFI in mining declined significantly between 1989 and 1993. However, the establishment of the first democratic government in 1994 created political certainty and resulted in GDFI in mining increasing (Figure 5.29). However, it has been pointed out by the Chamber of Mines and other role players that GDFI has been declining in recent years due to delays experienced in issuing of exploration and mining rights. However, the DME has pointed out that this matter has since been addressed.

Nonetheless, it is significant to note that increases in real GDFI happened against the background of controversies and disagreements in respect of the review of the minerals and mining policy, which commenced in September 1995 when the government led Mineral Policy Process Steering Committee was established. The new mining code, implemented in 2004, pivots around the principle of “use it or

lose”. In terms of this principle, mining companies are required to utilise their unused mineral rights or face the risk of losing them. The principle of “use it or lose it” did benefit South Africa to some extent as new investors rushed to secure rights relinquished by large South Africa companies such as Anglo Platinum. In addition, established South African companies were forced to commence exploration on previously hoarded mineral rights. The effect of the new mining code is demonstrated by Table 5.4, which shows that South Africa’s exploration expenditure increased from US\$53.2 million in 2001 to US\$207.9 in 2004 (Metal Economics Group, 2005). However, it is of great concern to note that South Africa’s proportion of worldwide expenditure dropped from 8,1 per cent in 2003 to 4,3 per cent in 2005 (Table 5.4). This suggests that, despite increases in exploration expenditure, South Africa is losing out in respect of share of global exploration expenditure.

It is, furthermore, of great concern that the gold mining industry does not seem to be attracting significant exploration expenditure. The industry attracted only 10 per cent of (US\$ 20.3 million) of the 2005 allocations for South Africa, with more than half of the funding going into minesite related work (Metals Economics Group, 2005). Furthermore, the Metals Economics Group 2005 report shows that the main beneficiaries of exploration expenditure in 2005 were the PGMs industry (at about 43 per cent) and the diamond industry (at 42 per cent).

Table 5.4 South Africa’s exploration expenditure (Source: Metals Economics Group, 2005).

Year	2001	2002	2003	2004	2005
SA percentage of worldwide exploration expenditure	3.7	4.7	8.1	5.5	4.3
Amount spent on SA exploration in millions (US\$)	53.2	58.4	127.6	194.9	207.9
Worldwide ranking	9 th	7 th	4 th	5 th	7 th

Overall trends from 1960-2004

Continued depressed gold prices in both dollar and real rand terms seem to have played a major role in influencing downscaling in the industry. Figures 5.3 and 5.6 demonstrate the influence of depressed gold prices on employment – employment trends seem to mimic the trends of dollar and real rand gold prices for most of the 1960-2004 period. However, as pointed out earlier, the correlations between employment and dollar gold price as well as real rand price, are surprisingly insignificant over the overall study period (respectively $p = 0.74$ and $p = 0.42$) – a clear indication that the relationship between employment and gold price is complex – it differs from one period to the other (Figures 5.3, 5.4 and 5.6). These differences across the three major periods are created by changes in the relative relationships between employment and dollar gold price, and real rand gold price.

The relationship between employment and the gold price, demonstrates that prices (especially the dollar and real rand gold prices) are amongst the most important critical factors that determine employment levels in the gold mining industry. The critical importance of the gold price is best demonstrated by the dollar gold price and the real rand gold price – with the dollar gold price proving to be the better indicator of the two. The nominal gold rand gold price seems not to be an ideal indicator of employment levels due to the fact that data is not deflated and employment seems not to respond to these prices (Period 3, Figure 5.4).

Table 5.5 reveals that eight factors show an overall decline between 1960 and 2004, namely: employment, ore milled, ore treated, gold production, gold grades, nominal and real working profits and official sector gold holdings. Most major declines (if ≥ 30 per cent is assumed to be major) were experienced in respect of: employment (57%), gold production (49 %), gold grades (59%), and nominal and real working profits (100%). The massive 59 per cent decline in gold grades is the critical factor responsible for the decline in gold production, working profits and employment - and therefore of downscaling. It is significant to note that despite the critical importance of gold grades to employment levels, the overall

correlation (over the entire period 1960-2004) between gold grades and employment is weak, due to the fact that the relative relationship between the two parameters changed over time, due to different business tactics. For example, as stated earlier, the negative correlation that existed between gold grades and employment during Period 2 was largely driven by the economics of scale strategy. This situation makes it difficult to use gold grades as a sole predictor of employment.

Major gold mining periods

Due to the labour intensive nature of South Africa's gold mining industry, expansion and contraction of the industry can best be demonstrated by employment trends. It is against this background that the following three major periods were identified (Figure 5.1):

Period 1 (1960-1975) - Stable Period

Period 2 (1975-1987) - Growth Period

Period 3 (1987-2004) - Downscaling and Gold Crisis Period

Period 1 – Stable Period: Period 1, referred to as the Stable Period, was a period of relatively stable employment levels (Figure 5.1). The stability was a result of the, then prevailing, relatively constant gold price for most of Period 1. The dollar gold price was fixed at US\$35 per ounce from 1934 until 1966 when Britain devalued its currency (Williams, 1995). These actions, coupled with the 1971 de-linking of the dollar from gold, and the global economic uncertainty created by the 1973 OPEC oil embargo, resulted in the gold price increasing significantly between 1971 and 1975 (Figures 5.2, 5.4 and 5.6).

Table 5.5 Summary of trends during 1960-2004 in respect of selected business factors.

Overall Decline between 1960-2004		Overall Increase between 1960-2004	
Business Factor	%	Business Factor	%
Employment	57%	Dollar Gold Price	1060%
Ore milled	7.7%	Nominal Rand Gold Price	10408%
Ore treated	27%	Real Rand Gold Price	173%
Gold Production	49%	Nominal Working Revenue	4722%
Gold Grades	59%	Real Working Revenue	25%
Nominal Working Profits	100%		
Real Working Profit	100%	Nominal Working Costs	7571%
Official Sector Gold Holdings	19%	Real Working Costs	99%
		Productivity in respect of ore milled	117%
		Productivity in respect of ore treated	72%
		Productivity in respect of gold produced	21%

The relatively stable gold price between 1960 and 1971 resulted in relatively stable revenues and profits during that period (Figure 5.15, 5.17, 5.23 and 5.24). However, the subsequent increase in prices, between 1971 and 1975, were accompanied by a significant increase in revenues and profits, despite increasing working costs. Table 5.6 shows that all but three factors (employment, gold grades and official sector holdings) increased during the 1960-1975 period, suggesting that, despite an increase in costs, the period was a relatively good one for the gold mining industry. The 15 per cent reduction in labour during Period 1 can be directly attributed to declining grades, which resulted in some marginal operations closing down (Camerer, 1964). The two per cent marginal decline in official sector gold holdings did not have any obvious significant impact on the industry and employment.

Figure 5.13 shows that gold grades commenced their decline during Period 1. This commencement in the decline of gold grades was in fact the source of the problems that the gold mining industry is currently facing. After increasing between 1960 and 1966, gold grades plateaued, then began a downward decline. The industry countered declining gold grades and the impact of relatively static gold prices and increasing real costs by reducing employment, increasing productivity and increasing tonnage of ore milled and ore treated.

Table 5.6 Summary of trends during 1960-1975 (Period 1) in respect of selected business factors.

Overall Increase between 1960- 1975		Overall Decline between 1960-1975	
Business Factor	%	Business Factor	%
Dollar Gold Price	357%	Employment	15%
Nominal Rand Gold Price	370%	Gold Grades	7%
Real Rand Gold Price	122%	Official Sector Gold Holdings	2%
Ore Milled	15%		
Ore Treated	12%		
Gold Production	7%		
Nominal Working Revenue	322%		
Real Working Revenue	95%		
Nominal Working Costs	270%		
Real Working Costs	75%		
Nominal Working Profits	486%		
Real Working Profits	177%		
Productivity in respect of ore milled	35%		
Productivity in respect of ore treated	32%		
Productivity in respect of gold produced	27%		

Period 2 – Expansion Period: A massive expansion of the gold mining industry, in employment growth and a number of other business factors, occurred during Period 2. This expansion was mainly driven by an increase in gold prices that occurred throughout most of the period. The following factors showed an overall increase between 1975 and 1987 (Table 5.7):

- Employment;
- Dollar gold price;
- Nominal rand gold;
- Real rand gold price;
- Ore milled;
- Ore treated;
- Nominal rand working revenue;
- Real rand working revenue;
- Nominal rand working costs;
- Real rand working costs;
- Nominal rand working profits; and
- Productivity in respect of ore treated.

Despite the strong gold price, the problem of declining gold grades and gold production persisted throughout Period 2. It seems that in a bid to address the problem, and in the belief that economies of scale would provide the necessary solutions, the industry increased employment, ore milled and ore treated – these increased by 49 per cent, 45 per cent and 58 per cent respectively between 1975 and 1987.

The strong positive correlations between ore milled and employment ($r = 0.98$) and ore treated and employment ($r = 0.98$) during Period 2, suggest that there is a strong relationship between employment and the two factors. The delay in response in respect of the relationships between employment and ore milled, and ore treated, indicates that care must be taken when interpreting correlations and impacts of individual variables on employment, especially on an annual basis.

Period 2 saw a consistent decline in gold production and gold grades, which became a serious problem for the gold mining industry (Figures 5.11 and 5.13). As stated earlier, the industry was probably caught unprepared, as it continued to increase employment despite production and grades. The conundrum is further demonstrated by Figures 5.12 and 5.14, which show strong negative correlations between employment and gold production, and gold grades, in respect of group 1976-1987 data (respectively $r = -0.86$ and $r = -0.98$).

As stated earlier, the de-linking of the dollar to gold dramatically increased the gold price - hence the increase in nominal and real rand revenue during Period 2 (Figures 5.15 and 5.17). The increase in revenue was accompanied by an increase in employment - hence the strong positive correlation between employment and nominal rand revenue during Period 2 ($r = 0.97$). However, despite the insignificance of the correlation between employment and real rand revenue ($p = 0.47$), the two variables increased substantially during Period 2 (Figure 5.17). Based on the aforementioned discussions, it can be concluded that revenue is one of the critical factors influencing employment levels.

The tactical decision by the industry to increase labour, during Period 2, resulted in increased working costs - hence the positive correlations between employment and working costs (nominal: $r = 0.95$ and real: $r = 0.79$). The correlations affirm the existence of the strong relationship between employment working costs.

Both nominal and real profits show upward trends (Figures 5.23 and 5.24). The insignificance of the correlation between employment and real rand profits is due to the erratic nature of the real rand profits and does not necessarily suggest that real profits do not influence employment. It is also evident that decline in real profits preceded the post-1987 reduction in employment - thereby indicating that the industry does not react immediately to declining real profits.

There is an inverse relationship between productivity in respect of ore milled and ore treated, largely due to the tactic by the industry to address declining grades

and gold production through increased tonnage (Figures 5.25 and 5.26). On the other hand, productivity in respect of gold produced declined significantly throughout Period 2 – suggesting that the tactic of increasing tonnage milled and treated could not improve gold content in ores and gold production. It can be observed that productivity improvement (in respect of ore milled and treated) during Period 2 did not impact negatively on employment. However, productivity improvement in respect of ore milled and ore treated did not improve productivity in respect of gold production. There is no evidence to suggest that productivity improvement played a role in determining employment levels during Period 2.

The decline in gold holdings during Period 2 did not negatively affect employment on South Africa's gold mines - gold holdings declined from 36 674 tons in 1975 to 35 612 in 1987, whilst employment increased from 370 595 (1975) to 553 549 (1987). This suggests that gold sales by central banks did not impact negatively on employment in South African mines during Period 2.

Table 5.7 Summary of trends during 1975 -1987 (Period 2) in respect of selected business factors.

Overall Increase between 1975- 1987		Overall Decline between 1975-1987	
Business Factor	%	Business Factor	%
Employment	49%	Gold Production	16%
Dollar Gold Price	177%	Gold Grades	43%
Nominal Rand Gold Price	666%	Real Working Profits	20%
Real Rand Gold Price	66%	Productivity in respect of ore milled	3%
Ore Milled	45%	Productivity in respect of gold produced	44%
Ore Treated	58%	Official Sector Gold Holdings	3%
Nominal Working Revenue	366%		
Real Working Revenue	20%		
Nominal Working Costs	40%		
Real Working Costs	9%		
Nominal Working Profits	269%		
Productivity in respect of ore treated	6%		

Period 3 – Downscaling and gold crisis: Period 3 experienced contraction of the industry in respect of operations and, most importantly, employment - hence the period being referred to as the downscaling and gold crisis period (Table 5.8). The strategy of addressing declining grades and gold production through economies of scale could only be sustained by high gold prices. The sudden decline in the dollar and real rand gold price, coupled with increasing costs, as well as the then unstable political environment created serious problems for the industry. In a bid to address these problems, which were exacerbated by already declining gold grades and gold production, the industry elected to reduce the number of employees, which resulted in declining quantities of ore milled and ore treated. The combination of rising real costs, declining gold grades, declining gold production, declining productivity in respect of gold production and depressed gold prices impacted negatively on the South African gold mining industry, to the extent that a gold crisis was declared by government, labour unions and business in 1996.

During the early years of Period 3, industry role players raised their concern about the sale of gold by central banks and the IMF, pointing out that these sales impacted negatively on the gold price, which in turn resulted in job losses. Whilst this view could have been well-founded during the late 1990s, gold prices were relatively high in recent years, despite the continued decline in gold holdings by major central banks. The current positive correlation that exists between declining employment and declining gold holdings seems to be coincidental and there is no direct linkage between the two parameters. Although hedging was not investigated in detail in this study, it is apparent that the matter requires thorough investigation as there are currently two views about the impact of hedging on the gold price. One view suggests that hedging can increase the supply of gold (through forward selling) and consequently depresses the gold price – the other view states that it is a necessary tool for the gold mining industry, as it provides the industry with protection against future uncertainties.

Table 5.8 Summary of trends during 1987-2004 (Period 3) in respect of business factors.

Overall Increase between 1987-2004		Overall Decline between 1987-2004	
Business Factor	%	Business Factor	%
Nominal Rand Gold Price	192%	Employment	66%
Nominal Working Revenue	145%	Dollar Gold Price	8%
Nominal Working Costs	315%	Real Rand Gold Price	26%
Productivity in respect of ore milled	65%	Gold Grades	22%
Productivity in respect of ore treated	23%	Ore Milled	45%
Real working costs	5%	Ore Treated	58%
		Gold Production	43%
		Real Working Revenue	38%
		Nominal Working Profits	100%
		Real Working Profits	100%
		Productivity in respect of gold produced	67%
		Official Sector Gold Holdings	30%

5.5 Summary

In summary, a historic analysis of South Africa's gold mining industry reveals three major periods between 1960 and 2004. The periods have been described as:

- Period 1 (1960 – 1975) – Stable Period
- Period 2 (1975 - 1987) – Growth or Expansion Period
- Period 3 (1987 - 2004) – Downscaling and Gold Crisis Period

It was demonstrated, in the discussions in this chapter, that individual factors (eg gold price) behaved differently across the above three periods. Consequently, the relationship between employment and respective factors differs from one period to another. For example, the dollar gold price was relatively stable during Period 1 and increased during Period 2 but subsequently declined during Period 3. Similarly, employment levels were relatively stable during Period 1 and increased during Period 2 and subsequently declined during Period 3.

The stable period (Period 1) was a consequence of relatively stable gold prices, which largely contributed to stable employment levels during the period. On the other hand, the expansion period (Period 2) was largely driven by relatively high gold prices and the desire by industry to address declining gold production through economies of scale. The expansion period involved considerable increase in employment, ore milled and ore treated.

The downscaling period (Period 3) is a consequence of a combination of socio-political and economic factors. Socio-political factors included the 1980s political instability and the 1987 unprecedented NUM industrial strike. These events seem to have precipitated downscaling, which took place post the 1987 period – political uncertainty resulted in companies reducing new investment and embarking on labour reduction. Economic factors included, inter alia, depressed dollar and real rand gold prices, declining gold grades, gold production, nominal and real rand profits, and real rand revenue. Whilst a combination of several factors played a role in causing downscaling, it is apparent that gold grades, which began declining during Period 1 (Figure 5.13), and depressed gold prices, seem to

be the primary economic factors that brought about the problems that the gold mining industry is currently facing. After increasing between 1960 and 1966, gold grades plateaued and began a downward decline – a decline which eventually resulted in progressively lower quantities of gold production, lower revenue and profits. Consequently, the industry cut down on labour, and both ore milled and ore treated declined significantly – resulting in massive contraction of the industry. With regard to the gold price, both real rand prices and dollar gold prices were depressed during Period 3, following their relatively high levels during Period 2.

In summary, major findings and conclusions in respect of the relationship between employment and business factors, in South Africa's gold mining industry, are discussed below:

a) Gold Price

- Relatively stable gold prices contributed to the relatively stable employment levels during Period 1 (Figures 5.3, 5.4 and 5.6). The relationship suggests that changes in employment levels can be influenced by changes in the price of gold.
- There was approximately a 1-year lag in respect of the relationship between employment and real rand gold price (Figure 5.6). A decrease in the real rand gold price was followed by a decrease in the number of employees, after a one year period, as demonstrated in Figures 5.6 (note: the highest level of employment was attained in 1987 and was preceded by a peak in real rand gold price in 1986). This suggests that the industry takes one year to react to the effects of changing real rand gold prices.
- Nominal rand gold prices did not necessarily provide a good indication of employment levels, as shown by the inverse relationship that exists in Period 3 (Figure 5.4). A situation that suggests that one has to be cautious when determining the influence of nominal rand gold price on employment.
- Dollar and real rand gold prices seem to be plausible gold price indicators of employment – the trends of the two factors mimic employment trends.

However, the relationship between the two factors and employment varies across the three mining periods. For example, in Period 3, the dollar gold price and employment have a strong correlation of 0.62 and $p = <0.01$, whilst the relationship between real rand gold price and employment is insignificant during Period 3 ($p = 0.65$).

b) Ore milled and ore treated

- Trends of ore milled and ore treated, more or less, mimic employment trends across the three gold mining periods (Figures 5.7 and 5.9).
- An increase in ore milled and ore treated was strongly associated with an increase in employment (both had strong correlations of 0.98 during Period 2, Appendix C2) - with ore milled and ore treated tracking employment levels by approximately 2 years (Period 2, Figures 5.7 and 5.9).
- A decrease in ore milled and ore treated was strongly associated with declining employment (both had strong correlations of 0.94 during Period 3) – ore milled and ore treated tracks employment levels by about 2-3 years (Period 3, Figures 5.7 and 5.9).
- The above relationships suggest that the quantities of ore milled and ore treated are strongly related to employment levels in the gold mining industry. This is expected, as the industry is labour intensive.

c) Gold production

- Gold production has been steadily declining since the end of Period 1 (Figure 5.11).
- An increase in gold production did not necessarily increase employment (Period 1, Figure 5.11), but a continuous decline in gold production eventually resulted in decline in employment during Period 3 (Figure 5.11).
- During Period 3, gold production and employment were strongly related and had a strong positive correlation of 0.94. This relationship demonstrates that declining gold production played an influential role in employment reduction and therefore contributed to downscaling.

d) Gold grades

- Gold grades have been steadily declining since the end of Period 1 (Figure 5.13).
- An increase in gold grades did not necessarily contribute to increase employment (Period 1, Figure 5.13) but a continuous decline in gold grades eventually resulted in decline in employment during Period 3 (Figure 5.13).
- During Period 3, gold grades and employment were strongly associated and had a strong correlation of 0.78 – this clearly demonstrates that gold grades influenced employment and contributed to downscaling.

e) Working Revenue

- Relationship between employment and revenue is best demonstrated by real rand revenue (Figure 5.17). Substantial decrease in real rand revenue is associated with a substantial decrease in employment (Period 3, Figure 5.17).
- Relatively stable revenue was accompanied by relatively stable employment levels (Period 1; Figures 5.15 and 5.17) and a significant change in revenue resulted in major changes in employment (Periods 2 and 3; Figure 5.17).
- A lag of approximately 2 years can be observed in respect of the relationship between employment and real rand revenue (Figure 5.17). For example, the downscaling that commenced after 1987 was preceded by a decline in real rand revenue as shown in Figure 5.17.
- The relationship between real rand revenue and employment reveals a strong positive correlation of 0.62 during Period 3.
- Based on the above observations, it can be concluded that real rand revenue played an influential role in determining the employment levels and downscaling of Period 3.

f) Working Costs

- Fairly slight change in working costs was accompanied by relatively stable employment levels (Period 1, Figures 5.19 and 5.21).
- Significant rise in working costs was closely associated with increase in employment during Period 2 (Periods 2 and 3; Figures 5.19 and 5.21).
- The irregular nature of real rand costs during Period 3 resulted in an insignificant correlation between employment and real rand costs ($p = 0.67$; Figure 5.21).

g) Working Profits

- Relatively stable profits were accompanied by relatively stable employment levels (Period 1, Figures 5.23 and 5.24) and significant change in profits was accompanied by major changes in employment (Period 2, Figures 5.23 and 5.24).
- A lag of about 2 years exists in respect of the relationship between employment and real rand profits (Figure 5.24).
- The relationship between working profits and employment is best demonstrated by real rand working profits (Figure 5.24). There is a positive correlation between employment and real working profits during Period 3 ($r = 0.62$), suggesting that a strong influential relationship exists between the two variables (Figure 5.24).

h) Productivity

- Improvements in productivity in respect of ore milled and ore treated was associated with marginal decline in employment during Period 1 (Period 1, Figures 5.25 and 5.26). This suggests that improvement in productivity involved reduction of employment levels.
- Improvements in productivity in respect of ore milled and ore treated did not result in decline in employment during Period 2 (Period 2, Figures 5.25 and 5.26). This suggests that other factors played a role in respect of productivity improvement.

- Despite consistent improvements in productivity (in respect of ore milled and ore treated) during Periods 1 and 2, productivity in respect of gold produced dropped significantly after 1970 (Figures 5.25, 5.26 and 5.27). The dichotomy is related to the economies of scale strategy that was largely employed during Period 2.
- The drop in productivity during the post-2002 period is probably due to the fact that productivity could no longer be largely improved by reduction of employment alone – other factors have to be taken into consideration (Period 3, Figures 5.25 and 5.26).
- Major improvement in productivity was associated with major decline in employment and downscaling during Period 3 (Figures 5.25, 5.26 and 5.27, early years of Period 3).
- It can therefore be concluded that, during the downscaling period (Period 3), productivity improvement involved reduction of the number of employees.

i) Institutional Gold Holdings

- Institutional gold holdings declined consistently from the beginning of Period 2 (Figure 5.28).
- There is no conclusive evidence that the decline in gold holdings negatively affected employment. In fact, during Period 2, employment levels increased despite decreasing gold holdings.

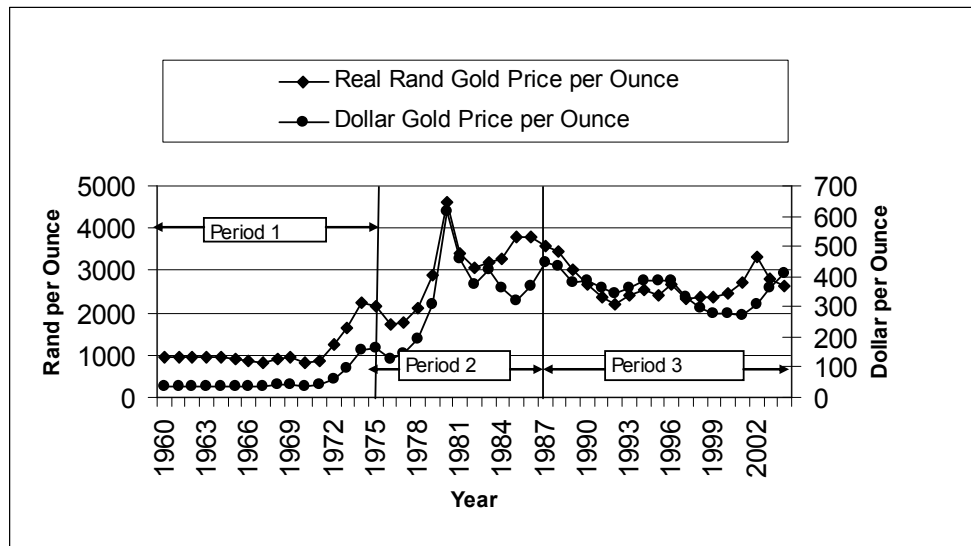


Figure 5.2 Annual average dollar gold price and real rand gold price: 1960-2004 (2004=100) (Data Source: DME).

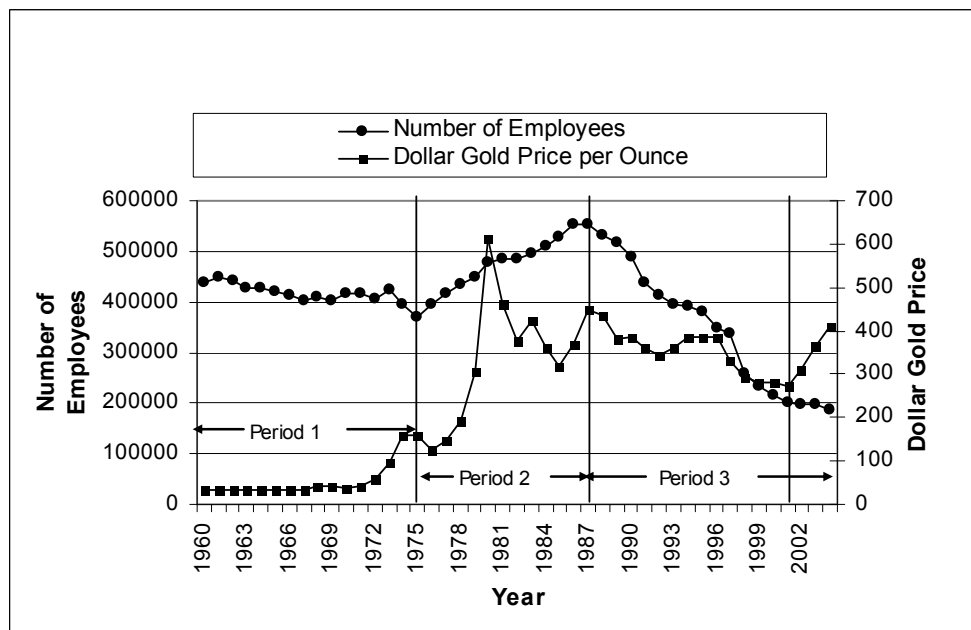


Figure 5.3 Annual average dollar gold price and annual average employment: 1960-2004 (Data Source: DME).

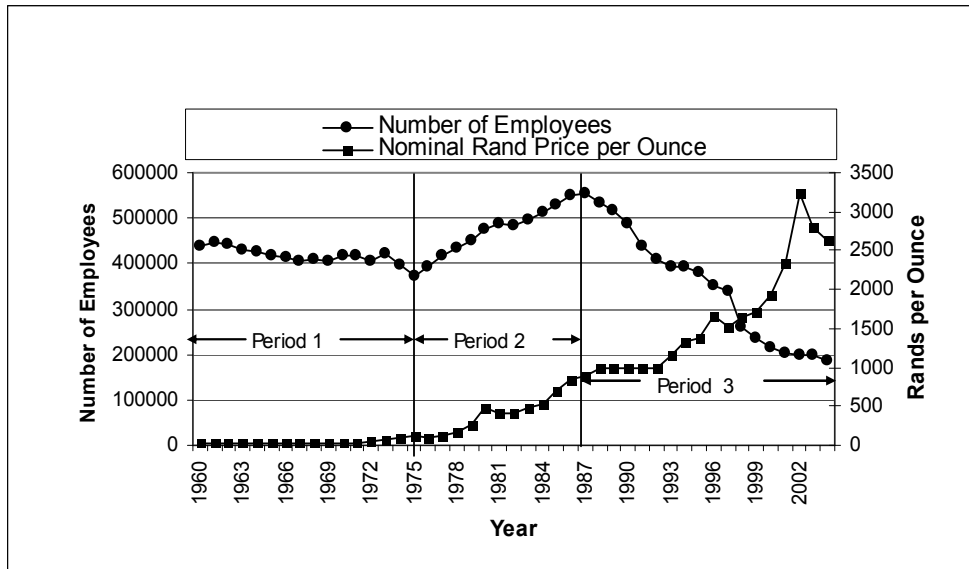


Figure 5.4 Annual average nominal rand gold price and annual average employment: Linear chart for 1960-2004 (Data Source: DME).

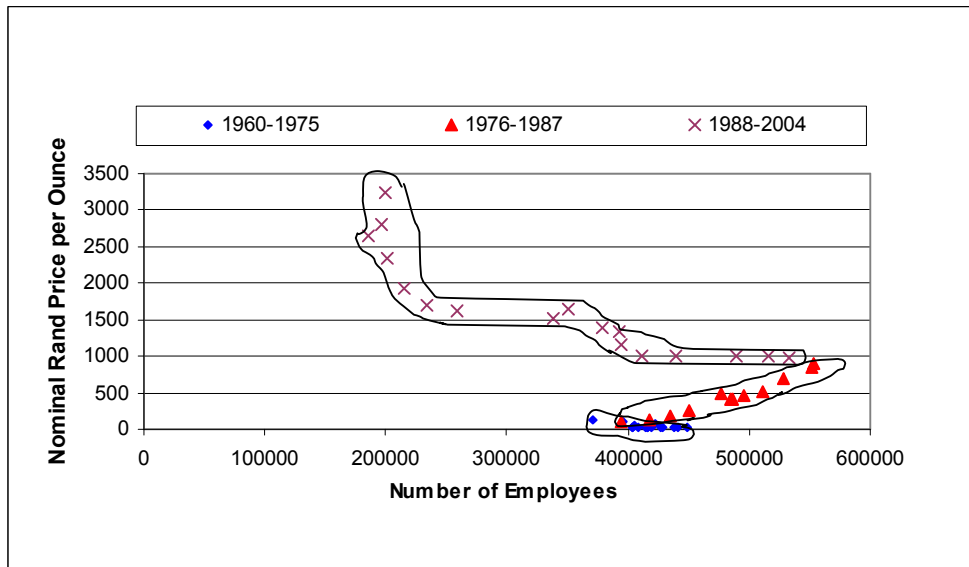


Figure 5.5 Annual average nominal rand gold price and annual average employment: Scatterplot for 1960-2004 (Data Source: DME).

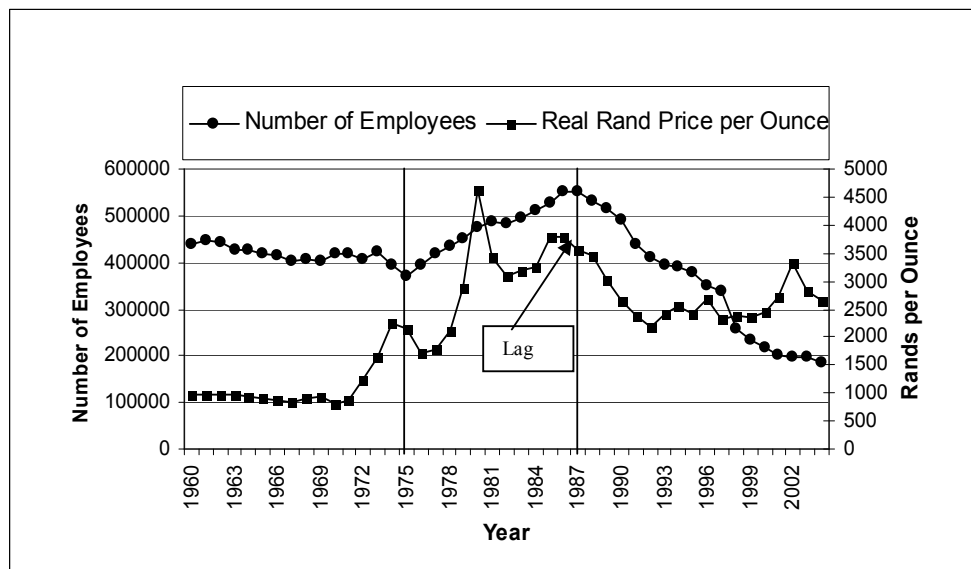


Figure 5.6 Annual average real rand gold price and annual average employment: Linear chart for 1960-2004 (2004=100) (Data Source: DME).

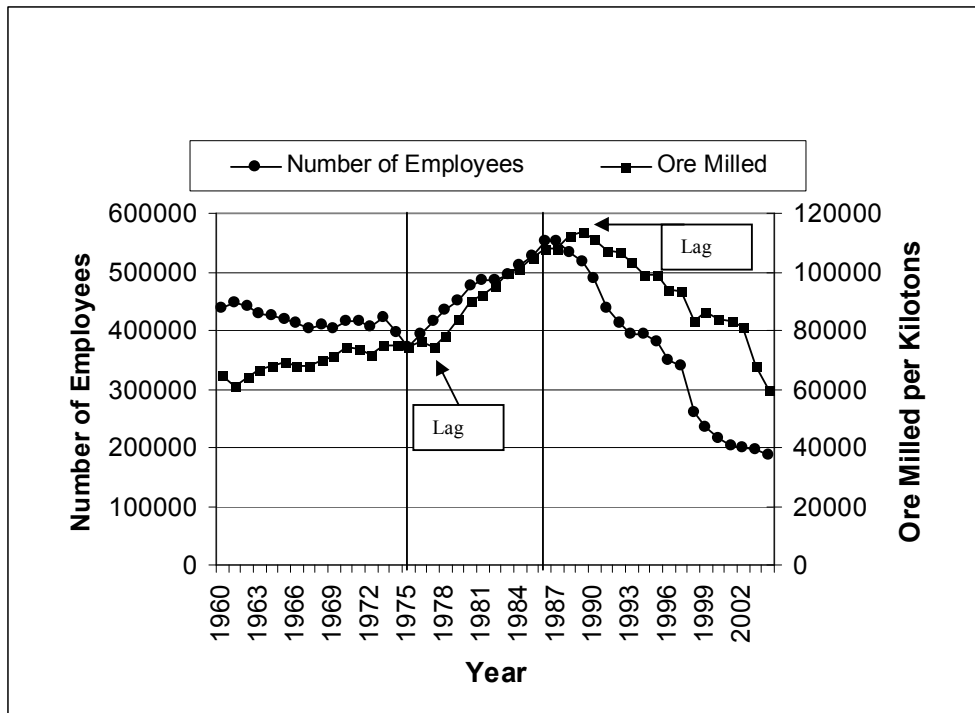


Figure 5.7 Annual average ore milled and annual average employment:
Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

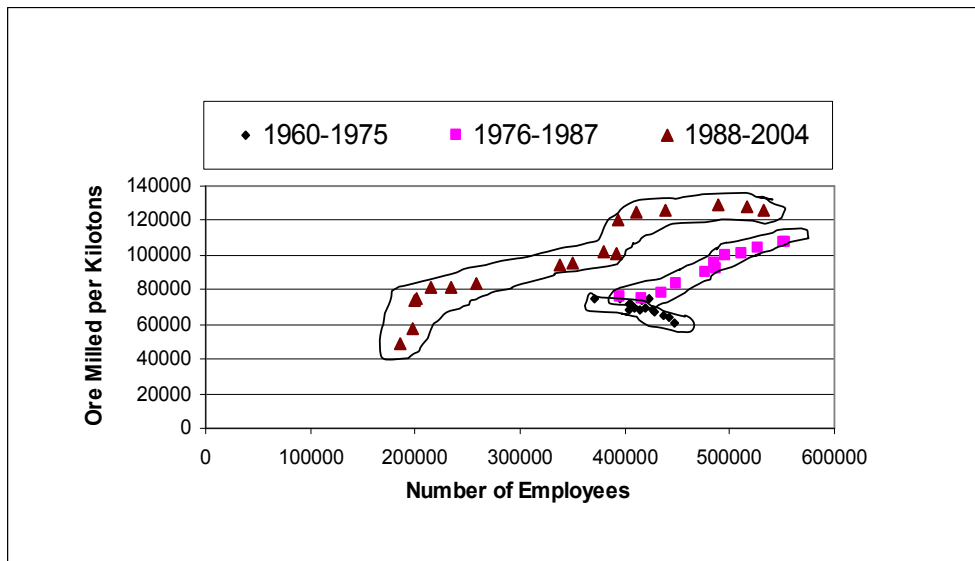


Figure 5.8 Annual average ore milled and annual average employment:
Scatterplot for 1960-2004 (Data Source: Chamber of Mines; DME).

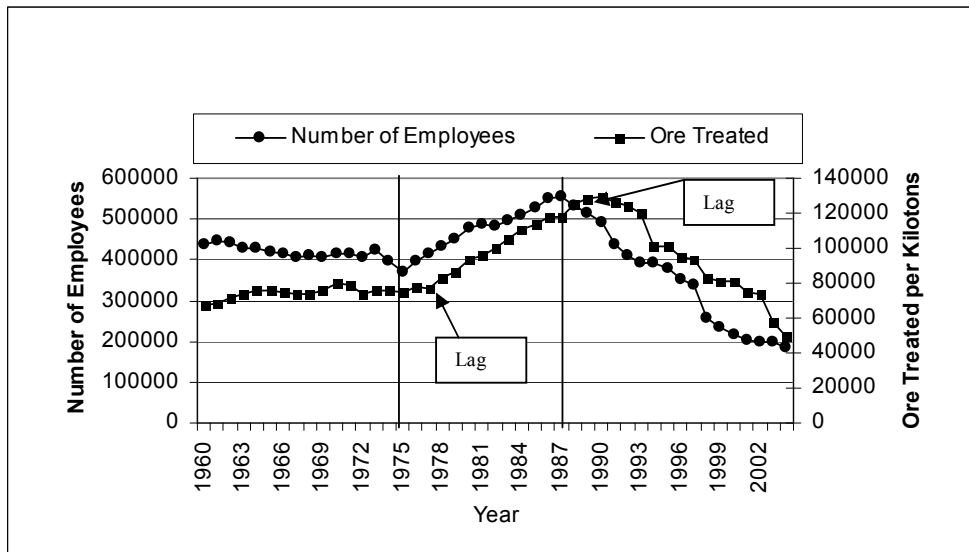


Figure 5.9 Annual average ore treated and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

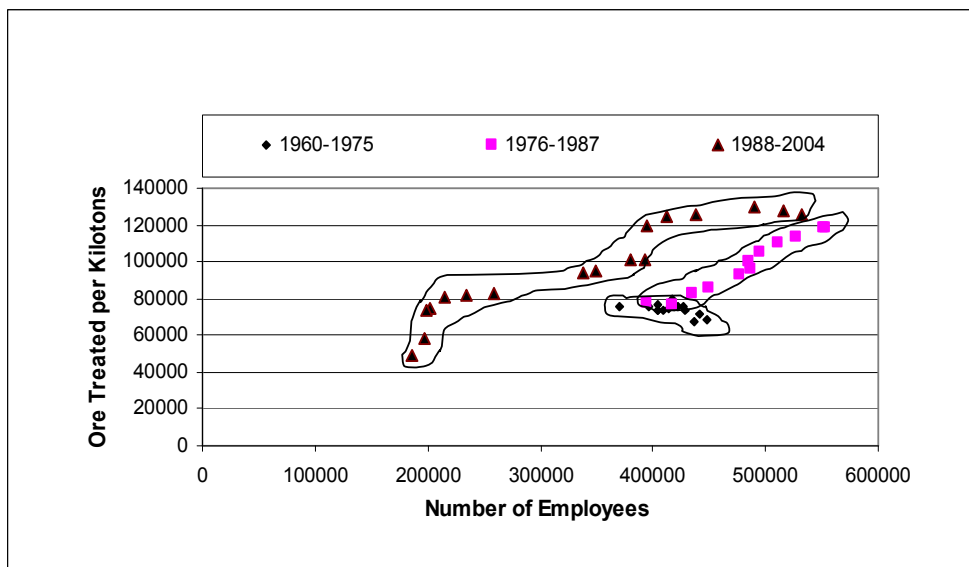


Figure 5.10 Annual average ore treated and annual average employment: Scatterplot for 1960-2004 (Data Source: Chamber of Mines; DME).

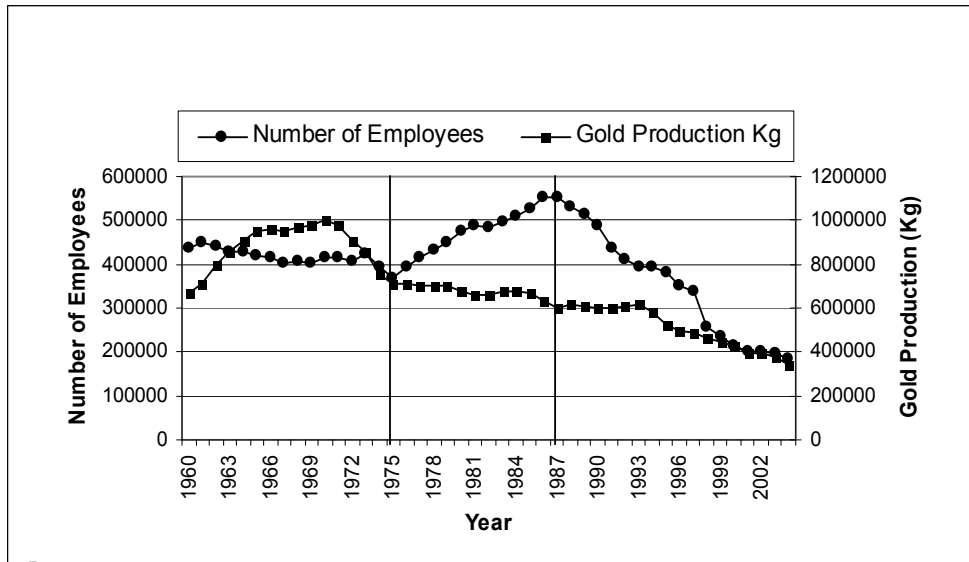


Figure 5.11 Annual average gold production and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

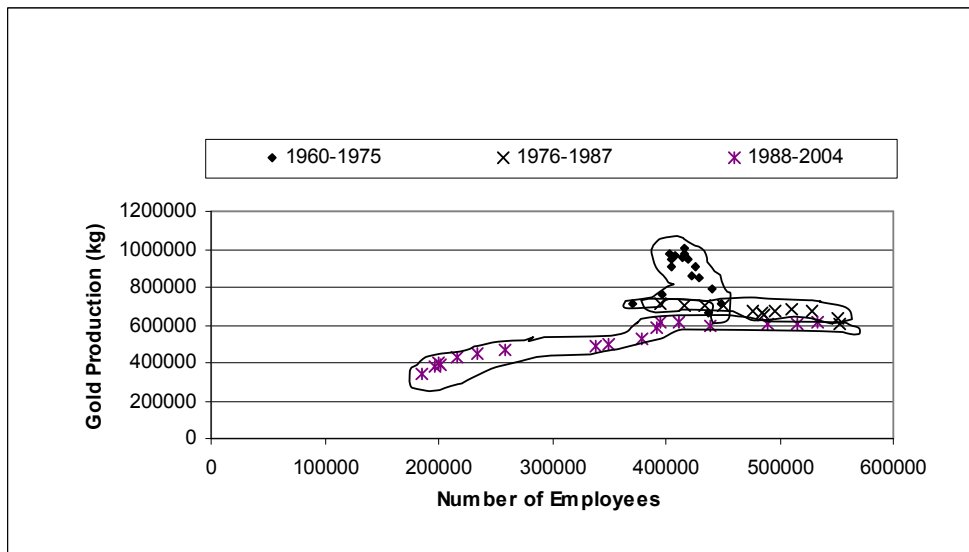


Figure 5.12 Annual average gold production and annual average employment: Scatterplot for 1960-2004 (Data Source: Chamber of Mines; DME).

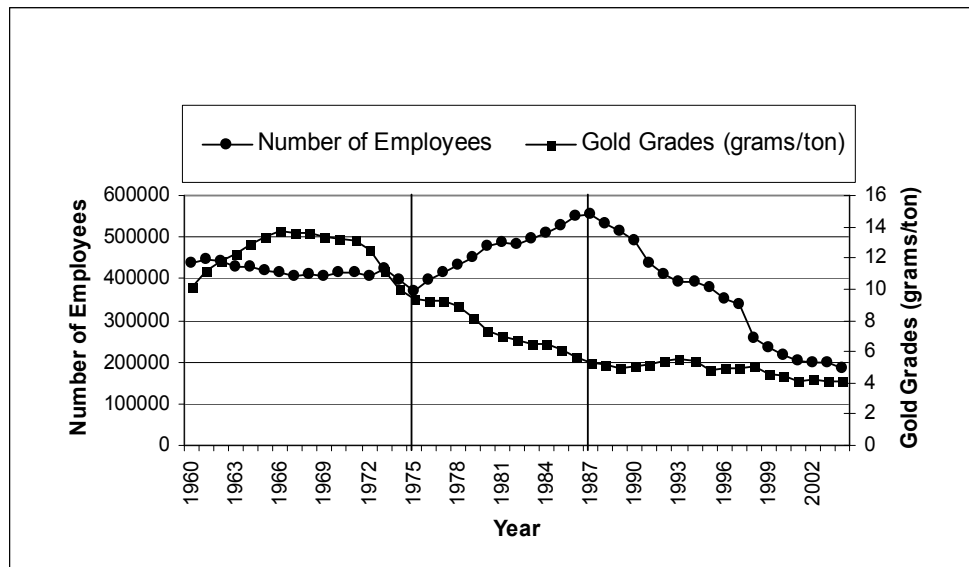


Figure 5.13 Annual average gold grades and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

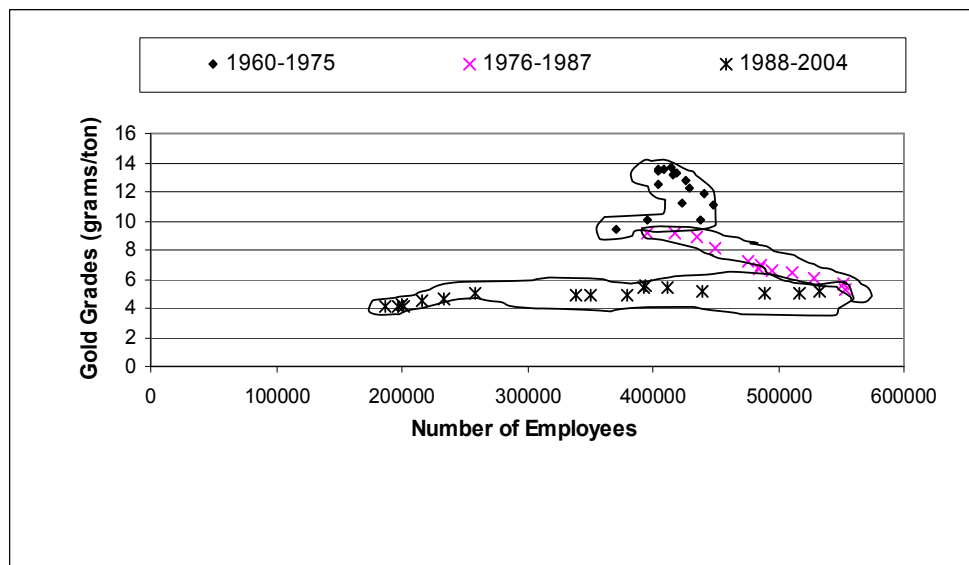


Figure 5.14 Annual average gold grades and annual average employment: Scatterplot for 1960-2004 (Data Source: Chamber of Mines; DME).

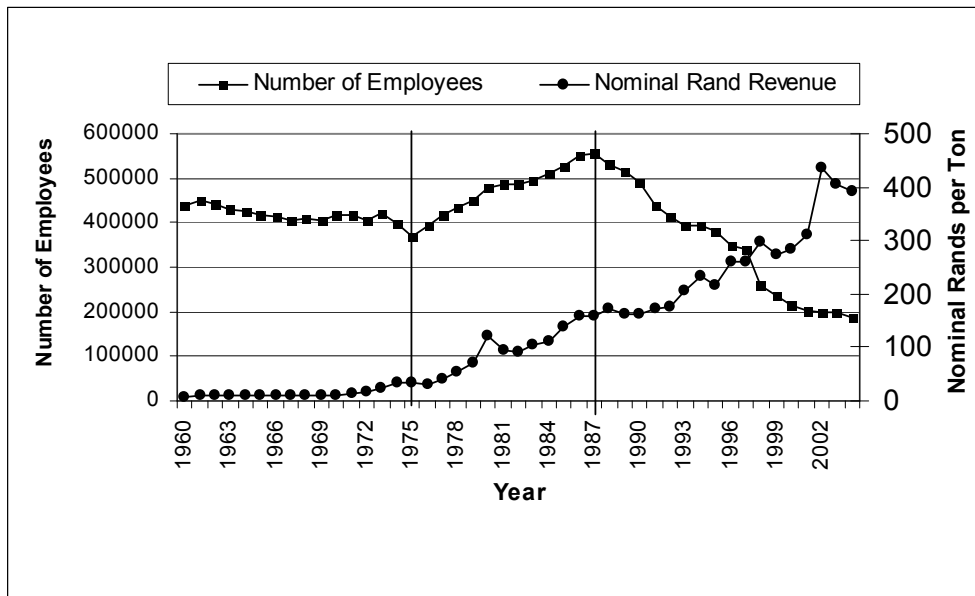


Figure 5.15 Annual average nominal rand working revenue and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

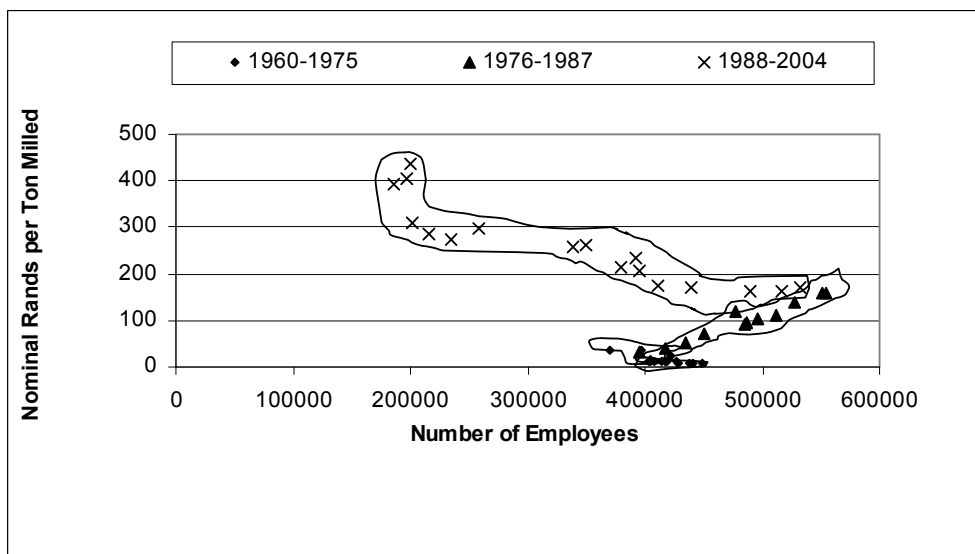


Figure 5.16 Annual average nominal rand working revenue per ton milled and annual average employment: Scatterplot chart for 1960- 2004 (Data Source: Chamber of Mines; DME).

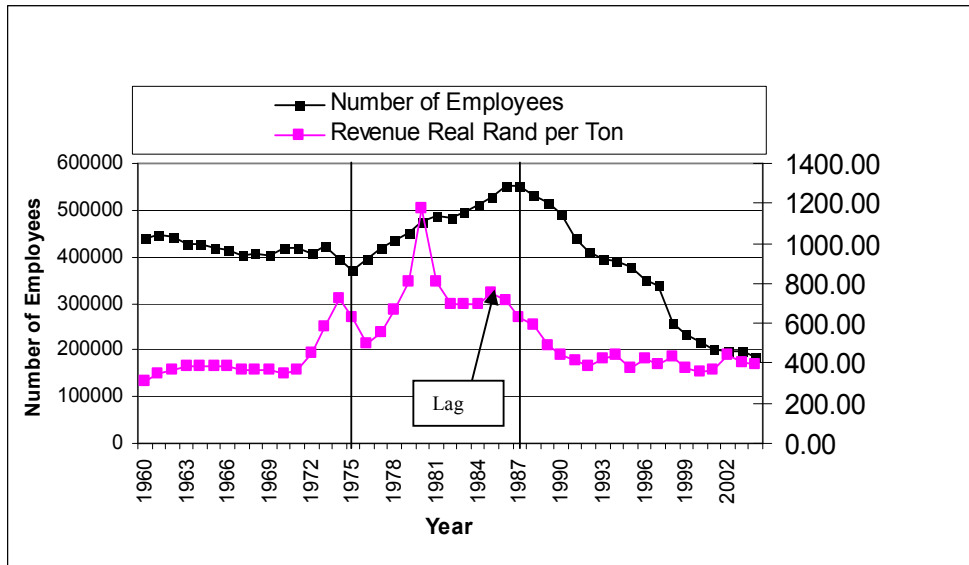


Figure 5.17 Annual average real rand working revenue and annual average employment: Linear chart for 1960-2004 (2004=100) (Data source: Chamber of Mines; DME).

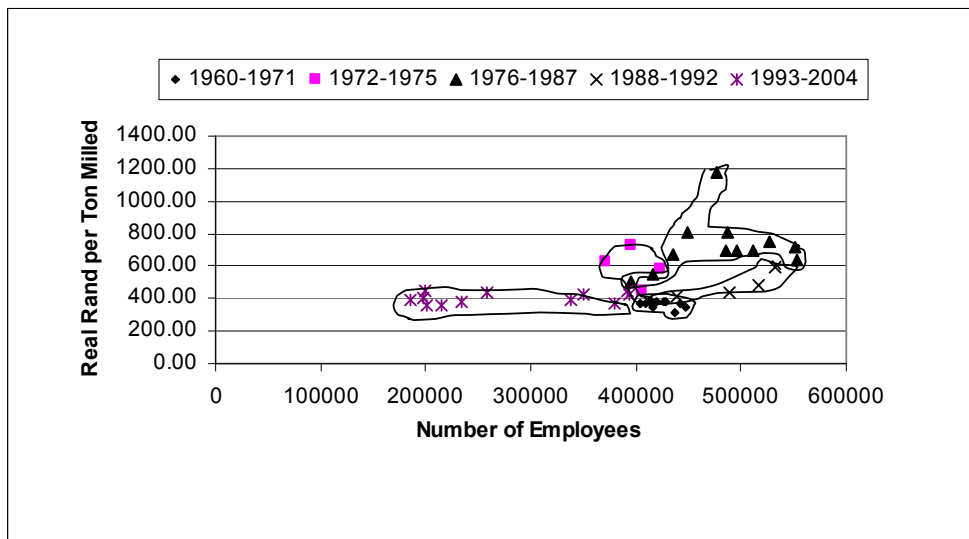


Figure 5.18 Annual average real rand working revenue and annual average employment: Scatterplot for 1960-2004 (2004=100) (Data Source: DME and Chamber of Mines).

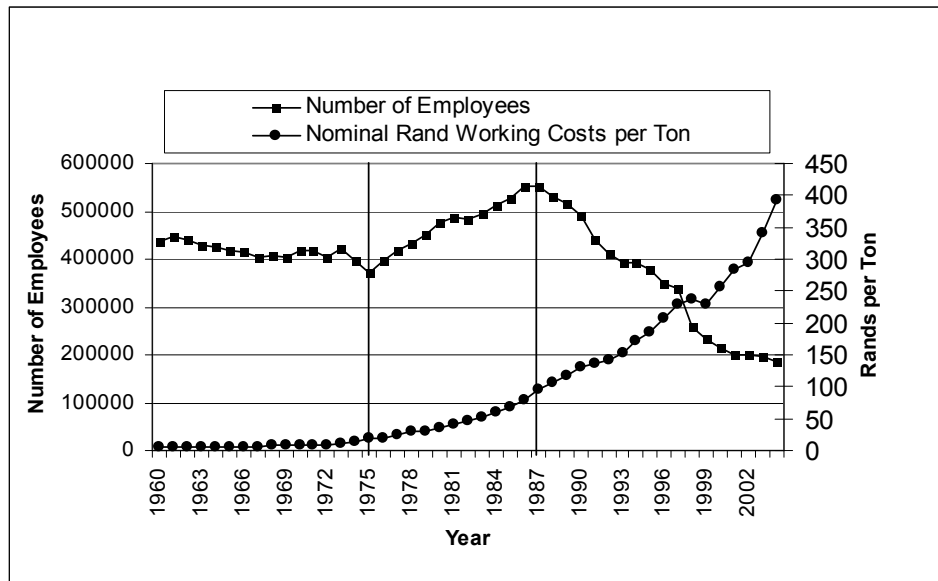


Figure 5.19 Annual average nominal rand working costs and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

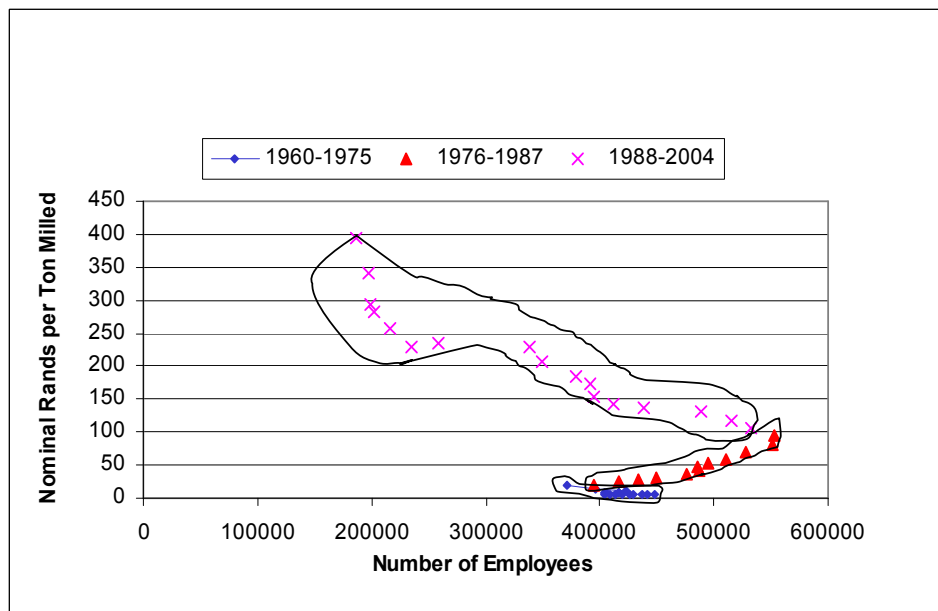


Figure 5.20 Annual average nominal rand working costs and annual average employment: Scatterplot for 1960-2004 (Data Source: Chamber of Mines; DME).

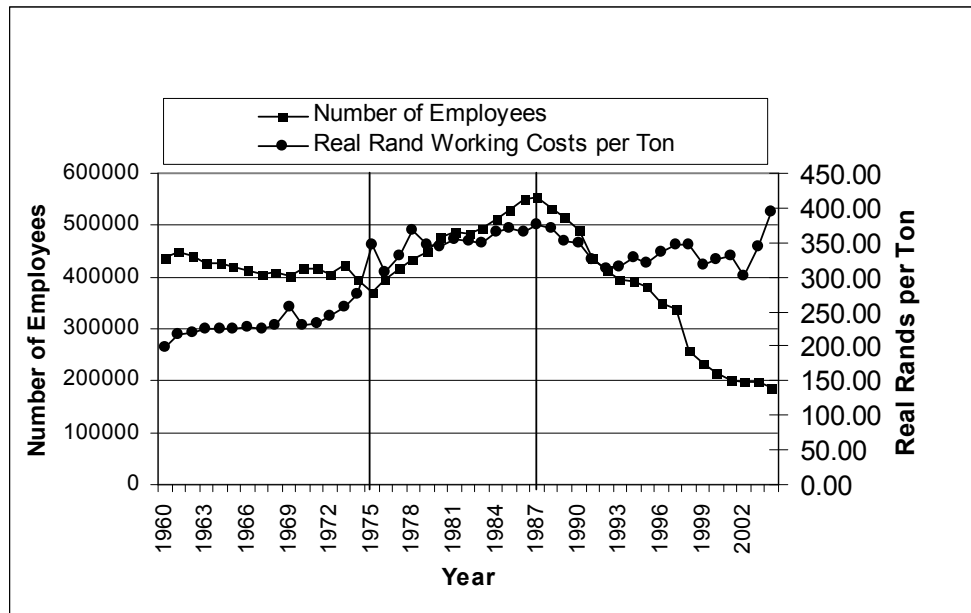


Figure 5.21 Annual average real rand working costs and annual average employment: Linear chart for 1960-2004 (2004=100) (Data Source: Chamber of Mines; DME)

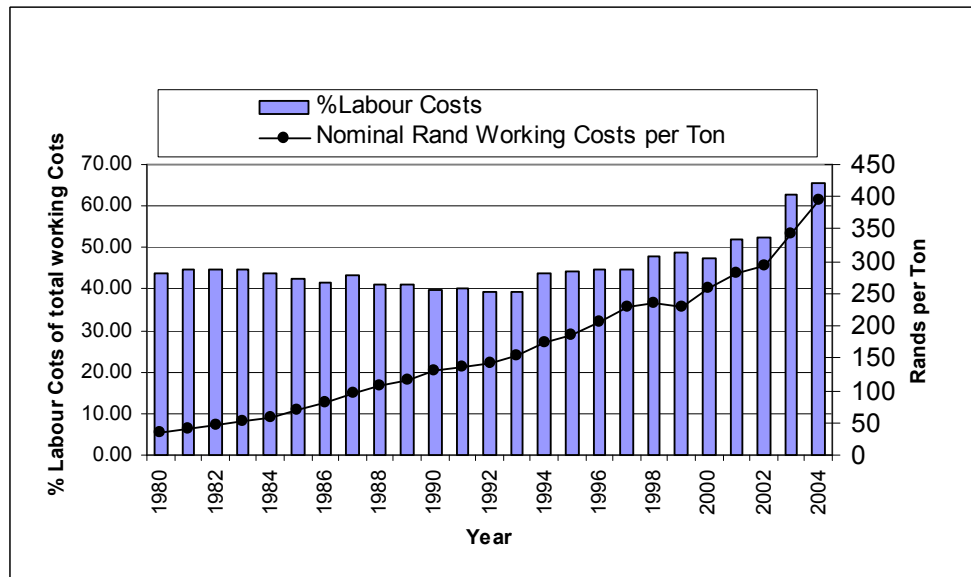


Figure 5.22 Annual average nominal rand working costs and annual average labour costs 1980 - 2004 (Data Source: Chamber of Mines; DME).

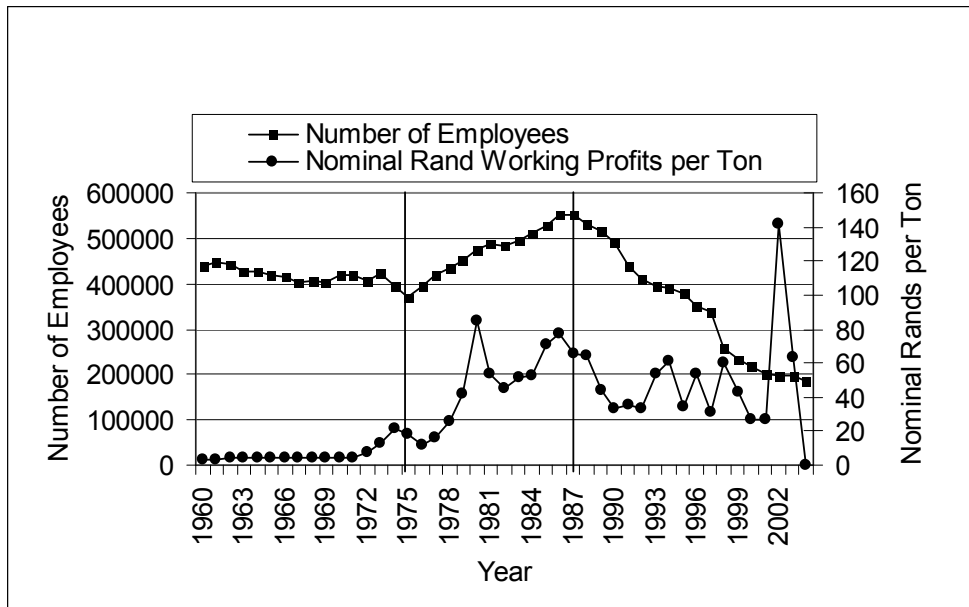


Figure 5.23 Annual average nominal rand working profits and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

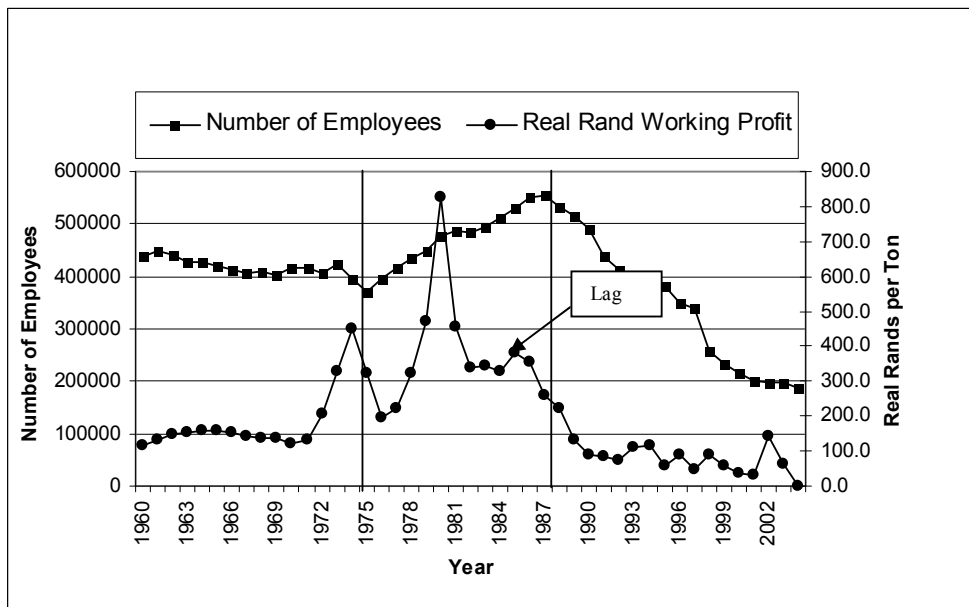


Figure 5.24 Annual average real rand working profits and annual average employment: Linear chart for 1960-2004 (2004=100) (Data Source: Chamber of Mines; DME).

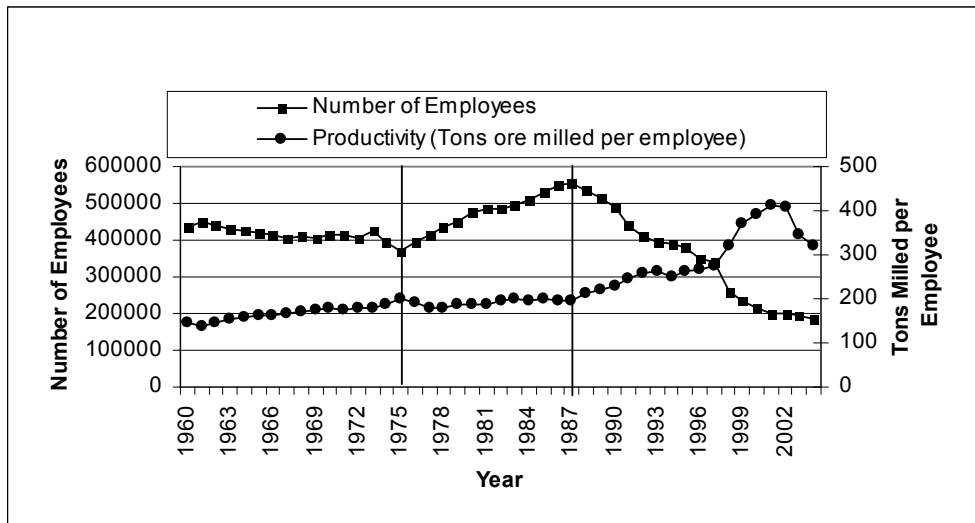


Figure 5.25 Annual average productivity (ore milled per employee) and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines;DME).

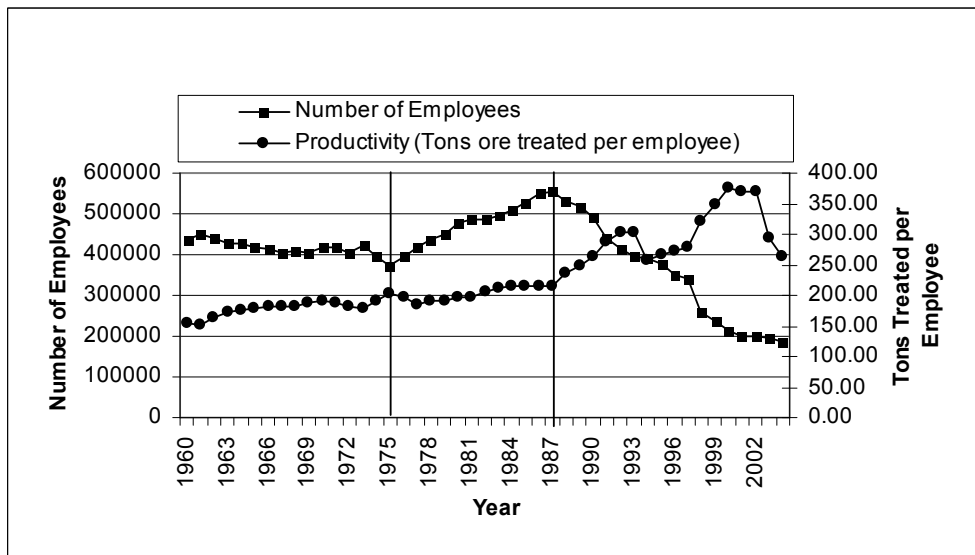


Figure 5.26 Annual average productivity (ore treated per employee) and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

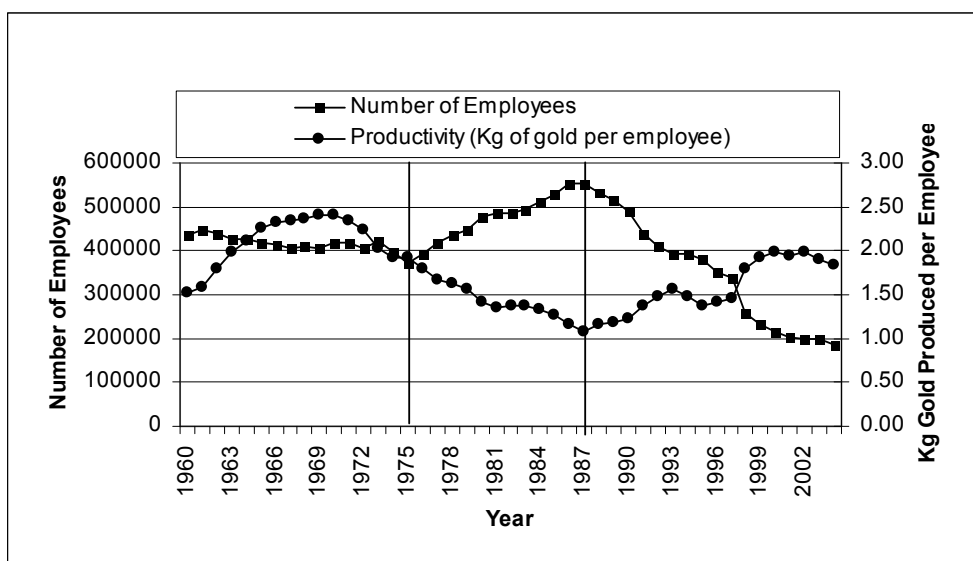


Figure 5.27 Annual average productivity (gold produced per employee) and annual average employment: Linear chart for 1960-2004 (Data Source: Chamber of Mines; DME).

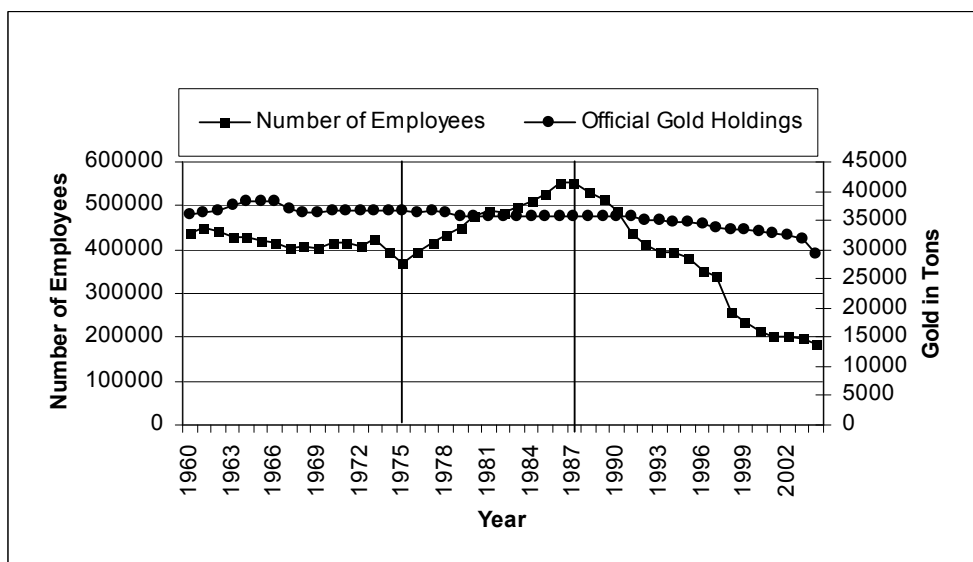


Figure 5.28 Official institutional gold holdings and annual average employment: Linear chart for 1960-2004 (Data Source: DME and GFMS Limited, 2005).

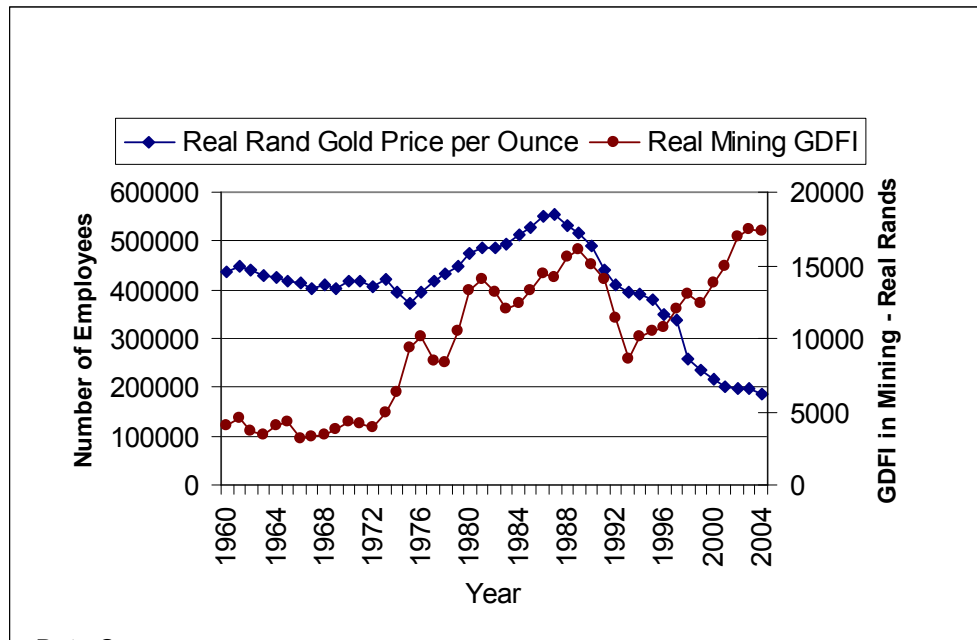


Figure 5.29 South Africa's gold mines: Employment and real GDFI for 1960-2004 (Data Source: DME) (2004=100).

CHAPTER 6

STATISTICAL MODELLING OF BUSINESS FACTORS INFLUENCING EMPLOYMENT IN SOUTH AFRICA'S GOLD MINING INDUSTRY

“It is difficult to predict, with any degree of certainty, the future pattern of employment in the mining sector. The sector is very sensitive to cycles in the international economy and to international competition.” Marcel Golding, Member of Parliament, 1996

6.1 Introduction

In Chapter 5, a largely qualitative approach, which included analyses of correlations between employment and individual business factors, was followed to determine the influence of socio-political and economic factors on employment and therefore on downscaling. Whilst the analysis is helpful, it does not produce quantitative results and therefore does not provide a tool to predict employment levels and consequently downscaling in the gold mining industry. In Chapter 6, a multivariate statistical analysis of the influence of business factors or parameters affecting employment in South Africa's gold mining industry was undertaken. In this regard, the most significant parameters were identified and statistical regression models were developed to assist in predicting employment.

6.2 Methodology

6.2.1. Regression

Bowerman and O'Connell (1990) describe regression analysis as a statistical methodology that is used to relate variables. The methodology involves building a regression model or prediction equation through relating a dependent variable to one or more independent variables or predictors. Boerman and O'Connell (1990) furthermore state that the limitation in the regression methodology is that one can only ascertain relationships but one can never be sure of the causal mechanism. The objective of the regression model is to select the subset of predictors to

optimize a pre-defined goodness of fit function, which means how well a statistical model fits a set of observations.

In this study, the predictor variables are the 17 business factors discussed in Chapter 5 and the dependent variable is the number of employees in the gold mining industry. The complete dataset in respect of the business factors and employment is presented in Appendices A and B. Statistical Analysis System (SAS) software was used to model the data using regression techniques, in order to determine significant predictors on the number of employees in the gold mining industry. The regression analysis was done on the overall data (1960-2004) and on the three gold mining periods: 1960-1975 (Period 1); 1976-1987 (Period 2); 1988-2004 (Period 3).

As stated in Chapter 5, the selection of a large number of variables was done to investigate as widely as possible the influence of various variables on employment. The business factors or predictors used in the analysis were: dollar gold price; nominal rand price; real rand gold price; nominal rand revenue; real rand revenue; gold grades; nominal rand working costs; real rand working costs; nominal rand working profits; real rand working profits; ore milled; ore treated; gold production; official gold holdings; productivity in respect of gold produced per employee; productivity in respect of ore milled per employee, and; productivity in terms of ore treated per employee. Ordinary multiple regression was performed by way of regressing the above business factors on the response variable, which is employment. The ordinary least squares approach was chosen on the assumption that the predictors are linearly related to the response, which is employment.

The objective of ordinary multiple regression analysis is to use the independent variables whose values are known to predict the relationship and defined for $n = 17$ variables:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + e \quad (1)$$

where $\beta_0, \beta_1, \beta_2, \dots, \beta_n$ are the regression coefficients that need to be estimated and e is the error term of the model. The predictor variables are denoted by $X_1, X_2, \dots, X_n$.

6.2.2 Analysis of Variance

Analysis of Variance (Anova) is a method used to compare statistical means of several groups of observations and is sometimes referred to as the test for significant difference between means (StatSoft, 2008). In this regard an F-test is used to test the null hypothesis for the difference of means. However, the test does not provide information about the magnitude of the difference - other statistical tests need to be performed to quantify the magnitude.

In this study, SAS software was used to perform Anova test on the dependent variable Y (employment) with the objective of explaining the variation in employment in the gold mining industry. The null hypothesis is that the means of the three gold mining periods are equal, ie:

$$H_0 : \mu_{y1} = \mu_{y2} = \mu_{y3} \quad (2)$$

The alternative is for H_0 to differ. H_0 = Hypothesis; μ_{y1} = Mean of employment for Period 1; μ_{y2} = Mean of employment for Period 2; μ_{y3} = Mean for employment for Period 3.

6.3 Results

6.3.1 Anova

The results of Anova are presented in Appendices D – G. In the study, the level of significance α is chosen to be 0.05 and the observed level of significance is represented as p- value. Appendix D shows that the p-value is less than $\alpha = 0.05$ and this indicates that we can reject H_0 and conclude that the three gold mining periods' employment means are significantly different. The mean of Period 2 is higher than the means of Periods 1 and 3 respectively (Appendix D). This is expected as Period 2 was the expansion period that occurred prior to Period 3 (the downscaling period).

To determine the relative difference between the pairs of the means, the three test for difference of means were performed: Bonferroni (Dunn) T, Tukey's Studentized Range and Scheffe's. The results of the three tests are similar and are presented in Appendices E, F and G, which show that the average of Y (employment) in Period 2 (Group 2) is significantly different to the average of Y in Period 3 (Group 3). Similarly, the average of Y in Period 3 (Group 3) is significantly different to average of Y in Period 1 (Group 1). Although, the average of Y in Period 1 (Group 1) does not differ significantly with average of Y in Period 2 (Group 2), the information shows that the groups are distinct from one another.

The Box and Whisker plot of Y (Employment) show that there is a small variability in employment during Period 1 (Group 1) – this is expected as Period 1 was a relatively stable period in terms of employment (Appendix H). Period 2 (Group 2) has more variability than Period 1, whilst Period 3 (Group 3) exhibits the largest variability. The variability in Period 3 is related to the massive downscaling that took place during the period. The box and whisker plot for Period 3 also shows that employment was more skewed around the mean, in comparison to Periods 2 and 1. This is due to the steep decline of employment during the downscaling period (Period 3).

The behaviour of employment over the 1960-2004 period can also be presented in terms of the Plot of Means (Appendix I). Appendix I shows that average employment increased between Group 1 and Group 2 but subsequently decreased between Group 2 and Group 3. The increase between Groups 1 and 2 is largely related to the increase in gold price, which subsequently resulted in the expansion of the gold mining industry, during Period 2. The expansion resulted in the number of employees increasing during Period 2 (Figure 5.3, between 1975 and 1987). The decrease between Groups 2 and 3 is a reflection of the downscaling period during Period 3, which is characterised by massive shedding of jobs (Figure 5.1).

6.3.2 Overall Period (1960–2004)

SAS software was used to analyse for ordinary model regression on data sets from 1960-2004. All seventeen business factors (predictor variables) were regressed individually against the response (employment) to identify variables to include into the regression model. The data set used is presented in Appendices A and B and the levels of significance were set at 0.05 for practical purposes. The computed significant values for overall regression done on individual business factors are shown by SAS output data in Appendix J1 under columns $\text{Pr}>F$ (p-value) and $\text{Pr}>F \mid t$ (p-value) respectively. The regression analysis on individual variables resulted in twelve variables being identified as statistically significant (p-value < 0.05): nominal rand gold price per ounce (X_2); nominal rand revenue per ton milled (X_4); real rand revenue per ton ore milled (X_5); nominal rand working costs per ton ore milled (X_7); real rand working profits per ton milled (X_{10}); ore milled in tons (X_{11}); ore treated in tons (X_{12}); gold production in kilograms (X_{13}); official institutional gold holdings in tons (X_{14}); productivity in terms of gold produced (X_{15}); productivity in terms of ore milled per employee (X_{16}) and productivity in terms of ore treated per employee (X_{17}). Regression on the twelve significant variables was done for all four gold mining periods (Overall Period, Periods 1, 2 and 3). Regression with regard to the Overall Period resulted in eight variables being identified as statistically significant (Appendices K1 and K2) for inclusion in the final model: nominal rand revenue per ton (X_4); nominal rand working costs per ton (X_7); ore milled in tons (X_{11}); ore treated in tons (X_{12}); gold production (X_{13}); productivity in terms of gold produced per employee (X_{15}); productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}). Statistically insignificant factors such as real rand working profits (X_{10}) were a result of the weak association of the factors with employment – this scenario is demonstrated in Appendix K3.

The model parameter estimates are provided in Appendix K2 and the resultant model is defined by:

$$\hat{Y} = 379995 + 417.35 x_4 - 446.89x_7 - 5.59x_{11} + 6.37x_{12} + 0.50x_{13} - 217838x_{15} + 2754.71x_{16} - 2734.06x_{17} \quad (3)$$

(Where x values represent business factors as shown in Appendices A and B; and $\hat{Y}$ represents employment.)

The above regression model (3) implies that on average, when holding other significant business factors constant, a unit increase in X_4 (nominal rand revenue per ton milled) will cause employment to increase by about 417 units; whereas a unit increase in X_7 (nominal rand working costs per ton milled) will decrease employment by about 447 units. Similarly, when holding other significant business factors constant, a unit increase in :

- X_{11} (ore milled) will result in employment levels decreasing by about 6 units;
- X_{12} (ore treated) will result in a corresponding increase in employment by about 6 units;
- X_{13} (gold production) will result in an increase in employment by about 1 units;
- X_{15} (productivity in respect of gold production) will result in a decrease in employment by about 217 838 units;
- X_{16} (productivity in respect of ore milled) will result in an increase in employment by 2 755 units; and
- X_{17} (productivity in respect of ore treated) will result in employment decreasing by 2 734 units.

The coefficient of determination (R-square) is 0.99 and this indicates that 99 per cent of variation in employment levels in the gold mining industry is explained by the variation in the significant predictors. This implies that, to a large extent (99%), by knowing the values of the significant business factors, we can be able to predict the level of employment. The significant business factors in the model above (3) also came out strongly in the linear correlation between the individual factors and employment, which suggests that all the factors are critical in determining employment levels (Appendix C1).

Figures 6.1 and 6.2 illustrate the fit in respect of actual employment and predicted employment, as generated by (3). The figures show that the model provides a fairly good fit in respect of predicting employment. A table showing actual (observed) employment and predicted employment also reveals that the regression model can reasonably predict employment in the gold mining industry (Appendix K4).

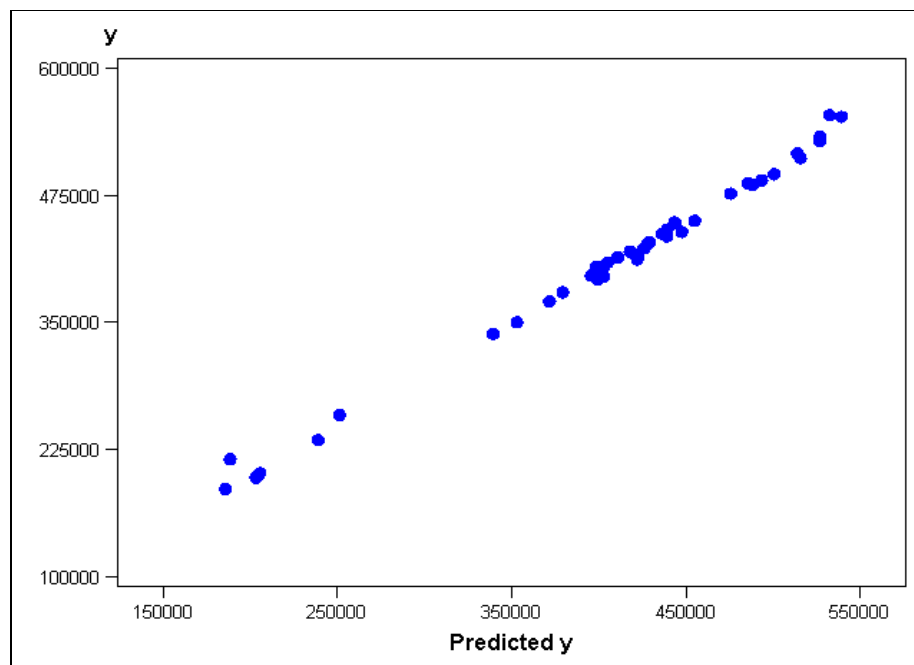


Figure 6.1 Regression analysis scatterplot: Observed y versus predicted y for Overall Period (y = employment).

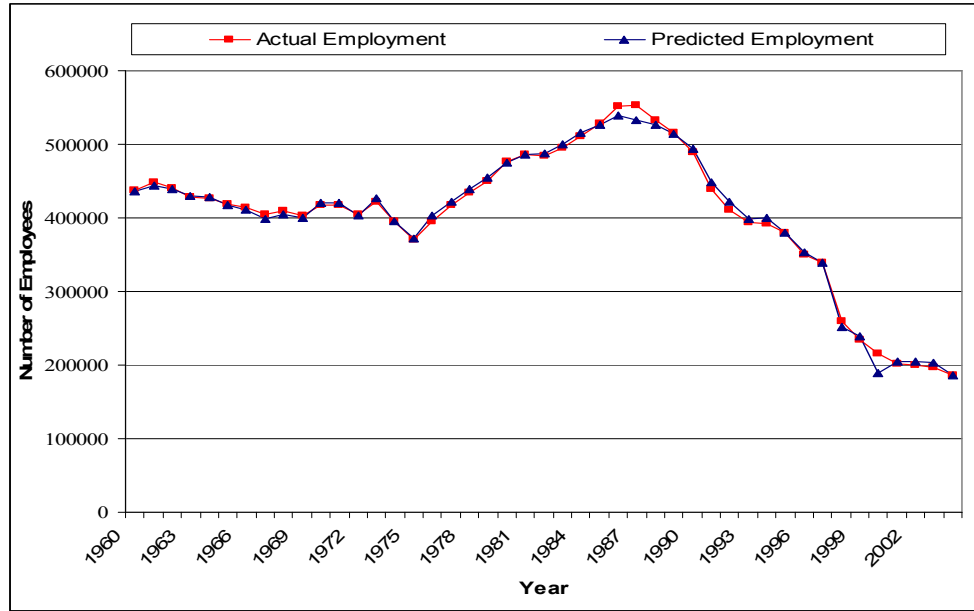


Figure 6.2 Regression analysis: Linear chart of actual employment and predicted employment for Overall Period.

6.3.3 Period 1 (1960–1975)

Application of ordinary model regression on the 1960-1975 data set resulted in the following variables being identified as statistically significant and were subsequently included in the final model: ore treated (X_{12}) and productivity in terms of ore treated (X_{17}). SAS output data is presented in Appendices L1 and L2 and the model parameter estimates are provided in Appendix L2, resulting in the following model:

$$\hat{Y} = 442995 + 8.35x_{12} - 3432.96x_{17} \quad (4)$$

(Where x values represent business factors as described in Appendices A and B; and $\hat{Y}$ represents employment.)

The above regression function (4) implies that, on average, when holding other significant factors constant, a unit increase in X_{12} (ore treated) will cause employment to increase by about 8 units; whereas a unit increase in X_{17} (productivity in terms of ore treated) will decrease the employment by about 3

433 units. The strong relationships between employment and ore treated and productivity in terms of ore treated is demonstrated by a high coefficient of determination (Appendix L1). The coefficient of determination (R-square) shows that 99 per cent of employment variation is explained by the variation of X_{12} and X_{17} in the model. This implies that by knowing the values of the two factors (X_{12} and X_{17}) we are able to predict, to a large extent, employment levels during Period 1.

The reliability of the regression model is depicted in Figure 6.3, which shows the fit to the data between actual employment and predicted employment, as generated by (4). The figure shows that the model provides a fairly good fit between actual and predicted employment levels during Period 1.

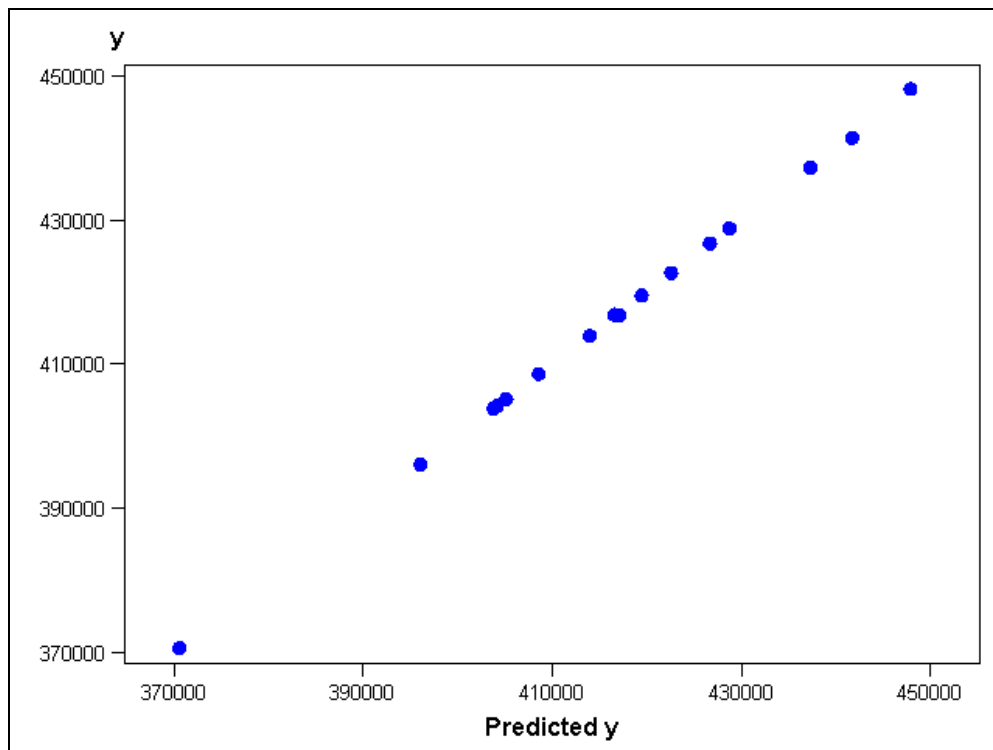


Figure 6.3 Regression analysis plot (scatterplot): Observed y versus predicted y for Period 1 (y=employment).

6.3.4 Period 2 (1976-1987)

Regression model was performed on Period 2 and the following variables were significant during the period: gold production per kg (X_{13}), and; productivity in terms of gold produced (X_{15}). The two variables provided the best possible optimal explanation of variability in employment. The SAS output data is presented in Appendices M1 and M2 and the model parameter estimates is shown in Appendix M2, resulting in the following model:

$$\hat{Y} = 498471 + 0.37x_{13} - 199223x_{15} \quad (5)$$

(Where x values represent business factors as described in Appendices A and B; and $\hat{Y}$ represents employment.)

The above regression model (5) implies that, on average, when holding other significant factors constant, a unit increase in X_{13} (gold produced) will result in employment increasing by about 0.4 units. A unit increase in X_{15} (productivity in terms of gold produced) will decrease employment by about 199 223 units.

The coefficient of determination (R-square) in Appendix M1 shows that 99 per cent of employment variation is explained by the variation of X_{13} (gold produced) and X_{15} (productivity in terms of gold produced) in the model. This implies that by knowing the values of the X_{13} and X_{15} we are able to predict, to a large extent, employment levels during Period 2. The fit to the data between actual and predicted employment as generated by (5) is illustrated in Figure 6.4.

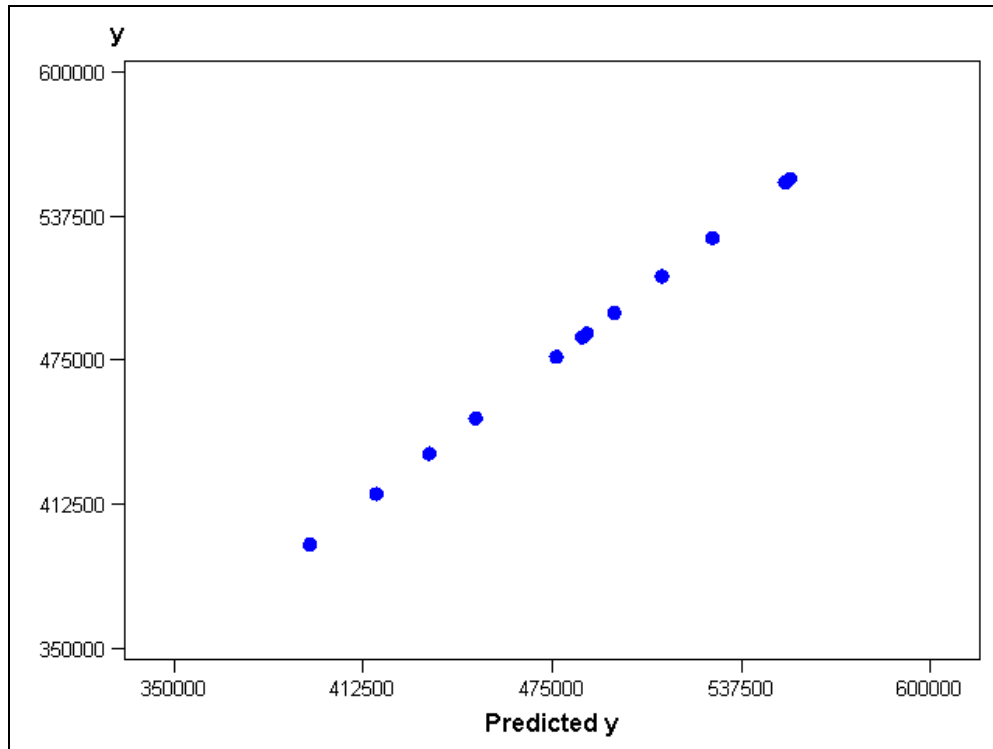


Figure 6.4 Regression analysis plot (scatterplot): Observed y versus predicted y for Period 2 (y=employment).

6.3.5 Period 3 (1988-2004)

Regression analysis was performed on Period 3 data and the following business factors were identified as significant during the period: real rand revenue per ton ore milled (X_5) and ore milled (X_{11}). SAS output data is presented in Appendices N1 and N2 and the model parameter estimates are shown in Appendix N2. The two significant business factors were included in the final regression model for Period 3 as shown below:

$$\hat{Y} = -253372 + 643.34x_5 + 7.24x_{11} \quad (6)$$

(Where x values represent business factors as described in Appendices A and B; $\hat{Y}$ represents employment.)

The coefficient of determination (R-square) is 0.99 and this indicates that 99 per cent of variation in employment levels in the gold mining industry is explained by the variation in the significant predictors. This implies that to a large extent (approximately 99%) by knowing the value of the significant factors we are able to predict the level of employment. The reliability of the regression model (6) in predicting employment is illustrated in Figure 6.5. The figure shows that the model provides a fairly good fit in respect of actual and predicting employment levels.

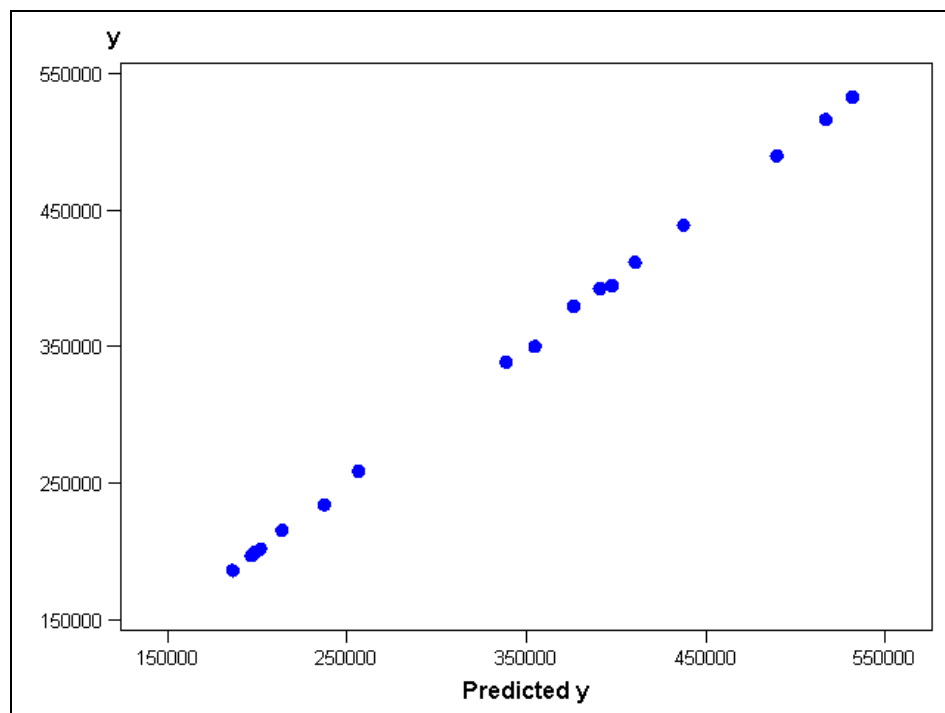


Figure 6.5 Regression analysis plot (scatterplot): Observed y versus Predicted y for Period 3 (y =employment)

6.4 Discussion

Management of downscaling in the gold mining industry requires understanding of the influence of various business factors such as gold price on employment. However, the influence of the business factors on employment is not only based

on the behaviour of individual factors, but depends on a combination of factors at any particular moment. It was against this background that a multivariate regression analysis of the influence of 17 business factors or parameters affecting employment in South Africa's gold mining industry was performed. SAS statistical software was used to perform regression analysis on the overall data (1960-2004) and the three identified gold mining periods: namely, Period 1 (1960-1977), Period 2 (1975-1987) and Period 3 (1987-2004).

Anova test revealed that the mean of employment of the respective periods differs. The Bonferroni T, Tukey's Studentized Range and Scheffe's tests also supported the conclusion that the three groups are distinct from one another (Appendices E, F and G). Similarly, both the Box and Whisker plot and the Plot of Means show three distinct groups of data sets (Appendices H and I). The aforementioned statistical plots (eg Box and Whisker) support the observation in Figure 5.1, which shows that the gold mining industry of South Africa has gone through three distinct periods (of different employment levels) during the period under study. The third period of the study prominently reveals a rapid decline in employment (Appendices H and I).

Regression analysis on the overall period (1960-2004) resulted in the identification of eight statistically significant business factors: nominal rand revenue per ton (X_4); nominal rand working costs per ton (X_7); ore milled in tons (X_{11}); ore treated in tons (X_{12}); gold production (X_{13}); productivity in terms of gold produced per employee (X_{15}); productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}). The significances of the above business factors implies that changes in employment levels in South Africa's gold mining industry can be explained, to a large extent, by the dollar gold price, nominal rand working revenue, nominal rand working costs, real rand working profits, gold production and productivity in terms of gold produced. The significant factors can be grouped as financial business factors (i.e. revenue and costs) and "production related" factors (i.e. ore milled, ore treated, gold production and productivity) – indicating that employment levels can be

explained in terms of both financial and “production related” in respect of the overall period. The correlation of the individual eight factors with employment is also significant (Appendix C1) – a further indication of the importance of the business factors in influencing employment levels.

The regression model, developed using the above eight business factors, provides (to a large extent) acceptable results in respect of predicting employment for the overall period. The predicted employment levels as generated by model (3), were fairly comparable with actual employment (Figures 6.1 and 6.2). The coefficient of determination (R-square) is also very high, at 0.99 suggesting that, to a large extent (approximately 99%), by knowing the values of the significant business factors we can also predict the level of employment in South Africa’s gold mining industry. The remaining 0.01 per cent is plausibly shared by the error and other factors.

The data was subjected to regression analyses and significant factors were generated in respect of the three periods (Period 1, Period 2 and Period 3) as well as for the overall period. A summary of significant business factors is presented in Table 6.1.

During Period 1, ore treated and productivity in terms of ore treated were the significant factors in predicting employment. The regression model for Period 1 has a coefficient of determination (R square) of 99 per cent – indicating that the variation in employment can be explained to a large extent by the two business factors. Despite being a relatively stable period, Period 1 exhibits a negative correlation between employment and ore treated ($r = -49$). This suggests that the industry was more productive during the period (Figure 5.26). It seems that the relatively stable gold prices of Period 1 prompted the industry to improve on productivity and reduce employment. Productivity improvement is also demonstrated by improvements in productivity in respect of ore milled and gold produced (Figures 5.25 and 5.27).

Table 6.1 Summary of significant business factors generated by regression analyses.

Overall Period	Period 1	Period 2	Period 3
• Nominal rand revenue • Nominal rand working costs • Ore milled • Ore treated • Gold production • Productivity in terms of gold produced per employee • Productivity in terms of ore milled per employee • Productivity in terms of ore treated per employee	• Ore treated • Productivity in terms of treated	• Gold production • Productivity in terms of gold produced	• Real rand revenue • Ore milled

The reliability of the regression model (4) is illustrated by Figure 6.3, which shows the fit to the data between actual employment and generated predicted employment. The 99 per cent in respect of the coefficient of determination means that the business factors in the model account for 99 per cent variability in employment levels during Period 1.

Regression analysis of Period 2 data generated the following significant business factors, namely: gold production and productivity in terms of gold production. The relationships between employment and the aforementioned factors show a strong negative correlation during Period 2 ($r = -0.86$ and $r = -0.99$ respectively) – this being a consequence of the industry’s economics of scale approach, which involved counteracting declining gold grades and gold production by increasing employment, ore milled and ore treated. The reliability of the regression model (5) for Period 2 is illustrated by Figure 6.4, which shows the fit to the data in respect of actual and predicted employment levels. The 99 per cent in respect of the

coefficient of determination implies that by knowing the values of ore treated and productivity in terms of ore treated, employment levels can be predicted to a large extent (approximately 99%) during Period 2.

Regression analysis on Period 3 data generated the following significant business factors: real rand revenue (X_5) and ore milled (X_{11}). The results allow for the postulation that real rand revenue and ore milled played an influential role during the downscaling of South Africa's gold mining industry. The results are not surprising as revenue was largely depressed during Period 3 (Figure 5.17), and such an environment would invariably contribute to reduction in employment. Similarly, ore milled declined significantly during Period 3 in line with declining employment (correlation between the two variables is $r = 0.94$; $p = < 0.01$). As in Periods 1 and 2, and the overall period, there is consistency in respect of the fit of the actual and predicted employment, as generated by the regression model (6) (Figure 6.5). The 99 per cent coefficient of determination (R square) implies that to a large extent, by knowing the values of the significant factors during Period 3 we can predict the level of employment during the period.

All four gold mining periods (overall period and Periods 1, 2 and 3) have their own distinct set of significant factors – an indication that variations in employment can be explained by different set of factors in the respective periods. All four predictive models for the investigated periods (overall period and Periods 1, 2 and 3) provide acceptable results in terms of the predicted employment levels, as demonstrated in Figures 6.1, 6.2, 6.3, 6.4 and 6.5. These models can assist in predicting future employment in the gold mining industry of South Africa and therefore can be valuable in the management of downscaling. The models should also be capable of predicting employment in other mining sectors (e.g. platinum sector) with the similar characteristics as the scope of this study.

6.5 Summary

Anova test analysis shows that the means of employment in respect of the three gold mining periods is significantly different – justifying the need to separate the

gold mining era into three distinct periods. The data revealed that the mean of Period 2 is higher than the means of Periods 1 and 3. The means of Periods 1 and 3 are lower than the mean of Period 2. The relative difference between the pairs of means was shown by the Bonferroni T, Tukey's and Studentized Range tests.

It was shown in this chapter that statistical techniques can be used to identify significant factors that affect employment in any particular period. However, the significant factors differ from one period to another – each period has its own set of significant business factors (Table 6.1). This implies that employment levels in the gold mining industry can be explained differently across the respective periods.

It was furthermore demonstrated that statistical regression models can be developed to predict the level of employment in the gold mining industry. Since significant factors differed from one period to another, the significant factors in each period were used to develop regression models for Periods 1, 2 and 3 as well as for the overall period. With regard to Period 3 (the downscaling period), the significant business factors were identified as real rand revenue and ore milled. Based on these results, it can be postulated that the two business factors played an influential role in respect of downscaling during Period 3. All four models developed for the respective gold mining periods are fairly reliable in terms of predicting employment levels in South Africa's gold mining industry. This is illustrated by the fit between actual and predicted employment levels for the respective periods (Figures 6.1, 6.3, 6.4 and 6.5). Moreover, all four periods show a relatively high coefficient of determination (R-square): Overall period = 0.99; Period 1 = 0.99; Period 2 = 0.99; and Period 3 = 0.99.

The high coefficient of determination implies that in all four gold mining periods, to a large extent, the factors concerned provide satisfactory account for variability in employment. These regression models are plausible and relevant in predicting employment in the gold mining industry and can assist stakeholders in managing downscaling in the South African mining industry.

CHAPTER 7

NATIONAL INITIATIVES TO MANAGE DOWNSCALING AND THE GOLD CRISIS

“The mining industry is one of our key industries. But as we are all aware, one seen as cause for national concern since it has come to be regarded as an industry that sets the trend for the downward spiral of retrenchments, misery and aggravated poverty. The dramatic levels of retrenchments in the industry, led primarily by the gold mining sector, earned the industry the unenviable title of an industry in crisis....” Speech of the Minister of Labour, Mr M Mdladlana, at the Mining Summit, 25 February 2000

7.1 Introduction

The rampant job losses of 1997 and the downscaling in the gold mining industry, prompted stakeholders in the industry to put in place several policy initiatives that aimed at alleviating the impact of job losses and retrenchments over a period of six years. The initiatives involved the creation of tripartite forums and review of the mining and minerals policy.

With regard to the tripartite forums, the following five forums were put in place from 1998 to 2004 to address, inter alia, problems relating to downscaling and the gold crisis:

- Gold Mining Summit – held in 1998
- GCC – established in 1998
- Mining Summit – held in 2000
- Sector Partnership Committee (SPC) – established in 2000
- Advisory Board – established in 2004

Except for the Advisory Board, the creation of these forums was not premeditated, but was rather products of reactions to the crisis relating to downscaling and the

need to create jobs. The forums deliberated on several issues, including retrenchments, and put forward a number of proposals to address downscaling.

7.2 Tripartite Forums

7.2.1 Gold Mining Summit

The loss of jobs and the persistent depressed gold price prompted the NUM to initiate a Gold Mining Summit, which was the first of the five initiatives launched to address downscaling and the gold crisis. Following a preparatory period of about two months, the summit was held from 26 to 27 February 1998. Participants at the summit were representatives from government, NUM and the Chamber of Mines. At the closure of the summit, the three parties adopted a declaration which, inter alia, called for the establishment of a Gold Crisis Committee (GCC) and the introduction of a moratorium on retrenchments.

7.2.2 The Gold Crisis Committee

As part of the process of implementing the Gold Mining Summit's declaration, participants established a tri-partite GCC primarily aimed at managing retrenchments and the entire downscaling in the gold mining industry.

Structure of the GCC

The GCC comprised nine voting members, each representing Government, the Chamber of Mines and the NUM. As it was perceived that government would be an ideal neutral party that would practice impartiality, government was appointed as the chair of the committee. In order to run the daily activities of the GCC, a Secretariat, also established on a tripartite basis, was appointed by the three parties.

Functions of the GCC

The primary functions of the GCC are presented and discussed below:

Function 1: Dealing with procedures for governing gold mining retrenchments and assessing alternative options to retrenchments.

Under this function, companies considering large-scale retrenchments were obliged to serve a notice to the GCC. The term “large-scale” was not defined and the situation often resulted in badgering in respect of which mines should serve notice. Over time, it was agreed, in principle, to consider the retrenchment of 100 or more employees as large-scale retrenchment. However, the NUM was concerned that mines would circumvent the process by retrenching employees in a series of small groups.

The process of retrenchment was also standardised, making it mandatory for companies to serve two notices in a prescribed manner. In terms of the standardised procedure, all notices were to be submitted in writing and companies serving notice could appear in person before the GCC and it in fact became the norm for the companies to appear before the GCC, as the forum provided them with the opportunity to present their case and motivations. Many companies, such as Gold Fields Ltd, appeared before the committee to present their respective cases.

In terms of the GCC notification process, the first notice was to be served when a company intended to commence with retrenchment proceedings. The notice was to contain the following information:

- Financial and operational circumstances of the mine over time;
- Reasons for contemplating retrenchments;
- All alternatives considered and reasons why they could not be implemented;
- Number of persons potentially affected;

- Process that the company intended to follow in meeting the requirements of fair labour practices; and
- The estimated timing of the proposed retrenchments.

The second notice, which was to be served once the GCC has deliberated on the first notice, required more detailed information in respect of the following:

- Actual number of employees to be retrenched and their job categories;
- Method of selection used;
- Timing of the proposed notice to employees;
- Material assistance offered and prospects for employment in future;
- Language of employees who were affected;
- Villages/towns/cities/countries of origin of employees who are affected;
- Skills profile of employees who are to be retrenched;
- Age profile of employees who are affected;
- Resources that can be provided to deliver Social Plan services;
- Retrenchment agreement/disagreement that may exist between mine management and the Unions; and
- Whether government response team would be required.

Function 2: Assessment of the National Economic Development & Labour Council (NEDLAC) Social Plan agreement and recommend a process for adapting it to the gold mining industry.

NEDLAC was established in 1994 through the Act of parliament Act 35 of 1994 (Republic of South Africa, 1994). The main objectives of NEDLAC are to create a consultative forum for, amongst others, reaching consensus and concluding agreements on matters pertaining to social and economic policy (NEDLAC Act, 1994). One of the most important achievements of NEDLAC was the development of a generic Social Plan framework aimed at addressing widespread

retrenchments that were taking place in several sectors, including the textile and mining industries. The GCC was tasked to adapt the NEDLAC generic Social Plan to the mining industry.

Function 3: Commissioning an investigation into targeted state assistance to marginal mines.

The function involved investigating the assistance of marginal gold mines and determining whether government should provide financial assistance to these mines.

Function 4: Support and direct initiatives to reduce speculations regarding official reserves of gold and support the role of gold as store of value in official institution.

Under this function, a study was undertaken to:

- Determine whether speculative activity associated with the sales of gold by central banks was the cause for the depressed gold price;
- Identify central banks with major gold holdings;
- Identify central banks which were selling gold reserves; and
- Develop an appropriate remedy to address the situation.

Function 5: Explore further opportunities for beneficiation and market development

The key objective of the study was to identify opportunities and strategies for beneficiation and developing markets for mineral products.

Function 6: Ensure an appropriate balance on imposts on the gold mining industry.

Under this function the GCC was expected to identify imposts on the gold mining industry and the appropriate balance in respect of respective imposts.

Function 7: Explore the correct balance between capital and labour intensive mining across the industry.

In terms of this function, the GCC was to undertake a study that would explore the correct balance between capital and labour intensive mining. The outcomes of the study would have been in the form of recommendations.

Function 8: Examine the adverse effects of South African gold mining across the Southern African Development Community (SADC) region and consider proposals for addressing them

A study had to be undertaken to investigate the impact of South Africa's gold mining industry on the SADC region.

GCC's task teams

In order to perform the abovementioned functions, the GCC established five task teams:

- Social Plan Task Team;
- Beneficiation Task Team;
- Capital & Labour Task Team;
- Gold Speculation Task team; and
- Targeted State Assistance Task Team

Social Plan Task Team: This task team developed a framework for the implementation of a Social Plan that was later adopted by government and other stakeholders (Department of Labour, 1999). The framework laid the foundation for the current Social Plan prescriptions contained in the new MPRDA. The Social Plan consists of the following three phases for dealing with downscaling and retrenchments.

Phase 1 (Saving of jobs): The main objective of Phase 1 was to develop proactive mechanisms for addressing downscaling and retrenchments. During this phase, mining companies would, jointly with labour and local governments,

establish committees to be known as Future Forums. The rationale behind the establishment of these forums was that the forums would be able to identify and analyse problems on the mines in good time (Department of Labour, 1999, International Labour Organisation, 2007). The key roles of the forums were to:

- Promote ongoing discussions between workers representatives and employers about the future of the mining industry;
- Proactively identify problems, challenges and possible solutions;
- Develop turnaround or deployment strategies to help reduce job losses and improve business sustainability; and
- Structure and implement proposals agreed on by both the employers and workers.

Future Forums would also seek assistance from the National Productivity Institute (NPI), which is statutory body reporting to the Department of Labour. The NPI established a Social Plan and Productivity Advisory Council, which was intended to assist mines in developing long-term strategies and in developing plans to support downscaling strategies.

Phase 2 (Management of retrenchments): Where retrenchments were inevitable, Phase 2 of the Social Plan would be implemented. In terms of Phase 2, companies that had taken a decision to retrench employees were required to implement the following:

- Notify the Minister of Labour.
- Provide the Department of Labour with relevant information about the retrenchees, for example:
 - i. Number of workers who were likely to be retrenched
 - ii. Timing of the proposed retrenchments
 - iii. Material assistance needed
 - iv. Origin of workers
 - v. Skills profile

- vi. Age profile
- vii. Resources needed to re-skill the employees and effect retrenchments
- viii. Retrenchments agreement/disagreement between management and union
- Effectively communicating with retrenchees and provide counseling.
- Effectively communicating and counsel workers that would remain behind.

Phase 3 (Creating jobs for local economies): In terms of Phase 3 of the Social Plan, when large scale retrenchments became unavoidable, the process of Social Plan would start (Department of Labour, 1999). The process included identification of job creation opportunities in the local economies. In this regard government provided R50 000 for local authorities to undertake integrated economic studies of affected municipalities to identify new economic opportunities.

Beneficiation task team: The mandate of the team was to explore ways of increasing beneficiation of South Africa's minerals, with special attention to employment generation. The team set its preliminary objectives in the development of sustainable and marketing strategies for the gold jewellery industry. Table 7.1 shows South Africa's jewellery industry SWOT analysis compiled by the task-team. The team pointed out that the underlying strength for a local jewellery industry was the local material availability for gold fabrication industries and is unchallenged by most countries. However, the team furthermore pointed out that key weaknesses and threats were consequences of local circumstances, which largely included lack of commitment from key stakeholders. The most important opportunity was identified as the jewellery industry, which was a growing market.

Table 7.1 SWOT analysis for South Africa's gold jewellery industry (Source: Modified from GCC Beneficiation Task Team Report, 1999).

STRENGTHS 1. Leading miner and refiner of gold 2. Major rough gem diamond supplier 3. Leading PGMs supplier 4. Assured gold alloy supplier	WEAKNESSES 1. Negligible gold consumer 2. Negligible jewellery consumer 3. Uncompetitive governance and regulatory environment 4. Financing disadvantages 5. Weak investment rating 6. Security and crime 7. Small operator outlook
OPPORTUNITIES 1. Strong world demand/growth 2. Good employment intensity 3. Attractive added value 4. Strong developing-world role in globalisation and trade	THREATS 1. Weak total commitment from all stakeholders 2. Competitiveness of the products

The main achievement of the task team was the appointment of a Champion, whose task was to develop and implement a strategy to transform the South African jewellery industry and to ensure a firm industry platform and a world-class competitive industry in all respects. Although considerable resources were put in place to facilitate the work of the Champion, the most significant output was the creation of a project known as Kgabane. The key objective of the Kgabane project, principally steered by the Minister of Minerals and Energy, was to assist and train women from disadvantaged communities to become involved in jewellery manufacturing.

Capital and labour task team: The task team was tasked to undertake a study to assess the balance between labour and capital-intensive mining. Unfortunately, the task team did focus on its mandate and therefore failed to address the issue of balance between labour and capital-intensive mining. Nonetheless, the task team

identified the following technological options for the gold mining industry (Internal Report of the GCC, 1999):

- Current technology: Continuing with utilization of technology presently used and enhancing it to increase productivity. The option will protect current jobs in the gold mining industry.
- Alternative technology: Introducing technology not requiring technical changes, but could be adapted or developed to reduce mining costs. The option will also protect current jobs in the industry.
- Available technology: Utilising technology requiring limited technical adaptation essentially involving more mechanized blasting based methods. Jobs could be lost if this option is implemented.
- Mechanized technology: Introducing highly mechanized technologies requiring substantial technical development and the integration of many technologies. The technologies could, inter alia, essentially include non-explosive methods. Significant amount of jobs will be lost if this option was adopted.

Although the study did not explicitly recommend the introduction of mechanisation in the mines, it pointed out at advantages and disadvantages of introducing mechanisation. The study warned that mechanization would require extensive skills development and adaptation to new technologies. It further warned that many jobs could be lost with the introduction of technologies not currently being used but pointed out that such jobs could be absorbed in the downstream or support industries.

Gold speculation task team: Its key mandate was to analyse the activities related to gold speculation and their impact on the gold price. The task team managed to establish that gold speculation around official sector gold holdings played a major

role in providing the basis for speculators to short the gold market and hence reduce the gold price. The task team's findings are presented below:

- The main reason for the declining gold price over the 1997-1999 period has been the negative perception that central banks will dump huge quantities of gold onto the market.
- Increased mobilisation of gold by central banks for interest earning purposes has provided market participants with an interest rate contango which encourages participants to go short on gold thus driving the price down.
- The physical sales of gold were not massive, as it constituted only 9 per cent of annual supply over the past 10 years. Only six central banks out of 130 central banks have sold material amounts of gold in the same period.
- The paper market, driven largely by speculators, is many times larger than the physical market – this continued to cast negative perceptions on the gold market.
- The declining gold price has had a negative impact on gold producers, especially the 41 Highly Indebted Poor Countries (HIPC).
- IMF should refrain from reducing its gold stocks. IMF had taken a decision to sell its gold reserves to fund its debt relief program. Its program was to use the proceedings from the gold sales to pay the debt of the HIPC.
- Other central banks such as the Bank of England should also reconsider their programs to reduce their gold holdings.
- Lobbying of influential people to discourage central banks and gold holding institutions from reducing their gold stocks.

Surprisingly, the task team failed to mention the issue of hedging by miners as one of the factors that affect the gold price since it largely involves speculation. The reason for the omission of hedging is that the industry was uncomfortable about openly accepting that hedging by producers can contribute to depression of the gold price.

Following recommendations by the Gold Speculation Task Team, two South African delegations were constituted to embark on lobbying road shows. One delegation, led by the then Deputy Minister of Minerals and Energy, Ms S Shabangu, lobbied African gold producing countries to oppose the sale of gold by the IMF and other central banks. The delegation visited Mali, Senegal, Ivory Coast, Burkina Farsi and Ghana, and succeeded in gaining support to oppose the sale of gold by central banks and the IMF. Following the successful trip to West Africa, the delegation (this time led by the then Minister of Minerals and Energy, Ms P Mlambo-Ngcuka) went to Europe to present their case at the African Caribbean and Pacific Group of States (ACP) Ministers' of mines meeting held from 26 to 27 July 1999 in Brussels. At the meeting, a declaration was adopted that:

- expressed gratitude to countries that had not taken any unilateral action to off-load some of their gold reserves;
- urged that a moratorium be placed on all official sector gold sales until a representative forum was speedily established to explore a central mechanism that could be put in place to ensure that gold sales took place in a structured and orderly manner; and
- called upon gold producers to minimise hedging in their selling strategies as it also created an adverse effect on the gold price.

The second delegation, led jointly by the NUM and the Chamber of Mines, visited London and Washington to lobby influential people in both the UK and USA government as well as in organisation such as the World Bank. Efforts to stop the

IMF from selling their gold holdings did bear fruit, as the IMF decided to suspend the sale of its gold holdings. Although some central banks continued to sell off some of their reserves, they did enter into an agreement on a structured process of selling gold.

Targeted state assistance: The task team's primary mandate was to examine the feasibility of targeted state assistance with the objective of preventing or reducing large-scale job losses on gold mines. The second mandate was to explore how assistance to targeted mines might contribute to sustain the future viability of these mines. The gist of the team's conclusions was that targeted state assistance should continue on marginal mines.

7.3 Mining Summit

A two-day Mining Summit was held from 25-26 February 2000. The objective of the Mining Summit was to explore ways of creating jobs and revitalising the mining industry. Like the previous Gold Mining Summit, participants were drawn from government, labour and employers. However, unlike in the case of the Gold Mining Summit, other non-affiliates of the Chamber of Mines were invited. In order to facilitate the deliberations, four commissions were created to discuss and reach consensus on the following areas:

- Mineral promotion and development;
- Managing impact of cyclical volatility;
- Coordinated and integrated rural development; and
- Employment and human resources development.

The four commissions, comprised government, labour and business reached consensus on the following key issues:

- a) Creation of a tripartite body, which was referred to as the Sector Partnership Committee (SPC) and was considered to be a precursor to the planned Advisory Board.
- b) Creation of a statutory Advisory Board to take over the activities of the SPC.

- c) Development of strategies to promote South Africa's mineral industry.
- d) Improvement and prioritization of promotion of beneficiation.
- e) Promotion of small and medium sector businesses throughout the minerals value chain.
- f) Coordination of integrated rural development strategies and initiatives.
- g) Development of strategies for:
 - job creation through the promotion of growth in the mining industry;
 - enhancing existing jobs through protection of labour standards and skills development;
 - development and implementation of a Social Plan; and
 - programs based on existing policy on HIV/AIDS.

7.4 Sector Partnerships Committee

In implementing the Mining Summit consensus, stakeholders created a tripartite committee, termed the Sector Partnership Committee (SPC). The SPC was in fact a precursor to the permanent statutory Advisory Board that was later established in terms of the MPRDA. Like the GCC, the SPC organisational structure was based on tripartism, which comprised government, labour and business. Its structure is presented below:

Chairperson: The Director General of the DME was the Chairperson of the SPC.

Committee of Principals: The SPC consisted of a committee of principals, who met annually to review SPC activities. The committee comprised the Ministers of Minerals and Energy, Labour and Trade and Industry; the President of the NUM of Mineworkers, the Secretary General of the NUM; the President of the Chamber of Mines and the CEO of the Chamber of Mines.

In order to perform its functions the SPC created the following five implementing structures (committees):

- Mining Industry Promotion Implementing Structure
- Mineral Beneficiation Implementing Structure
- Cyclical Volatility and Depletion Implementing Structure
- Co-ordinated Rural Development Implementing Structure
- Employment and Human Resources Implementing Structure

The above five SPC structures had their own respective mandates and operated in a tripartite manner. Each structure comprised representatives of labour, government and business. Details of the activities of the SPC structures are contained in the SPC internal report of 2001 and are summarised below.

Mining Industry Promotion Implementing Structure: The key mandate of this structure was to explore ways and implement strategies to improve the image of the mining industry. In this regard the structure (committee) embarked on various programs which included promotion of the mining industry at selected international mining forums and shows. The promotional structure successfully accomplished its task of promoting the industry internationally. However, whilst such activities do help in promoting the industry, it would have been of great value if a strategy to promote South Africa's minerals had been developed.

Mineral Beneficiation Implementing Structure: The principal mandate of this structure was to explore ways of adding value to South Africa's minerals throughout the value chain and to advance job creation potential. The implementing structure's key programs were:

- Selection of minerals with potential and assessing existing beneficiation activities,
- Promotion of development of a sustainable and competitive jewellery industry;
- Commence with a jewellery transformation study; and
- Enhance skills development of disadvantaged students.

The structure continued to provide support to the Jewellery Transformation Champion, which was tasked to develop a world-class national jewellery strategy as recommended by the task team of the GCC. An international consulting firm (Kaiser Associates) was appointed to develop a jewellery strategy. Kaiser Associates pointed out that the transformation and growth of South Africa's jewellery industry would require the implementation of the following recommendations (Kaiser Associates, 2001):

- a) South Africa must establish a financing system that can assist manufacturers to unlock capital to invest in export market growth. This would need:
 - government involvement but not government subsidies;
 - ensuring that equal opportunities are presented across the industry; and
 - IDC and commercial banks playing a major role
- b) A strong South African brand should be created.
- c) A cross industry communication should be created, especially across manufacturers for capacity sharing/marketing and training.
- d) An exporter's manual should be developed to assist new entrants with a tool to penetrate export markets.
- e) A hive concept should be used as one of the initiatives in the overall industry development program.
- f) Industry-wide empowerment initiatives should be widened and tap on new entrepreneurship.
- g) Total commitment and cooperation from government, jewellery industry and mining houses will be needed to achieve success.

The structure prepared assessment templates for three selected minerals. These templates related to the beneficiation of iron ore, PGMs and stainless steel. With regard to iron ore, it was proposed that the focus should be on the beneficiation of iron ore to pig iron. It was suggested that the production of pig iron has the potential to create jobs both directly and indirectly. In terms of PGMs, it was

proposed that the focus should be on the jewellery and the auto catalyst markets where these metals might be utilised extensively. Recommendations were made to increase South Africa's market share on the jewellery and auto catalyst markets. Stainless steel was also identified as another possible growth area for South Africa and it was proposed that opportunities should be explored for downstream stainless steel production and how that these could be further improved.

Cyclical Volatility and Depletion Implementing Structure: The key mandate of the structure was to, inter alia, develop a mining industry Social Plan and proposals to minimise job losses. The structure was also task with the responsibility of piloting the Social Plan on the mines. The implementing structure comprised two sub-structures; namely, the Targeted State Assistance and the Social Plan sub-committee.

Social Plan sub-committee: The sub-committee's mandate was very similar to that of the GCC Social Plan task team, in that it had to minimise job losses and where retrenchments were unavoidable, it had to manage large-scale retrenchment and reduce the negative impact on employees and local economies. In this regard, the committee's activities were guided by the recommendations of the GCC Social Plan task team, which had recommended that the Social Plan be implemented in terms of the following three phases:

- Phase 1: Saving jobs;
- Phase 2: Managing Retrenchments; and
- Phase 3: Creating jobs for local economies.

Systems and processes were put in place under each of the three phases to assist stakeholders to deal with retrenchments.

Targeted State Assistance sub-committee: The sub-committee key activities involved investigating and providing recommendations to the DME on which mines should be given financial assistance by the state and some of its activities are discussed below:

- The committee recommended that two marginal mines (ERPM and Grootvlei gold mines) in Gauteng be assisted with water

pumping and the treatment of extraneous water. However the DME decided to only subsidise ERPM as they were of the opinion that Grootvlei was financially strong. ERPM was awarded a subsidy of R1.65 million per month for the period 2001/2002.

- The committee also developed a counseling video to assist in counseling redundant employees prior to retrenchments taking place. The video covered various aspects of the Social Plan, such as the financial issues (eg Unemployment Insurance Fund, employment counseling, and training and retraining of retrenched, etc.).
- The committee recommended that DME appoints a Social Plan manager to oversee and enforce the implementation of the mining Social Plan.

Co-ordinated Rural Development Implementing Structure: The structure mandate was to explore economic and job opportunities in rural labour sending areas with the aim of creating sustainable jobs for retrenched employees. In addition, the implementing structure aimed at integrating the mining industry's rural development initiatives with national initiatives. The most important achievements of the committee included, inter alia, implementation of rural development pilot projects in the Eastern Cape. The pilot projects were small businesses operated by retrenched employees.

Employment and Human Resources Implementing Structure: The key mandate of the structure was to:

- identify the type of skills required in the mining industry and labour sending areas; and
- develop strategies to develop the necessary skills.

In this regard, the implementing structure focused on skills development, work re-organization and employment equity. It managed to achieve the following in respect of skills development, work re-organisation and employment equity.

- a) *Skills development:* The provision of Adult Basic Education and Training (ABET) was identified as an important part of the human resources development strategy in the mining sector as some of the employees lacked basic high school education. A framework for the provision of ABET and implementation in the mining sector was developed. In addition proposals were put in place to ensure that ABET programs addresses skills development and thereby ensuring that ABET is included as part of MQA initiatives.
- b) *Work re-organisation:* A study on the impact of the introduction of full calendar operations (FULCO) and other organisational changes on mine injuries was completed in collaboration with SIMRAC (SPC Internal Report, 2001). While the study also suggested that FULCO had reduced the reportable injury rate, it was considered indefinite or incomplete due to lack of sufficient data. Four main work organisational changes were identified as having taken place in the sector since 1997:
 - Increase in subcontracting;
 - Rearrangement of shift schedules and working time;
 - Acceleration of incentive bonus and productivity schemes; and
 - Increased use of self-directed teamwork concept.
- c) *Employment Equity:* The committee investigated employment equity in the mining industry and pointed out that the 2000 Department of Labour compliance survey reveals that the mining

sector needed attention in most areas of equity with the following identified as key problems:

- Training and development;
- Recruitment and selection processes;
- Succession and experience planning;
- Performance and evaluation systems;
- Job classification and grading; and
- Corporate culture.

7.5 ADVISORY BOARD

The Advisory Board was established in terms of MPRDA, which was implemented on 1 April 2004. The rationale behind the establishment of the Board was to:

- ensure that the activities of the SPC were continued;
- advise the Minister of Minerals and Energy on promotion of minerals and mining related matters;
- advise the Minister of Minerals and Energy on disputes in respect of mining and exploration rights; and
- advise the Minister of Minerals and Energy on environmental issues relating to mining.

7.5.1 The Advisory Board structure

As with both the GCC and the SPC, the organisational structure of the Advisory Board was constituted on a tripartite basis, as follows:

Chairperson: The Director General of the DME is the Chairperson of the Board.

Board Members: The Board consists of representatives from government, NUM, Chamber of Mines, SAMDA, communities and individual mining and mineral experts.

Committees of the Board: The Board has two types of committees – those that deal with the promotion and development of the mineral industry, and those that focus on regulatory issues. The promotion and development committees were the former SPC sub-committees that had been incorporated into the Board. In

addition, the Board has seven Regional Committees that have a mandate to mediate on disputes in respect of regional issues relating to prospecting and mining.

7.6 Policy Initiatives to Address Downscaling

Whilst tripartite forums, such as the GCC and SPC played an important role in addressing various problems associated with downscaling, legislative interventions were needed to implement some of the ideas emanating from the forums. For example, the enforcement of the Social Plan needed legislative backup to ensure full implementation – hence the incorporation of Social Plan requirements into the MPDRA. However, the process of developing legislation in South Africa differed profoundly from the traditional process often followed in other developing countries. Both the South African and the traditional legislative approach in policy development are discussed in the following sections.

7.6.1 Minerals and mining policy development: The traditional approach

Traditionally, mineral policy development in developing countries is often sponsored and driven by funding institutions such as the World Bank. Mineral policy development sponsored by the World Bank during the past two decades includes: Ghana, Mali, Mozambique and, most recently, the Democratic Republic of Congo. Whilst consultation with some stakeholders in the mining industry also takes place in respect of traditional approaches, it is not as extensive and broad-based as in the South African one. For example, the traditional approach does not often involve the participation and consultation of labour Unions during the development of policy. Consequently, policy development sometimes lacks the influence of organised labour and some of the most important issues relating to employees, such as retrenchments and downscaling, are often omitted or given less prominence.

During the last two decades the development of minerals and mining policies in Africa were largely influenced by the following studies:

- Survey of 32 mining companies on Mineral Exploration Investment Criteria – Dr Charles Johnson (1990);
- Strategy for African Mining – John Strongman (1992);
- Mining and Minerals Sustainable Development – International Institute for Environmental and Development (2002); and
- Extractive Industry Review – World Bank (2005).

Policy reforms of the late 1990s were largely based on the 1990 Charles Johnson's mining industry survey of 32 large companies and the 1992 World Bank study (by John Strongman) entitled Strategy for African Mining. These reforms were primarily introduced after the abandonment of the policy of nationalisation by a number of African countries. In his study, Charles Johnson examined some of the most important factors in a mining company's long-run exploration strategy and identified that mineral policy ranked third on a list of mineral exploration investment criteria, after geological potential and political stability (Humphries, 1994). The World Bank 1992 study on Strategy for African Mining pointed out that the recovery of the mining sector in Africa required a shift in government objectives towards a primary objective of maximising tax revenue from mining over a long term, rather than pursuing other economic or political objectives such as control of resources or enhancement of employment. In terms of the recommendations from the report, governments should focus on obtaining a fair share of the economic rent from mining through fiscal arrangements that are stable, competitive and fair, rather than through ownership and operation. These recommendations resulted in many African countries neglecting social issues in pursuit of maximising rent. It is unfortunate that the policy reforms of the 1990s did not address the issue of mining and sustainable development holistically – it is not surprising that issues relating to downscaling and employment were not given prominence in the study.

The tendency to neglect social issues created discontent amongst Non-Government Organisations (NGOs), workers and communities affected by

mining. In a bid to address these discontents, multinational mining companies sponsored a study entitled Mining, Minerals and Sustainable Development. Although the study, published in 2002, recommended a multifaceted approach to address sustainable development, through, for example, addressing the concerns and needs of communities, it glaringly under-emphasised the need to improve employment issues, especially in respect of downscaling and retrenchments. Nevertheless the study did succeed in highlighting the need for the promotion of sustainable development in mining projects.

The World Bank project on the Extractive Industry Review was also initiated to investigate the future role of the World Bank in respect of extractive industries, as well as to address concerns and perceptions of NGOs that the mining industry, and similar industries, do not benefit countries and communities affected by these industries. Recommendations of the study emphasised the need to ensure that benefits from the extractive industries contribute positively to societies affected by these industries (World Bank, 2005).

The above-mentioned four studies demonstrate how various studies contributed towards the traditional development of minerals and mining policies in developed countries, and how policies evolved from emphasising on maximising rent to embracing the concept of sustainable development, which includes empowerment of communities. However, none of the four studies emphasised on the need to address employment issues related to downscaling and retrenchments.

7.6.2 Minerals and mining policy development: The South African approach

In South Africa, the issue of downscaling and its related negative impacts were recognised during the early 1990s when discussions on the development of a new minerals and mining policy for South Africa commenced. However, the matter assumed prominent role during discussions at the Gold Mining Summit, GCC, Mining Summit, SPC and Advisory Board. Proposals and ideas on how to address the negative impact of downscaling were incorporated into the new mining policy

and the MPRDA – a policy developed through a process that conspicuously deviated from the traditional approach.

The development of South Africa's minerals and mining policy was unique in the sense that it involved participation and consultation of wide spectra of stakeholders. In addition, the historic political relationship that existed between labour unions and the ruling ANC, resulted in the NUM playing a central and influential role in shaping the new policy. However, despite the influence of the NUM in policy formulation, the process followed involved open discussions with all other stakeholders in the tripartite forums. The engagement of organised labour in policy formulation, and the desire to empower communities, resulted in socio-economic issues being given prominence in the new minerals and mining code – hence the inclusion of the Labour and Social Plan in the new MPRDA. In terms of section 23 of the MPRDA, a mining right application should be accompanied by a prescribed Social and Labour Plan.

The incorporation of labour, social and downscaling issues into the legislation followed a lengthy process, commencing with the release of the 1997 Green Paper on Minerals and Mining Policy. Government consulted with various stakeholders on the matter before publishing its policy proposal, which was subsequently released as formal government policy in the White Paper on Minerals and Mining Policy (released in October 1998). As part of its policy, government committed itself to address the need to preserve mining employment and deal with retrenchments in the short term. In the medium-term, government committed itself to:

- the introduction of a provision requiring mining companies to notify government in the case of retrenchments that cumulatively exceed 10 per cent of workforce in any twelve-month period;
- encourage mines to establish a Social Plan fund; and
- entrust the Advisory Board with the task of monitoring restructuring in the mining industry and providing recommendations to the Minister of Minerals and Energy.

Following a lengthy consultative process the above policy was translated into the MPRDA, which legislated, inter alia, the appointment of a Board to take over the activities of the SPC.

7.7 Discussion

a) Summary and critical analysis of the tripartite initiatives

The three tripartite initiatives and their respective committees

A summary and comparative analysis of the three tripartite initiatives and their respective committees are presented in Tables 7.2 and 7.3. The operational structures of the initiatives were all designed to operate on a tripartite basis. In all three cases, tripartite committees and sub-committees were constituted to perform the functions of the respective organisations. Whilst tripartite forums are the most appropriate way of providing a consultative process in strategy development, consensus is often difficult to reach and in most such cases, issues are often left unresolved.

The creation of tripartite task teams to address strategic themes pertinent to the industry is commendable. However, the achievements of some of the task teams were not dramatic and in some cases task teams failed to abide by their terms of reference. An analysis of the GCC and SPC structures reveals that the most successful committees were those that dealt with the Social Plan, gold speculation and beneficiation matters.

Halting downscaling and addressing the gold crisis in the gold mining industry

There is no doubt that not one of the six tripartite national initiatives managed to arrest downscaling in the gold mining industry. Since downscaling commenced in 1987, the gold mining industry has lost a substantial number of employees and the situation is still not improving.

Developing and implementing a Social Plan for the mining industry

Although there were problems in respect of implementing the Social Plan, the forums have to be commended for pioneering a mining Social Plan. As earlier stated the tripartite forums successfully developed a Social Plan framework, which was later incorporated in the new MPRDA.

Table 7.2 A comparative analysis of the Gold Mining Summit, the Mining Summit and the MPRDA.

Initiative	Gold Mining Summit	Mining Summit	MPRDA
Date held/Instituted	26-27 February 1998	25-26 February 2000	Green Paper: December 1997 White Paper: October 1998 Implementation of the Act: 1 April 2004
Participants	Participants were from NUM, Chamber of Mines and government	Participants were from NUM, Chamber of Mines, government, NGO and other small business organisation.	This was a government process that involved consultation of all stakeholders
Declaration and consensus reached	Consensus was reached on: • Moratorium on retrenchments • Formation of a Gold Crisis Committee • Agreeing on a Social Plan • Government should investigate targeted State Assistance to marginal mines • Re-skilling of mineworkers to provide them with portable skills	Consensus was reached on: • Developing strategies for promoting and developing the minerals and mining industry • Formation of Sector Partnership Committee • Developing a strategy to manage the impact of cyclical volatility • Driving and implementing beneficiation strategies • Sustaining existing jobs on marginal mines • Implementing the mining Social Plan	Consensus was reached on: • Constituting the Advisory Board • Creation of a Social Plan directorate in the Department of Minerals and Energy • Implementation of the Mbula Declaration • Agreeing on the Mining Charter • Establishment of a statutory Advisory Board

Table 7.3 A comparative analysis of the GCC, SPC and Advisory Board

Committees/ Bodies created	GCC	SPC	Advisory Board
Sub-Committees/ Task Teams/Structured created	• Social Plan Task Team • Targeted State Assistance Task Team • Beneficiation Task Team • Capital Labour Task Team • Gold Speculation Task Team	• Social Plan Implementing Structure • Mineral Promotion Implementing Structure • Beneficiation Implementing Structure • Coordinated Integrated Rural Develop Implementing Structure • Employment and Human Resources Development	• Nine Regional/Provincial Regulator Committees • Social Plan Implementing Structure • Mineral Promotion Implementing Structure • Beneficiation Implementing Structure • Coordinated Integrated Rural Develop Implementing Structure • Employment and Human Resources Development structure
Key Achievements	• Development of a mining Social Plan Framework • Proposal to appoint a Jewellery Champion to transform the jewellery industry • SWOT analysis of South Africa's jewellery industry	• Piloting the Social Plan • Appointment of a Jewellery Champion and overseeing its activities • Completion of a study entitled Jewellery Cluster Study – Strategic Recommendations • Promoting the mining industry at major mining conferences and arranging an annual mining week	• Restructuring of the DME to create a Social Plan and small-scale mining Directorates

Strategies to address gold speculation and sale of gold by official gold holding institutions

There is evidence that speculation around official sector gold reserves plays a significant role in depressing the dollar gold price. There are two reasons behind this: Firstly, a negative perception is often created that central banks will dump huge quantities of gold onto the market and increase the supply. These actions leading to the perception that gold is no longer an important reserve asset. Secondly, according to the Chamber of Mines and NUM Joint Briefing Document (1999), speculators also drive the gold price downwards by borrowing gold from central banks to go “short” thereby benefiting from an interest rate contango.

The initiative to lobby central banks and the IMF from wholesale selling of their reserves was extremely successful. This is evident from the fact that the IMF revisited their plan to sell off gold and eventually aborted their plan. Although European central banks could not be dissuaded from reducing sales, they adopted a positive step by announcing the signing of the Central Banks Agreement. The agreement provided sufficient certainty as to the volume and timing of sales, and bound signatories to the agreement to sell a maximum of 2 000 tonnes, spread more or less equally over five years (GFMS Ltd, 2004). However, whilst the strategy of lobbying has been successful, this matter should not be left as it is and organisations such as the World Gold Council and governments of gold producing countries should continue to promote gold as a store of value. The approach that was followed has been a reactive one and a more proactive strategy needs to be put in place, especially during relatively high gold price periods.

Another issue needs to be addressed, that is the practice by some gold producers, to participate in the forward market through gold hedging. Although some views held that hedging does not necessarily depress the gold price considerably, there is no doubt that it does increase gold supply in the market - which would naturally depress the gold price. It would be useful if future strategies to address downscaling in the gold mining industry also investigate the matter in detail to determine if hedging does indeed negatively affect the gold price.

Exploring ways of adding value to South Africa's gold and other minerals

The concept of increased beneficiation of South Africa's minerals has been argued by many players in the minerals industry. In a publication entitled "South Africa's Gold – A Blessing and a Curse", Edwards (1989) (one of the early proponents of beneficiation) points out at the importance of beneficiating South Africa's minerals. There are, in essence, two schools of thoughts. Some role players, especially government and labour unions, believe that increased beneficiation will contribute towards the creation of jobs and also address the social impact associated with downscaling in the gold mining industry. In this regard, both labour unions and government are strong proponents of a legislated process that will improve the beneficiation of South Africa's minerals. Congress of South African Trade Union's (COSATU) and NUM's position on beneficiation is captured in their submission to the Department of Finance on the Draft Mineral and Petroleum Royalty Bill (Congress of South African Trade Unions and National Union of Mineworkers, 2003). In the submission, they call for active promotion of beneficiation and point out that the relevant provisions in the MPRDA are too weak.

On the other hand, organised business as represented by the Chamber of Mines is of the opinion that mining companies should not be forced to beneficiate their products in South Africa and secondly, believe that the gold mining industry is already beneficiating significantly in respect of refined gold bullion. In its submission to the portfolio committee the Chamber argues that comparative advantage in respect of natural resources is no longer considered to be a key driver of manufacturing beneficiation investment. The Chamber points out that competitive advantage in the form of cost competitive production, skills and craftsmanship were the key drivers of manufacturing and beneficiation (Chamber of Mines, 2005). The Chamber furthermore warned against forcing mining companies to subsidise beneficiation or to go into areas where mines had little expertise or skills. The importance of cost competitiveness production has also been highlighted by Ford et al (2000) in their study on opportunities for value addition to minerals in. Ford et al (2000) furthermore pointed out that the

prerequisite to value addition was the presence of competitiveness of value addition, which can be achieved through technological innovation and well functioning Research and Development (R&D) facilities. They, however, further pointed out that whilst SADC was well served by R&D facilities in the primary and secondary processing stages, R&D linkages to the fabrication sector (e.g. jewellery manufacturing) do not appear to be fully developed.

The GCC, SPC and Advisory Board have recognised the importance of adding value to South Africa's minerals, especially gold, and the appointment of a Jewellery Champion was an important step in the process of trying to transform the South African jewellery industry. The Champion managed to commission a study (undertaken by Kaiser Associates) on the transformation of the jewellery industry of South Africa. It is important to note that both the GCC task team and the Kaiser Associates studies highlighted the need for all stakeholders to show total commitment in terms of investing resources for jewellery transformation to succeed. The GCC task team pointed to the importance of the need for total commitment in their SWOT analysis exercise, wherein they identified the lack of total commitment from all stakeholders as one of the main weaknesses and threats.

The current legislative process on beneficiation will most likely address the issue of lack of commitment. Government has already showed its commitment by introducing legislation on beneficiation; however, consultation with key stakeholders should be paramount to the process.

Determining the appropriate balance between capital and labour

Whilst it was commendable for the GCC to investigate this matter, it is the view of the author that business conditions and circumstances, at any particular time, will determine which option best suits the extraction of gold, or any other mineral, at a profit. Government's role should be limited to providing R&D incentives to private sector and public research institutions. The task team's recommendations

were not specific (perhaps it avoided being controversial) and gave the following options for consideration:

- Utilising current technology;
- Introducing alternative technology;
- Utilising available technology; and
- Introducing mechanized technology.

It is apparent that the South African gold mining industry did not do enough to invest in appropriate R&D to increase mechanisation of the industry. Whilst jobs could have been lost in the process of mechanisation, the manufacture of mining equipment could have developed into an important industry providing more sustainable employment opportunities. Finland is a typical example of a country that used forestry (a natural resource based industry) to create an environment for the development of other industries, such as industrial electronics and logging equipment (Vuori and Yla- Anttila, 1992).

Assessing the feasibility of targeted State assistance with the objective of preventing or reducing large-scale job losses on gold mines

The matter of targeted state assistance to marginal mines has been investigated on at least two occasions. As a result of a sharp fall in the gold price during the 1988–1989 period, Cabinet appointed a committee to investigate the financial problems of marginal–profit mines and explored ways of developing a strategy to address the problems (Marais, 1990). The committee’s recommendations reiterated, and cautioned, that the economy would best be served in the long term by a policy approach that does not necessarily concentrate on assistance to a particular industry, but rather one which is aimed at the optimal combination of interest rates, the exchange rate, the general wage level and tax rates and that which promotes economic development in general. However, the committee did recommend in its conclusions that government should still provide assistance to marginal-profit mines. The committee furthermore pointed out that such aid should be in the national interest and mines should not depend permanently on State assistance for their long-term viability.

The GCC also established a task to investigate the targeted state assistance to marginal mines. The gist of their recommendations was more or less similar to the above-mentioned 1989 Cabinet appointed committee; the task team argued that the benefits of providing subsidies to marginal mines outweigh the costs associated with closure and retrenchments.

Regrettably historical evidence in respect of subsidising mines in South Africa shows that subsidies create dependency and the state is often locked into these subsidies for ever. A typical example of this scenario is the subsidisation of ERPM in the East Rand – government has been locked in for many years and it is doubtful if the subsidisation of the mine will ever cease.

Strategies for employment creation, rural development and human resources development

With regard to employment creation and rural development, various initiatives were put in place. These include piloting small-scale mining projects, the promotion of junior-scale mining and the establishment of small enterprises by the MDA.

Efforts to promote small-scale mining are largely coordinated by the DME and some projects are now coming to fruition. Nonetheless there is no doubt that more support is required as this sector is bound to increase with increasing downscaling. Likewise, the promotion of junior mining, which has been given impetus by the new MPRDA and the BEE requirements, seems to be gaining momentum. However, the country is still a long way from developing a real junior mining sector similar to that of the Canadians and Australians. The development of a really vibrant junior mining sector will require a totally new and innovative strategy.

In terms of rural development the MDA excelled in its program to re-skill retrenched employees. Former employees were trained to open and run small business, such as bakeries. Although most mines boast human resource

development programs in the form of ABET, technical training for artisans and technicians, management and professional training and transformation in the industry in respect of racial employment equity is still of concern. This concern resulted in targets on employment equity being put in place by the Mining Charter implemented in 2004.

b) National policy initiatives to manage downscaling: The three phases

The loss of jobs during Period 3 and most importantly during the 1997–2001 sub-period was of great concern to employees, employers and government, to the extent that tripartite national policy initiatives were put in place to address the situation. The initiatives can be subdivided into three phases; Phase 1 (Reactive phase), Phase 2 (Policy development phase) and Phase 3 (Implementation phase) (Figure 7.1).

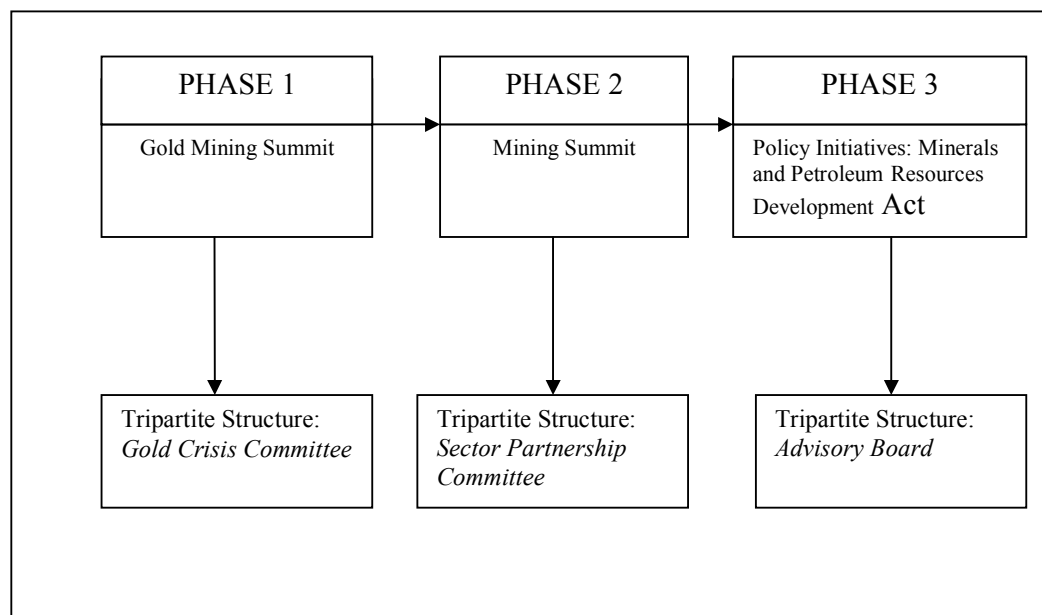


Figure 7.1 Three national initiatives to address downscaling.

Phase 1 (Reactive Phase: 26 February 1998 - 25 February 2000): Phase 1, which was a reactive phase, commenced when the National Union of Mineworkers (NUM) called for the holding of a tripartite Gold Mining Summit to

respond to the loss of jobs in the gold mining sector and the then persistent depressed gold price. Following a preparatory period of about two months, the tripartite summit was held from 26 to 27 February 1998. Participants at the summit included representatives from government, NUM and the Chamber of Mines. At the closure of the summit, the three parties adopted a declaration which, inter alia, called for the introduction of a moratorium on retrenchments and establishment of a tripartite Gold Crisis Committee (GCC) to implement recommendations of the summit. The primary functions of the GCC are summarised below:

- Dealing with procedures for governing gold mining retrenchments and assessing alternative options to retrenchments;
- Assessment of the National Economic Development & Labour Council (NEDLAC) Social Plan agreement and recommend a process for adapting it to the gold mining industry;
- Commissioning an investigation into targeted state assistance to marginal mines and provide recommendations;
- Support and direct initiatives to reduce speculation regarding official reserves of gold and support the role of gold as store of value in official institutions;
- Explore further opportunities for beneficiation of minerals and development of markets for beneficiated minerals;
- Ensure an appropriate balance on imposts on the gold mining industry;
- Explore the correct balance between capital and labour intensive mining across the industry; and
- Examine the adverse effects of South African gold mining across the SADC region and consider proposals for addressing them.

The holding of the gold mining summit was a watershed moment for South Africa, marking the beginning of the establishment of institutionalised tripartite forums in the mining industry. The question that should be asked is whether or not the Gold Mining Summit and the GCC made a difference in respect of addressing the crisis in the gold mining sector. It is evident that the summit and the GCC could not stop the loss of jobs, as employment dropped from 258 821 in 1998 to 186 132 in 2004. Nonetheless, the following important achievements occurred:

- Development of key elements of a Social Plan framework for the mining industry. This included agreeing on principles regarding the re-skilling of mineworkers so as to provide them with portable skills; and
- Undertaking an investigation into targeted state assistance to marginal mines.

Phase 2 (Policy development phase: 25 February 2000- 31 March 2004): Phase 1 was largely a reactive phase and stakeholders soon realised that there was a need to adopt a proactive approach, which would involve all sectors of the mining industry. In this regard, on 25 and 26 February 2000, the Mining Summit was held to, inter alia, explore ways of addressing downscaling and the creation of jobs in the mining industry. As part of the outcomes of the Mining Summit, the tripartite Sector Partnership Committee (SPC) was established to facilitate the implementation of the Gold Mining Summit and the Mining Summit's declarations. The mandate of the SPC was largely of a strategic and pro-active nature and included the following:

- Development of initiatives to promote the mining industry;
- Development of strategies to beneficiate South Africa's minerals;
- Exploring initiatives to address cyclical volatility and resource depletion;
- Investigating initiatives to co-ordinate rural development and job creation in labour sending areas; and

- Explore ways of creating employment and development of human resources in the mining sector.

The holding of a mining summit played an important part in addressing downscaling in the mining industry. The key difference between the mining summit and the gold mining summit was that the mining summit addressed broader mining issues in all sectors, whilst the gold mining summit focused on the gold mining industry. Consensus and declarations at the mining summit were more proactive than at the gold mining summit, which were reactive in nature. This is understandable, as the gold mining summit was a response to massive retrenchments and problems facing the gold mining sector. Activities of the SPC were also proactive in terms of seeking solutions to address, inter alia, employment, human resources development, rural development and promotion of the minerals and mining.

The key objective of the mining summit was to explore ways of creating jobs in the mining industry. Whilst the objective was always going to be difficult to achieve, the SPC managed to make significant strides in respect of the following:

- Development of a strategy to promote minerals and mining in South Africa;
- Development of a strategy to manage cyclical volatility;
- Development of proposals to promote beneficiation; and
- Implementation of the Social Plan through pilot projects.

Phase 3 (Policy implementation phase: 1 April 2004 - Present): Whilst phases 1 and 2 were instrumental in generating many ideas, strategies and recommendations on the management of downscaling, the phases often fell short of implementation. The problem was complex - ranging from reluctance by some stakeholders to lack of legislative instruments to implement recommendations and proposals. The process of transforming the country's mining code allowed for the incorporation of some of the recommendations and views into the legislative process. For example the GCC and the SPC were instrumental in developing

elements of the mining industry Social Plan – these were subsequently incorporated into the MPRDA.

Phase 3 commenced on 1 April 2004, with the implementation of MPRDA, which addresses issues relating to downscaling through the Labour and Social Plan. In terms of the MPRDA mining companies are required to compile a Labour and Social Plan as part of their mining plans. The MPRDA also legislated for the establishment of a tripartite Advisory Board to advise the Minister of Minerals and Energy on, amongst others, management of downscaling in the mining industry.

7.8 Summary

In a bid to address negative impacts associated with downscaling, stakeholders in the gold mining industry implemented tripartite (comprising government, labour and business) national initiatives. The initiatives were implemented in a three-phased process, which involved holding two tripartite summits; Gold Mining Summit (Phase 1) and Mining Summit (Phase 2) and incorporating and implementing recommendations emanating from Phases 1 and 2 into the legislative process (Phase 3). Phases 1 and 2 involved creation of committees (GCC in Phase 1 and SPC in Phase 2) which were responsible for conceptualising, inter alia, various ideas and recommendations for addressing downscaling. The most important ideas, outcomes, programs and recommendations on the management of downscaling are summarised below:

- The GCC and SPC conceptualised and developed the mining Social Plan, which has since become an important tool in managing downscaling in South Africa's mining industry. Stakeholders also agreed on principles regarding the re-skilling of mineworkers so as to provide them with portable skills.
- On marginal mines, the GCC committee argued that the benefits of providing subsidies to marginal mines outweigh the costs associated with closure and retrenchments. The committee therefore

recommended for the continued subsidisation of targeted marginal mines.

- On skills developed, the SPC developed policies to encourage and direct the implementation of ABET, which was then incorporated into MQA initiatives.
- On attracting investment and therefore creating new jobs to counter job losses associated with downscaling, the SPC embarked on promoting South Africa's mining industry at international mining shows and forums.
- With regard to beneficiation, the GCC and SPC proposed that beneficiation of South Africa's minerals be promoted to create jobs to compensate for the loss of jobs in the gold mining industry. In this regard the jewellery industry was identified as the most important mineral beneficiation sector. However, the lack of total commitment from stakeholders to drive jewellery beneficiation was identified as the biggest threat and weakness.
- On addressing speculation around sales of central banks' reserves, the initiative to lobby central banks and the IMF from wholesale selling of their reserves bore fruit. The IMF revisited their plan to sell off gold and eventually abandoned the plan. The lobbying also resulted in the European central banks announcing the signing of the Central Banks Agreement, which provided for a structured way of selling gold reserves.

The development of a new mining policy in South Africa followed a unique procedure in that consultation took place amongst all three key stakeholders (labour, government and business) throughout the process. Nonetheless, the consultation has benefited employees and labour unions in that downscaling and retrenchment issues have been addressed in the new mining code.

Whilst national initiatives to address downscaling in the gold mining industry were beneficial in respect of dealing with generic issues across the gold mining

industry and other mining sectors, individual mines were continuously faced with their own unique downscaling challenges. In the next chapter the management of downscaling at one of South Africa's largest mines will be investigated.

CHAPTER 8

CASE STUDY: ANALYSIS OF MANAGEMENT OF DOWNSCALING AT DRIEFONTEIN GOLD MINE

“The next few weeks are going to be taxing on every person in GFSA and Goldfields Ltd. The executive and senior management are committed to do everything within our power to ensure that the transition for the company and each individual is as smooth, fair and painless as possible. I invite you to join us in our effort to ensure that the process is credible and successful. If you have any suggestions on how the process can be improved, at any level, please let us know.” Goldfields South Africa Circular on 3 February 1998 (Gold Fields Ltd, 1998a)

8.1 Introduction

As part of the study of analysing management of downscaling and the gold crisis in South Africa’s gold mining industry, Driefontein Gold Mine was used as a case study. The study on Driefontein involved an analysis of selected business factors during the Downscaling period (Period 3), as well as analysis of measures and strategies that were put in place by management to address downscaling and the gold crisis.

8.2 Location of Driefontein Gold Mine

Driefontein Gold Mine is located in the West Wits Line goldfield, some 70 km south-west of Johannesburg near Carletonville (Figure 8.1). It is one of the most significant gold operations in the world and has, to-date, produced some 100 million ounces of gold over the past 33 years (Gold Fields Annual Report, 2003). In fact, according to the 2003 Annual Report, the mine has established a record by being the first gold mine in the world to produce 100 million ounces of gold. The mine is subdivided into two divisions; namely, East Driefontein and West Driefontein, which used to operate as separate entities prior to their merger in 1981.

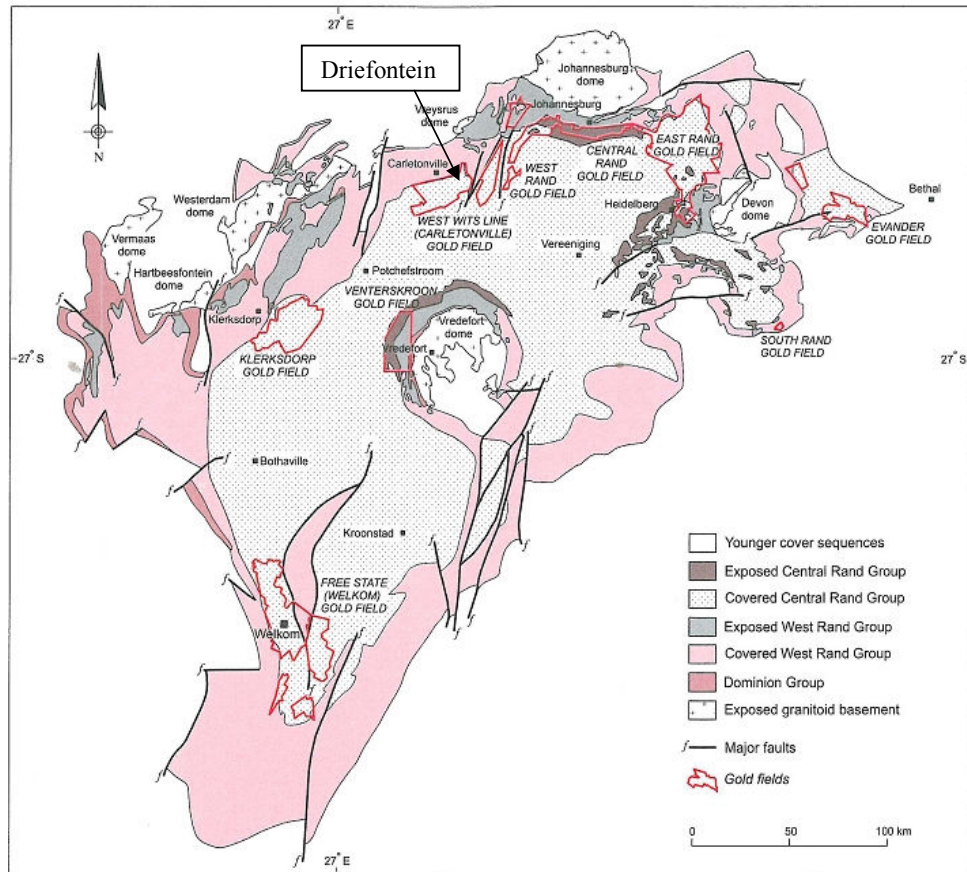


Figure 8.1 Simplified map of the Witwatersrand basin showing principal gold fields and Driefontein Gold Mine (modified after Pretorius 1986).
(Source: Robb I. J. and Robb V.M., 1998).

8.3 Geology and Gold Reefs

Gold in Driefontein occurs in tabular sheets of the Witwatersrand Supergroup conglomerates. The conglomerates, which comprise a wide variety of pebbles and fine sediments, are part of a sedimentary system that was deposited onto basement granites and greenstones. Three gold bearing reefs are mined at Driefontein; namely, Carbon Leader (CLR), Ventersdorp Contact Reef (VCR) and Middelvlei Reef (MR).

8.4 Mining

Mining at Driefontein is typical traditional South African deep underground mining in which opportunities for increased mechanisation in respect of current technology are limited (Mining-Technology, 2006). According to Mining-Technology (2006), the mine consists of eight operating shaft systems, which mine the VCR, CLR and, to a limited extent the MR. Gold occurs in conglomerate horizons (reefs) comprising variety of pebbles, sand and silt particles, sulphides and carbon. The reefs thicknesses range from thin contact horizon ($< 1\text{cm}$) to multiple conglomerate bands (21 meters). Like most Witwatersrand mines, mining at Driefontein involves accessing the auriferous reefs by sinking vertical primary shafts and sub shafts, and developing cross cuts, drive tunnels along reefs, raises, winzes and gullies. Mining methods are typical Witwatersrand ones, which are mainly longwall and paddock. Once the reefs are accessed and exposed, mining takes place on gently dipping stopes (± 23 degrees) ranging in thickness from about 1 cm to 21 meters. Operations are labour intensive in that they involve drilling of rock faces, blasting, removing blasted rocks and supporting mined out stopes with for example timber. Availability of labour is therefore a critical part of mining operations.

8.5 Analysis of Selected Business Factors During the Downscaling Period (Period 3) at Driefontein Gold Mine

(Note Figures 8.3 – 8.24 shown on pages 284 - 294)

8.5.1 Employment at Driefontein Gold Mine

Figure 8.2 shows that employment at Driefontein, although cyclical in pattern, dropped from 28 521 in 1980 to 18 567 in 2004 – representing a 35 per cent decline. Employment at the mine reached a high of 33 514 in 1986 and subsequently dropped to 18 567 in 2004 – representing a 45 per cent decline. The overall decline in employment at the mine is in line with the decline in employment in South Africa's gold mining industry (Figure 5.1). However, the 1987/1988 countrywide commencement of downscaling in the gold mining industry only became prominent at Driefontein during the 1997/1998 period (Figures 5.1 and 8.2).

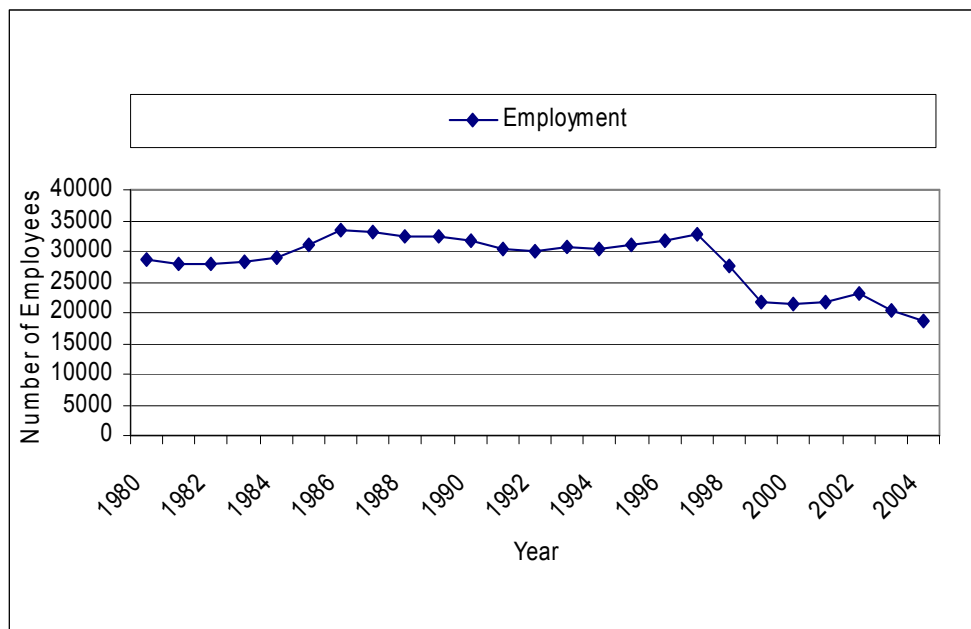


Figure 8.2 Driefontein: Annual average employments - Linear chart for 1980-2004 (Data Source: DME).

A closer analysis of Figure 8.2 reveals that employment at Driefontein underwent three major periods (1980-1997, 1997-1999 and 1999-2004) between 1980 and 2004. Period 1980-1997 was a phase of cyclical, but fairly stable employment levels. This trend is in contrast to the nationwide trend of a sharp decrease in employment levels (Figure 5.1). The relative stability in employment at Driefontein during the 1980-1997 period can be attributed mainly to the then Gold Fields' policy of not retrenching employees. The period was followed by a sharp decline in employment between 1997 and 1999, which was, in turn, followed by a moderate decline in employment between 1999 and 2004.

However, despite the relative stability in employment during the 1980-1997 period, the mine did not escape the nationwide unstable socio-political environment that prevailed during the late eighties and early nineties. The uncertainty associated with political changes negatively affected employment at Driefontein and employment dropped from 33 514 in 1986 to 30 126 in 1992. The successful conclusion of political negotiations and the inauguration of Nelson Mandela as first democratic President in 1994 resulted in a stable socio-political environment resulting in positive spin-offs for employment at Driefontein. Consequently, employment increased from 30 126 in 1992 to 32 618 in 1997. However, the 1996 merger of Gold Fields and Gencor coupled with depressed gold prices and declining gold grades, resulted in major corporate restructuring at Gold Fields and rationalisation in the form of massive retrenchments, took place throughout the entire group. At Driefontein employment dropped from 32 618 in 1997 to 21 818 in 1999 – representing 33 per cent drop in employment. Incidentally, the drop in employment between 1997 and 1999 coincided with a national and global pronouncement of a crisis in the gold mining industry – an indication that Driefontein did not escape the crisis.

8.5.2 Gold price and employment

Figure 8.3 shows an overall decline in both employment and the dollar gold price between 1980 and 2004. The gold price declined by 33 per cent, whilst employment dropped by some 35 per cent. The decline in the dollar gold price

and employment suggests that the dollar gold price played an influential role in determining employment levels at Driefontein.

The relationship between dollar gold prices and employment at Driefontein reveals that both parameters moved more or less in tandem throughout Period 3 (1987-2004). The decline in dollar gold price between 1987 and 1992 seems to have had, a negative impact on employment levels (Figure 8.3), though not significant. The gold price dropped by 23 per cent whilst employment dropped by 9 per cent between 1987 and 1992. Figure 8.3 also shows a significant drop in both the dollar gold price and employment between 1997 and 1999, which were, incidentally, the years of massive retrenchments countrywide. However, the subsequent increase in the gold dollar price between 1999 and 2002 resulted in an increase in employment during the same period. The post 2002 period has seen a continued decline in employment despite increasing dollar gold prices. This inverse relationship is in line with the national trend exhibited in Figure 5.3.

The relationship between employment and real rand gold price behaved similarly to that of the dollar gold price and employment. With regard to the rand gold price, the impact of a relatively strong rand against the dollar during most of the post-2002 era resulted in the rand gold price declining in tandem with employment (Figure 8.5). Figure 8.6 shows three distinct data groups revealed in Figure 8.4. The 1999-2004 group represents the post-restructuring (lower employment) period at Driefontein.

8.5.3 Ore milled and employment

Figure 8.7 shows that whilst employment declined between 1980 and 2004, ore milled increased from 5 301 tons to 6 468 tons during the same period – representing a 22 per cent increase in ore milled against a 35 per cent decline in employment. This inverse relationship suggests that the mine focused on productivity improvement during the Downscaling period, especially during the post-1997 era (after the restructuring of Gold Fields). Figure 8.19 demonstrates the increase in productivity that took place during the post-1997 period.

It is ironic that whilst overall nationwide ore milled showed a sharp decline from 1987 onwards (Figure 5.7, Phase 3), ore milled at Driefontein remained fairly stable between 1987 and 1997, and even increased during the post-1997 period. The stability in ore milled during the pre-1997 period is ascribed to the fact that grades (Figure 8.11) at the mine were fairly stable and, unlike in other mines, management was not under severe pressure to increase tonnage in order to compensate for declining grades. However, the situation changed in 1998 when grades on the mine dropped to below 9 grams per ton for the first time. The drop in gold grades and associated drop in gold production resulted in management pursuing the economies of scale strategy by increasing the quantity of ore milled. It seems that management was of the opinion that they could address the problem of declining ore grades and gold production through economies of scale. Regrettably between 1977 and 1987, a similar approach was employed by the industry in general, when it tried unsuccessfully to address the problem of declining gold grades through economies of scale (Figure 5.7).

As with the gold price, two major data sets can be observed in Figure 8.8. Group 1980-1998 represents data prior to the restructuring, whilst group 1999-2004 is the post-restructuring data. The relative stability in respect of employment and ore milled during 1980-1998 is ascribed to Gold Fields' policy that was opposed to retrenchments during this period. The period was followed by the post-restructuring period - a period of relatively high ore milled and lower employment levels (1999-2004).

8.5.4 Gold produced and employment

Figure 8.9 shows that both gold production and employment declined progressively between 1980 and 2004. Gold production dropped from 83.1 tons in 1980 to 35.8 tons in 2004 – representing a 57 per cent drop in gold production. In almost similar manner, employment dropped from 28 521 in 1980 to 18 567 in 2004 – representing a 35 per cent decline. The downward decline in gold production at Driefontein is in line with the nationwide decline in gold production that commenced in 1971 (Figure 5.11).

Figure 8.10 demonstrates three groups of data sets; namely, 1980-1984, 1985-1998 and 1999-2004. Both the 1980-1984 and 1985-1998 groups represent the pre-restructuring period, when employment levels were relatively high. The 1980-1984 data represents an environment of relatively high gold production and high employment, whilst the 1985-1998 data represents a period of increased employment and relatively high gold production. The 1999-2004 (post-restructuring period) data represents a period of low and declining gold production and employment. This latter trend is in line with the nationwide trend of declining gold production and employment in the gold mines during the same period.

8.5.5 Gold grades and employment

Figure 8.11 shows that employment levels dropped more or less in tandem with gold grades. Gold grades dropped from a high of 15,66 g/t in 1980 to 5,54 g/t in 2004 (65 per cent decline), whilst employment dropped from 28 521 in 1980 to 18 567 in 2004 (35 per cent decline). The simultaneous decline in both gold grades and employment suggests that, like the nationwide trend, gold grades played a critical role in the shedding of jobs at Driefontein. Like gold production, the restructuring at Driefontein can be depicted in the scatter diagram in Figure 8.12. Group 1999-2004 data represent the post-restructuring period that was accompanied by relatively low employment and grades.

8.5.6 Real rand working revenue and employment

Figure 8.13 shows that both employment and real rand working revenue declined considerably between 1980 and 2004. Revenue dropped from R2 371.36 per ton in 1980 to R469.04 per ton in 2004 – representing an 80 per cent decline in revenue; whilst employment declined by 35 per cent during the same period. The continuous drop in gold grades resulted in declining gold production, which impacted negatively on revenue as well as employment. Figure 8.11 shows three data sets; namely, 1980, 1981-1998, and 1999-2004. The latter group, representing the post-restructuring period, was a period of relatively low revenue and employment – a scenario consistent with the nationwide trend (Figures 5.17).

8.5.7 Real rand working costs and employment

Figure 8.15 shows that there is a marginal increase in real working costs from R332.23 per ton in 1980 to R365.40 per ton in 2004 – representing a 10 per cent increase. Conversely, employment declined from 28 521 in 1980 to 18 567 in 2004 – a 35 per cent decline. The insignificant changes in real working costs between 1980 and 2004 are a reflection of the situation in the industry (Figure 5.21).

A closer analysis of Figures 8.15 and 8.16 show that employment increased more or less in tandem with working costs between 1980 and 1998. This resulted in a period of relatively high working costs and high employment levels. The restructuring of Driefontein in 1997/1998 changed the business environment on the mine to that of relatively lower working costs and employment levels. The decision to cut down on labour seems to have benefited the mine as there is a noticeable containment of costs throughout the post-1999 period. The same can be said about the broader gold mining industry - Figure 5. 21 shows that costs have generally been contained in the industry for most of Period 3.

8.5.8 Real rand working profits and employment

Figure 8.17 shows that both employment and real working profits dropped significantly between 1980 and 2004. Employment dropped from 28 521 to 18 567 – a 35 per cent decline - whilst real working profits dropped from R2 039.13 to R103.64 - representing a 95 per cent decline. The decline in profitability at Driefontein during the post-1980 era is not an isolated issue and resembles the nationwide decline in profitability of the gold mining industry during this period (Figure 5.24).

Figure 8.17 shows that the overall decline in real working profits during 1980-2004 period affected employment negatively. Ironically, despite declining profits that were already apparent by 1981, employment was relatively stable between 1980 and 1997, although cyclical. As stated earlier, the stability is ascribed to Gold Fields' policy of not retrenching employees. Whilst other mining companies

commenced with the retrenchment of employees during the 1987/1988 period, Gold Fields only started with retrenchments 10 years later.

Figure 8.18 shows three data sets; namely, 1980, 1981-1998 and 1999-2004. The 1980 data represent a period of relatively high profits and employment levels, whilst the 1981-1998 data was a period of relatively low to medium profits and high employment levels. The restructuring and rationalisation of Gold Fields in 1997/1998 resulted in a substantial reduction in employment as represented in Figure 8.18 (group 1999-2004), but did not necessarily improve profitability – resulting in a period of low employment levels and low profitability.

8.5.9 Productivity in terms of ore milled per employee and employment

An overall inverse relationship exists between productivity in terms of ore milled per employee and employment (Figure 8.19). Productivity increased from a low of 186 tons milled per employee in 1980 to 348 tons in 2004 – representing a 87 per cent increase. In contrast employment decreased from 28 521 in 1980 to 18 567 in 2004 – a decrease of 35 per cent. The increase in productivity is in line with nationwide improvement in productivity on the gold mines during the Downscaling Period (Figure 5. 25).

Figures 8.19 and 8.20 show two trends and groups of data sets that can be observed between 1980 and 2004. The 1980–1998 (prior to restructuring) data represents a period of relatively stable and lower productivity as well as lower employment levels. The second group represents the post-restructuring period (1999-2004), during which productivity increased and employment declined. There is a marginal drop in productivity in respect of the entire gold mining industry between 2001 and 2004 (Figure 5. 25). Paradoxically, productivity at Driefontein increased during the same period (Figure 8.19) - a reflection of the efficiency with which the new management of Gold Fields is running its operations.

8.5.10 Productivity in terms of gold produced per employee and employment

Both employment and productivity in respect of gold produced per employee shows an overall decline between 1980 and 2004. Whilst employment dropped by 35 per cent between 1980 and 2004, productivity dropped from 3kg gold per employee to 2kg per employee - a decline of 33 per cent (Figure 8.21).

Figure 8.21 reveals three main trends: 1980-1986; 1986-1997; and 1997-2004 in respect of the relationship between employment and productivity in terms of gold produced. The relationship is also demonstrated by Figure 8.22, which shows three major groupings: 1980-1986; 1987-1997 and 1998-2004. Figures 8.21 and 8.22 also show that following the 1997/1998 restructuring at Driefontein, productivity improved marginally and remained fairly stable between 1997 and 2004. The marginal improvement and stable productivity levels are in line with the nationwide trends depicted in Figure 5.27.

8.5.11 Institutional gold holdings and employment

An overall positive relationship exists between institutional gold holdings and employment (Figure 8.23). Gold holdings declined from 35 694 in 1980 to 31 8111 in 2004 – a decline of some 11 per cent. During the same period, employment at Driefontein decreased from 28 521 to 18 567 in 2004 - a 35 per cent decline. The relationship in respect of gold holdings and employment can be subdivided into four periods (Figure 8.23): 1980-1985 (inverse relationship between employment and gold holdings but fairly constant period); 1985-1992 (both employment and gold holdings decline); 1992-1997 (increased employment and declining gold holdings); and 1997-2004 (declining employment and declining gold holdings). The data is also represented in Figure 8.24, which shows that in recent years both employment and gold holdings are relatively low (Group 1998-2004). The current scenario of declining gold holdings and employment resembles the nationwide one (Figure 5.28).

8.6 Management of Downscaling and the Gold Crisis at Driefontein

8.6.1 Commencement of downscaling and the gold crisis at Driefontein

As earlier stated, Figure 8.2 shows that significant downscaling at Driefontein commenced in 1997, when employment dropped from 32 618 in 1997 to 21 818 in 1999 - approximately 10 years after the commencement of downscaling in the entire gold mining industry of South Africa. For many years, Driefontein was virtually shielded from the crisis that hit the gold mining industry. The policy at Driefontein, of not retrenching employees played an important role in this regard and the presence of stable gold grades at the mines also provided some comfort to management.

8.6.2 Analysis of the management of downscaling and the gold crisis at Driefontein

The good intentions of Gold Fields to avoid retrenchments at all costs could not be sustained. The drop in gold grades, coupled with depressed gold dollar prices, put pressure on the operations of the mine. The mine could therefore not escape the crisis being experienced by the global and national gold mining industry. The 33 per cent decline in employment between 1997 and 2001 is evidence of this. Realising the threat to the mine and the holding company, management at Gold Fields embarked on an unprecedented organisation restructuring that involved introducing a number of interventions aimed at addressing the problems. These interventions seem to have paid off, as is evident in Figure 8.19, which shows a concurrent reduction in the rate of job losses and productivity increase between 2000 and 2004.

The strong linkage between Driefontein and Gold Fields meant that interventions aimed at downscaling and rationalising operations at Driefontein would inevitably affect Gold Fields' head office. At head office level, rationalisation of operations involved, amongst others, the reduction of operating and capital costs. According to Gold Fields' May 1998 report to the GCC, the process of reducing costs included, inter alia (Gold Fields, 1998b):

- Cost containment campaigns. Head office personnel were reduced from 700 people to 122;
- Restructuring and productivity improvement campaigns;
- Critical review of head office and mine overheads;
- Critical review of head office and mine capital expenditure; and
- Cancellation of mechanisation research.

At mine level, management of downscaling was left to the respective management of both West Driefontein and East Driefontein - the two divisions of the mine. Gold Fields was a signatory to the Gold Mining Summit declaration of 1997, and Driefontein therefore had to consult with the GCC on its downscaling processes. An outline of processes and management strategies followed to respond to downscaling are outlined in detail in the Gold Fields' May 1998 report to the GCC and are discussed below.

Management of downscaling at West Driefontein

(a) Background on financial and operational conditions of the mine over time

West Driefontein commenced operations in 1952, and had been relatively profitable for a number of years (Gold Fields, 1998b). However, the gold crisis that occurred during the 1996-2001 period did not spare the mine from being negatively affected in respect of employment. According to the May 1998 Gold Fields' GCC Report, East Driefontein gold mine made a working profit of R303 million in the year ended 30 June 1997. The mine spent R233 million on capital expenditure in the year ending 1997. The expenditure, which was regarded by the company as being vital for the long term viability of the mine, resulted in the mine suffering losses (Gold Fields, 1998b).

(b) Reasons for contemplating retrenchments and downscaling

In the May 1998 report to the GCC and at a GCC meeting in June 1998, Gold Fields' management informed the committee that the difficult financial situation outlined above necessitated the closure of unprofitable sections of the mine. Management pointed out that their rationalisation plan included getting the mine back to profitability by, amongst others, reducing tons milled per month, from 230 000 to 190 000 tons (Gold Fields, 1998b). During discussions with management, it was pointed out that mining operations at No 7 Shaft (a VCR shaft), were viewed as nearing an end, and management was of the opinion that no further work would take place in the near future. It was also stated that marginal mining at No 4 Shaft, which mined MR, CL and VCR reefs, was not economic and consequently some of the operations would be closed. This measure resulted in a reduction in unprofitable mining areas from 61% of working panels to 28% of working panels.

Management furthermore stated out that the contemplated rationalisation would threaten the livelihood of employees on the mine as it foresaw labour being reduced by some 29 per cent from 16 500 to 11 700, resulting in a possible 4 800 redundancies. The proposed reduction in the labour force affected both surface and underground employees in all categories of employment.

(c) Alternatives to retrenchments considered

As per the requirements of the GCC, management were required to present a plan to minimise the impact of job losses. The May 1998 report to the GCC outlined several measures that were to be put in place to address the contemplated job losses. A summary of these measures is presented below.

i. Joint management – labour productivity improvements initiatives

In a bid to improve productivity and gold production on the mine, management established a task team comprising management and labour. The initiative produced some positive results, as evident in Figures 8.19 and 8.21. Productivity in terms of tons ore milled per employee improved

from 191 in 1998 to 348 in 2004. Likewise productivity in terms of kilograms of gold produced per employee increased from 1,69 to 1,93 in 2004.

ii. Reduction of costs

Costs were relatively high at West Driefontein and management put in place cost reduction measures to reduce both working costs and capital expenditure. According to management, the 1998 capital expenditure was reduced from R337 million to R270 million – representing a 20 per cent reduction in capital expenditure. Working costs were also reduced as evident in Figure 8.15, which shows that costs did decline significantly after the 1997/1998 restructuring. However, it is apparent that the decline in working costs was achieved through, amongst others, reduction in the labour force – a situation which led to hardships on employees.

iii. FULCO

As a strategy to improve productivity, a number of South Africa's gold mines introduced several changes to work organisation in underground operations (Lewis and Wegner, 2001). Lewis and Wegner further state that the most important of work organisation changes included changes to work time arrangements – away from the industry norm of an 11- shift fortnight, either in the direction of the 5-day working week, or towards full calendar operations with various shift arrangements and varying impact on overtime levels. According to Van Aswegen (2000), the introduction of FULCO was expected to improve the productivity of gold mines.

At West Driefontein management and Unions embarked on lengthy discussions and negotiations about the introduction of FULCO. Following successful discussions, a FULCO was implemented at No 5 Shaft on 16 February 1998 (Gold Fields, 1998b). Further discussions and negotiations were held to extend “FULCO” to other sections of the mine, such as the No 6 Shaft Complex with the intention of saving about 450 jobs (Gold

Fields, 1998b). Management also introduced selective mining on the mine to ensure that only “pay ore” was mined.

iv. Outside contractors

The practice of utilising subcontractors was increasingly becoming the norm in the gold mining. This issue was highlighted by COSATU and NUM in their submission on the “2001 Minerals and Petroleum Resources Development Bill”. In the submission they pointed out that the mining industry was increasingly retrenching workers and replacing them with contractors. The unions stated that it was opposed to subcontracting as it exposed workers to poor working conditions, sub-standard health, poor safety standards and the destruction of quality jobs. The situation led to concerns being raised by the unions as there were about 100 000 contractors in 1995 in South Africa’s mines (Talbot, 1999).

As part of the process of preserving long-term jobs on the mine, management agreed to reduce the number of outside contractors. A moratorium in respect of employing contractors was instituted and many contractors were replaced by employees identified as redundant.

v. Temporary employees

Following an agreement with labour unions, West Driefontein management decided to stop the employment of temporary employees. Unions did not necessarily support the employment of temporary employees, as they viewed such employees as being vulnerable to exploitation.

vi. Use of external consulting expertise

As part of the process of improving efficiency and profitability, two consulting firms were appointed. Proudfoot Consultants were appointed to provide recommendations on efficiency improvement and its mandate involved assessment and improvement of surface operations, especially in

the metallurgical plant. Commencing in January 1998, the company spent seven months implementing methods to improve efficiencies (Gold Fields, 1998b).

West Driefontein management also appointed Anderson Consultants in May 1997 to facilitate an underground productivity improvement – in this regard “Project Stope” was established (Gold Fields, 1998b). As a result of the “Project Stope” project, the following six measures, referred to by management as “quick wins”, were put in place:

- Quality team meetings;
- Quality face preparation;
- Quality marking off;
- Quality drilling;
- Quality night shift operation; and
- Quality day to day planning.

(d) Retrenchment procedures at West Driefontein

Details on retrenchments procedures at West Driefontein are captured in the May 1998 Gold Fields Report to the GCC and were also presented at GCC meetings. According to the report management held a total of eighteen meetings with unions in an attempt to obtain agreement on job losses avoidance measures. Management proposals and plans included the following:

- Securing agreements on extended unpaid leave or job sharing;
- Securing agreement on early retirement of those relatively close to retirement age;
- Considering the implementation of voluntary separations; and
- Implementation of compulsory retrenchments as a last resort.

Negotiations between management and unions on extended leave or job sharing did not yield the same positive results as negotiations at East Driefontein – and the matter was in fact rejected outright by all unions at West Driefontein.

(e) The number of persons affected by downscaling

Following lengthy discussions between management and unions, an agreement relating to measures to be put in place at West Driefontein to avoid job losses was reached on 30 March 1998 (Gold Fields, 1998b). According to the May 1998 Gold Fields report to the GCC the identified measures included putting employees on early retirement and voluntary separation. During negotiations the measure relating to extended unpaid leave was removed from negotiations at the request of the NUM. The agreement resulted in some 1 421 early retirees being identified. However, management informed the NUM that the prospect of compulsory retrenchment for up to 3 080 employees still existed in the event that voluntary separation did not achieve the desired objective. Statistical information in respect of measures to rationalise operations at West Driefontein is presented below:

Workforce at commencement	=	16 500
Early retirements	=	1 421
Natural attrition	=	300
Balance for extended voluntary separation/ failing which retrenchment would be effected	=	<u>3 080</u>
Total redundancies		4 800
<u>Jobs secured</u>		<u>11 701</u>

Management informed the GCC that the above statistics do not reflect the potential benefit of the FULCO arrangements which could have saved approximately 450 jobs. Management further stated it was their intention that the vast majority of the balance of 3 080 employees would be dealt with by voluntary separations.

Management of downscaling at East Driefontein

(a) Financial and operational circumstances of the mine over time

East Driefontein commenced operations in 1972, and in March 1998 some 13 955 employees were working on the mine (Gold Fields, 1998b). According to the

report submitted to the GCC, while East Driefontein made a working profit of R460 million in the year ended 30 June 1997, the mine spent R334million on capital expenditure during the year. Economic circumstances resulted in the mine recording a R9 million loss in the quarter ending December 1997.

(b) Reason for contemplating retrenchments

The May 1998 Gold Fields' Report to the GCC stated that management had put in place several rationalisation strategies aimed at ensuring sustainable and profitable operations. These strategies included, inter alia, reduction in ore milled from 240 000 tons to 180 000 tons – representing 25 per cent reduction in production. This reduction was attributed principally to a reduction in “unpay mining” areas from 62 per cent of working panels to 30 per cent of working panels. In addition, the mine indicated it would reduce labour by about 16 per cent from 16 700 to 13 955, that is a possible 2 745 redundancies.

(c) Alternatives considered

Management indicated that in addition to the re-planning of mining operations leading to lower tons milled, the following initiatives were put in place (Gold Fields, 1998b):

- Improved management of costs associated with stores;
- Tighter control over and elimination of overtime where possible;
- Focus on mining production improvement measures through training and education;
- Reduction of the number of outside contractors;
- Re-deployment to underground workings of employees in certain departments to decrease inefficiencies and cost ineffectiveness;
- Introduction of FULCO;
- Increased efforts to increase productivity throughout the mine;

- Additional effort placed on backlog sweepings, thereby providing job opportunities for employees whose jobs would otherwise have been redundant;
- Vacancies in certain non-core occupations were frozen; and
- Termination of the services of employees beyond retirement age.

(d) Retrenchment procedures followed at East Driefontein

Numerous negotiations were held with all unions in an attempt to find agreement on job loss avoidance measures. Negotiations between management and unions included:

- Securing agreements on extended unpaid leave or job sharing;
- Implementing early retirement of employees that were relatively close to retirement age;
- Introducing voluntary separations; and
- Implementation of compulsory retrenchments as a last resort.

Discussions with the NUM, the largest union on the mine, regarding extended unpaid leave arrangements and early retirement resulted in an agreement being reached that entailed putting some employees on extended leave for four months. Whilst the NUM accepted the principle of extended leave and early retirement, other unions and associations rejected it. Nonetheless, the extended leave measure was implemented.

(e) The number of persons affected by rationalisation

Following a total of 14 meetings the NUM and management entered into an agreement on the issue of extended unpaid leave and early retirement. Management and NUM agreed that some 1 432 employee would be placed on extended unpaid leave for an indefinite period. A total of 445 were put on early retirement with full pension and a further 705 employees were requested to

consider an offer to take on early retirement on full pension. Management also stated that in the event that an insignificant proportion of the 705 voluntary early retirees opted for such retirement, it would become necessary to attempt to reduce employee numbers through the alternative of voluntary separation. A breakdown of rationalisation figures was as follows:

Workforce at commencement	=	16 500
Early retirements	=	1 150
Natural attrition	=	255
Balance for extended leave/voluntary separation	=	<u>1 432</u>
Total redundancies		2 745
<u>Jobs Secured</u>		<u>13 955</u>

Management informed the GCC that the vast majority of the 1 432 employees listed in the balance would be accommodated through extended leave and, if necessary, voluntary separations. However, it became extremely difficult to implement the extended unpaid leave principle due to the fact that some employees (mostly non-NUM employees) opted not to support the extended unpaid leave initiative, despite acceptance by the NUM.

(f) Material assistance offered

Management at East Driefontein made various offers in terms of material assistance to both potential retirees and employees on unpaid leave, including payment of risk benefit premiums and of union membership subscriptions while employees were on extended leave. Other offers included assistance in terms of bus transport to employees homes and assistance with provident fund claims.

(g) Timing of retrenchments

Employees began to go on extended leave and early retirement by April 1998. The initiatives and agreements put in place at East Driefontein proved to be successful as compulsory retrenchments were avoided.

8.7 Discussion

Location and reefs at Driefontein gold mine

Driefontein Gold Mine, which is used in this chapter as a case study, is located in the Far West Wits Line Gold Field, some 60 km west of Johannesburg. The mine is a typical South African deep gold mine mining gold hosted within the Witwatersrand basin. Like most Witwatersrand type mines, the ore being mined is conglomerate bearing reefs. Three main reefs are currently being exploited; namely, CLR, VCR and MR. Mining methods are conventional South African deep mining methods that require continuous availability of labour.

Employment at Driefontein Gold Mine

Employment on the mine has decreased from 28 521 in 1980 to 18 567 in 2004, which represents a 35 per cent decline in employment. However, Figure 8.1 shows that employment at Driefontein, though cyclical, was relatively stable between 1980 and 1997. This is in contrast to the nationwide sharp decline in employment that commenced in 1987 (Figure 5.1). However, a comparison of employment trends at Driefontein and the nationwide gold mining industry shows that employment at Driefontein increased during Period 2. Available data show that employment increase from 28 521 in 1980 to 33 165 in 1987 (Figure 8.2). Similarly, nationwide employment levels showed an upward trend between 1980 and 1987 (Figure 5.1). This upward trend in employment, at both Driefontein and nationwide, was ironic as the dollar and real rand gold prices had already commenced their decline from the highs of 1980 (Figures 5.3 and 5.6). As stated earlier the increase in nationwide employment can be attributed to the economies of scale strategy employed by the industry. The strategy was aimed at addressing declining gold grades and gold production through increased ore milled. Although grades did not necessarily decline at Driefontein, gold production did

decline between 1980 and 1987 (Figure 8.9). Similarly, Driefontein management seems to have adopted the economies of scale strategy by increasing employment levels and ore milled in the belief that gold production would improve.

Surprisingly, employment at Driefontein did not necessarily experience a sharp decline, as with nationwide employment, during Period 3. Employment was fairly stable between 1987 and 1997 (Figure 8.2), with the stability ascribed to the following two factors:

- The policy of Gold Fields of not retrenching employees; and
- The fairly stable gold grades at the mine between 1986 and 1997.

However, despite relatively stable employment levels at Driefontein between 1987 and 1997, the mine did not escape the unstable political environment that engulfed South Africa during the late 1980s completely – Figure 8.2 shows a marginal decline in employment between 1987 and 1992. Real downscaling at Driefontein commenced 10 years after nationwide downscaling (Figure 8.2 and Figure 5.1). This implies that the nationwide gold crisis that commenced in 1987 affected different mines at different times.

Ore milled

Figure 8.7 shows an overall increase in ore milled against a decline in employment between 1980-2004 period – employment declined by 35 per cent, whilst ore milled increased by 22 per cent. A further scrutiny of Figure 8.7 shows ore milled was fairly stable for most of Period 3. In fact, ore milled only increased after the restructuring that took place during the 1997-1998 period. This scenario suggests that the new management at Driefontein succeeded in changing business culture at the mine and managed to improve productivity considerably. Table 8.1 shows that ore milled at the mine increased by 14 per cent, whilst nationwide ore milled dropped by 45 per cent. This provides an indication that most of the country's marginal shafts and mines are not surviving the impact of declining grades.

Table 8.1 Comparison of selected business factors at Driefontein and in South Africa's gold mining industry for the period 1987-2004.

	Driefontein Gold Mine	South African Gold Mining Industry
Employment	Declined 44%	Declined 66%
Ore milled	Increased 14%	Declined 45%
Gold production	Declined 46%	Declined 43%
Gold grades	Declined 52%	Declined 22%
Working Revenue	Declined 65%	Declined 38%
Working costs	Declined 14%	Declined 5%
Working profits	Decline 89%	Declined 100%
Productivity (ore milled)	Increased 102%	Increased 65%
Productivity (gold produced)	Decreased 2.5%	Declined 69%

Gold production

Figure 8.9 shows that both employment and gold production declined throughout the 1980-2004 period. Gold production dropped from 83.1 tons in 1980 to 35.8 tons in 2004, whilst employment dropped from 28 521 to 18 567 – representing declines of 57 per cent and 35 per cent respectively. In comparison, nationwide gold production declined by 49 per cent, whilst employment dropped 61 per cent between 1980 and 2004 (Figure 5.11). However, a closer analysis of Figure 8.9 shows that, unlike ore milled and employment, gold production has been declining progressively since 1980 – suggesting that the real downscaling and restructuring at Driefontein that commenced in 1997 should have been implemented much earlier.

Gold grades

Both gold grades and employment declined throughout the 1980-2004 period (Figure 8.11) with gold grades plummeting by 65 per cent and employment dropping 35 per cent. The trend is somewhat comparable to the nationwide one –

gold grades dropped by 44 per cent, whilst employment dropped by 61 per cent between 1980 and 2004 (Figure 5.13). Figure 8.8 shows that gold grades were fairly stable between 1986 and 1997. This relative stability in gold grades could have created complacency within management of Driefontein to the extent that they found no need to downscale when most other mines had already commenced the process of downscaling. However, the sudden drop in gold grades after 1997 resulted in the shedding of labour to cut costs. The overall drop in grades at Driefontein was more pronounced than the nationwide drop. Figure 8.8 and Table 8.1 show that grades at Driefontein dropped by 52 per cent during the Downscaling period (Period 3), whilst nationwide grades dropped by 22 per cent.

Real working revenue

Figure 8.13 shows that both real working revenue and employment declined over the 1980-2004 period. Real working revenue declined by 80 per cent, whilst employment dropped by 35 per cent. Nationwide, real working revenue dropped by 66 per cent against a drop of 61 per cent in employment (Figure 5.17). Period 3 trends in respect of the relationship between real working revenue and employment are similar to nationwide trends, as shown in Figure 5.17. However, like gold grades, the decline in working revenue at Driefontein was more pronounced than the nationwide decline in revenue during Period 3 (Downscaling period). Real working revenue at Driefontein declined by 65 per cent against the nationwide decline of 38 per cent. It is apparent from Figures 8.13 and 8.14 that declining revenues had a negative impact on employment and certainly contributed to downscaling and the gold crisis at Driefontein.

Real rand working costs

Real rand working costs show an overall marginal change between 1980 and 2004, against an overall decline in employment during the same period (Figure 8.15) - costs show a marginal increase of 10 per cent, whilst employment decreased 35 per cent. Similar pattern is reflected in respect of nationwide trends: nationwide real working costs show a 14 per cent increase against a 61 per cent decline in employment (Figure 5.21).

Table 8.1 also shows that working costs at both Driefontein and nationwide declined (Driefontein: 14% and Nationwide: 5%) during the Downscaling Period. The reduction in working costs demonstrates the effectiveness of rationalisation at South Africa's gold mines.

Real working profits

Both real working profit and employment dropped significantly between 1980 and 2004 (Figure 8.17). Working profits dropped by 95 per cent against a drop of 35 per cent in employment. This relationship is in line with the nationwide trend revealed in Figure 5.24, which shows that nationwide real working profits dropped by a massive 100 per cent and employment by 61 per cent between 1980 and 2004.

Further analysis of working profits during Period 3 shows that working profits at Driefontein declined in similar large proportions as did nationwide profits (Table 8.1). These enormous declines in profits illustrate the dire strain the gold mining industry of South Africa is undergoing.

Productivity

The productivity (single factor) in respect of both ore milled per employee shows a strong inverse relationship with employment (Figure 8.19). Productivity in terms of ore milled improved by 87 per cent between 1980 and 2004, whilst employment declined by 35 per cent. The overall improvement in productivity is in line with nationwide improvement in productivity – productivity in respect of the entire gold mining industry improved by 70 per cent during 1980-2004. Although similar improvements in nationwide productivity can be observed during Period 3, productivity improvement at Driefontein was much higher than it was nationwide (Table 8.1).

Productivity in respect of gold produced per employee and employment show a declining trend between 1980 and 2004 (Figure 8.21). Productivity declined by 33 per cent and employment by 35 per cent during the 1980-2004 period. In contrast,

nationwide productivity in respect of gold produced per employee increased by 41 per cent during the 1980-2004 period, whilst employment dropped by 59 per cent (Figure 5.27). However, despite the overall decline in productivity and employment at Driefontein, a cyclical trend can be observed in respect of the both employment and productivity curves (Figure 8.21). Furthermore, it can be observed that productivity improved between 1986 and 1994 as well as between 1996 and 1999. These improvements in productivity are accompanied by a noticeable decline in employment – suggesting that productivity improvements impacted negatively on employment.

Table 8.1, Figure 8.19 and Figure 8.21 show a major productivity improvement in respect of ore milled, but a marginal decline of 2,5 per cent in respect of productivity in terms of gold produced during Period 3 (1987-2004). However, nationwide productivity data show a different situation: productivity in terms of gold produced improved significantly (Table 8.1). This state of affairs should be a worrying one for Driefontein management, which seems to be focusing on increased tonnage, whilst not addressing problems relating to gold production.

Institutional gold holdings play a critical role in the gold market, to the extent that many role players are of the opinion that gold sales by central banks and institutions such as IMF depress the gold price and often result in job losses in the gold mining industry. Figure 8.23 shows that institutional gold holdings dropped more or less in tandem with employment throughout the 1980 – 2004 period. Gold holdings dropped by about 11 per cent, against the 35 per cent drop in employment at Driefontein. The overall decline in both gold holdings and employment compares favourably with the nationwide trend, which demonstrates that employment in South Africa's gold mining industry has declined in line with gold holdings (Figure 5.28). However, this does not necessarily suggest that a direct causal relationship between gold holdings and employment on South Africa's mines exist.

Measures to manage downscaling and the gold crisis at Driefontein

There is no doubt that the nationwide downscaling and the gold crisis that occurred from 1987- 2004 also affected Driefontein. Nevertheless, both Gold Fields and Driefontein management put several effective measures in place to address downscaling and the crisis. However, these measures had to be negotiated with employees before being implemented and labour unions, such as, the NUM played a critical role, especially in respect of negotiating for their members rights. In addition to negotiating with employees, the GCC had to be consulted when a mine contemplated retrenching employees. The consultation with the GCC was in accordance with the tripartite agreement reached between government, business and labour. It is difficult to assess the benefits Driefontein gained by consulting with the GCC. However, it is certain that acting as a “gate keeper” the GCC did manage to minimise job losses on the mine as it prompted management to seek alternatives to retrenchments.

Some of the important measures that Gold Fields and Driefontein management put in place to address downscaling included the following:

- Reduction of head office personnel;
- Replacement of contractors by Gold Fields’ employees;
- Placing employees on extended leave;
- Releasing employees through natural attrition;
- Releasing employees through voluntary separation;
- Releasing employees through medical repatriation; and
- Releasing employees through early retirement.

It is apparent from Figure 8.2 that the above measures managed to contain the loss of jobs at Driefontein and that many jobs were saved. According to information submitted to the GCC by Driefontein management, over 1 000 jobs were saved through, for example, the implementation of extended leave. However, not all jobs could be saved and, as at May 1998, close to 6 000 jobs had been lost at Driefontein.

Lessons learned at Driefontein

Gold Price

The relationship between gold price and employment at Driefontein suggests that the gold price is one of the most important factors in terms of influencing employment levels. At Driefontein, employment declined by 35 per cent between 1980 and 2004 – during the same period the gold price declined by 33 per cent. This relationship confirms the already known fact that gold mining operations should closely monitor the gold price as it can have a negative impact on the profitability of the operations.

Ore milled

One of the most important lessons learned in respect of ore milled, is that the tendency of pursuing economies of scale by increasing ore milled to compensate for declining gold grades and gold production is an unsustainable strategy that should not be followed by other mines.

Gold production and gold grades

It has been shown at Driefontein that, as with gold prices, gold production and gold grades are closely related to employment levels and play an influential role in determining the level of employment (Figures 8.9 and 8.11). This is expected, as a decline in gold production and gold grades may result in lower income and closure of some low grade mining operations. The importance of declining grades on employment levels is also revealed by the nationwide data, which demonstrates that declining grades are one of the main factors that contributed to downscaling (Figures 5.11 and 5.13).

Working costs

Working costs were also closely related to employment at Driefontein and the restructuring at the mine, which involved retrenchments, managed to drop the costs (Figure 8.15). Unfortunately, the containment of costs came at a great cost to employment – suggesting that reduction of the number of employees can also contribute to the reduction of costs.

Consultations between employees and management

The extensive consultations that took place at Driefontein between management and employees are a good example of how downscaling and retrenchments should be addressed, especially during initial stages. Both management and the unions managed to agree on important measures that helped in saving some of the jobs on the mine. However, an important lesson coming out of consultations and negotiations processes at the two Driefontein mines (East Driefontein and West Driefontein) is that outcomes of downscaling negotiations will always differ, despite close similarities in the circumstances of the employees and the mines. For example, employees at East Driefontein agreed to the measure of saving jobs through extended leave arrangements, whilst those at West Driefontein rejected the measure outright. The other important lesson learned is that preparation for downscaling should commence much earlier – even before retrenchments are contemplated. Driefontein management, like most South African gold mines, was caught off guard.

Policy of not retrenching employees

For many years, Gold Field practiced the policy of not retrenching employees even when economic circumstance indicated that there was a need to reduce the number of employees. This policy was definitely not sustainable and only served to postpone the inevitable. Economic circumstances and pressure from shareholders resulted in the company changing its policy of not retrenching employees (Prof R. P. Viljoen – former consulting geologist at Gold Fields, personal communication). The lesson learned on this matter is that whilst it is always important to save and protect jobs, short-term unsustainable measures are not the answer – sustainable measures should be explored and implemented.

Short-term measures vs Sustainable measures

Most of the measures implemented at Driefontein to save jobs and costs were reactive and short-term in nature. For example, the measures relating to extended leave, releasing employees through attrition and early retirement are not sustainable measures for the country and the mine. The lesson for the mines and

the country is that sustainable programs should be put in place to provide redundant employees with alternatives in respect of new job opportunities or skills.

However, it can be argued that Gold Fields' decision to restructure, albeit unpleasant, has in a way brought a relatively sustainable situation to the company and to Driefontein. The benefits include: largely stable costs, a decline in the rate of job losses, and improved productivity in terms of ore milled (Figures 8.15 and 8.19). The lesson to other mining companies is that well planned and managed restructuring, which involves the shedding of jobs, can bring benefits to a company.

8.8 Summary

Driefontein Gold Mine did not escape the nationwide downscaling, which engulfed South Africa's gold mines after 1987. Employment at the mine decreased from 28 521 in 1980 to 18 567 in 2004 - representing a 35 per cent decline between 1980 and 2004. However, it is significant to note that commencement of downscaling at the mine happened 10 years after the commencement of nationwide downscaling in the gold mining industry. The delay in the commencement of downscaling can be mainly attributed to the policy of Gold Fields of not retrenching employees and also to the relatively stable gold grades between 1987 and 1997. The delay in downscaling at Driefontein suggests that the nationwide gold crisis that commenced in 1987 affected different mines at different times.

Chapters 7 and 8 reveal that the negative impact of downscaling in the gold mining industry was managed through the implementation of national and mine level initiatives. Whilst national initiatives were implemented in a tripartite manner and involved government, labour and business, mine level initiatives were largely bilateral (involving business and labour). Like at nationwide level, mine level initiatives were not unilaterally implemented – they were often negotiated with employees before being executed. In fact during the GCC era, mines were

obliged to consult with the GCC (a tripartite committee) prior to retrenching employees. Figure 8.2 shows that initiatives to address downscaling at Driefontein were fairly successful as employment levels stabilised after 1999 and many jobs were saved. A summary of some of the important measures that were introduced at Driefontein and Gold Fields to manage downscaling included the following:

- Reduction of Gold Fields head office personnel – this reduced costs and therefore saved a number of jobs at mine level.
- Replacement of contractors with Gold Fields’ employees – this created and preserved “quality jobs” on the mines as most contractors are often exploited by their employers.
- Placing employees on extended leave – the strategy helped in avoiding compulsory retrenchments.
- Releasing employees through natural attrition and medical repatriation – the strategy helped in avoiding compulsory retrenchments.
- Releasing employees through voluntary separation and early retirement – the strategy helped in avoiding compulsory retrenchments and was effective in reducing the number of employees.
- Implementation of productivity improvement campaigns such as the introduction of FULCO – FULCO was expected to improve productivity at the mine.
- Cancellation of mechanisation research – the action was intended to protect jobs in the industry.
- Cancellation of capital expenditure – Management embarked on a cost reduction campaign to reduce both working costs and capital expenditure.
- Introduction of selective mining – the objective was to ensure that only “pay ore” was mined and thereby increasing profitability.

- Termination of employing temporary employees – a prohibition of employment of temporary employees was put in place to protect jobs of permanent employees.
- Offering material assistance to redundant employees - management made various offers such as payment of risk benefit premiums and of union membership subscriptions while employees were on extended leave. Other forms of assistance included, inter alia, provision of bus transport to employees.

Although most of the above measures are largely reactive and short-term, they provide valuable lessons for the reactive management of downscaling on the mines. One of the most important lessons learned at Driefontein is that downscaling must be planned at the initial stages of a mine. The restructuring of Gold Fields also provides a valuable lesson on the benefits of a properly implemented restructuring program – costs were effectively contained after the restructuring.

Whilst Chapters 7 and 8 provides an understanding of how downscaling was managed at national and mine level, successful future management of downscaling will depend on a reasonable understanding of international experiences. In this regard, experiences of other countries are discussed in the next chapter.

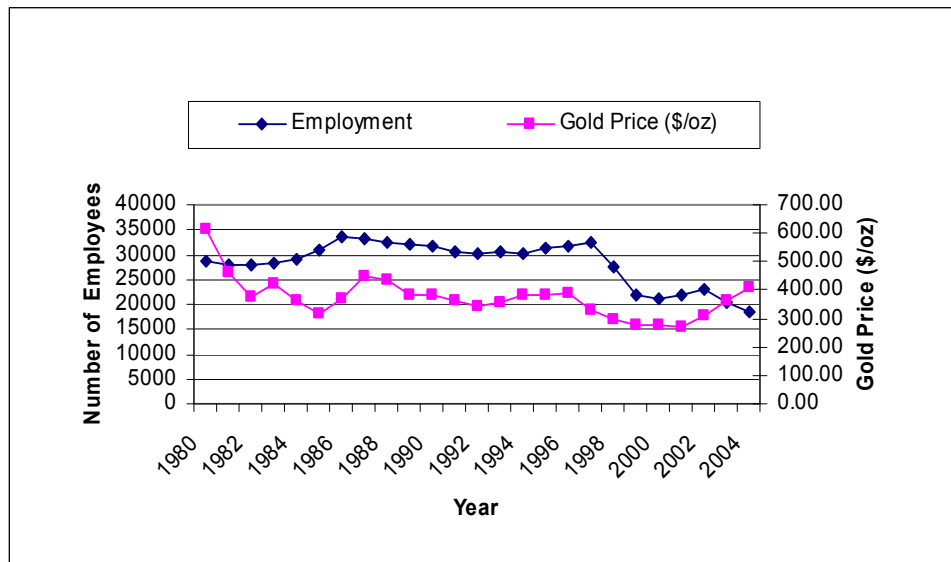


Figure 8.3 Driefontein: Annual average dollar gold price and annual average employment - Linear chart for 1980-2004 (Data Source: DME).

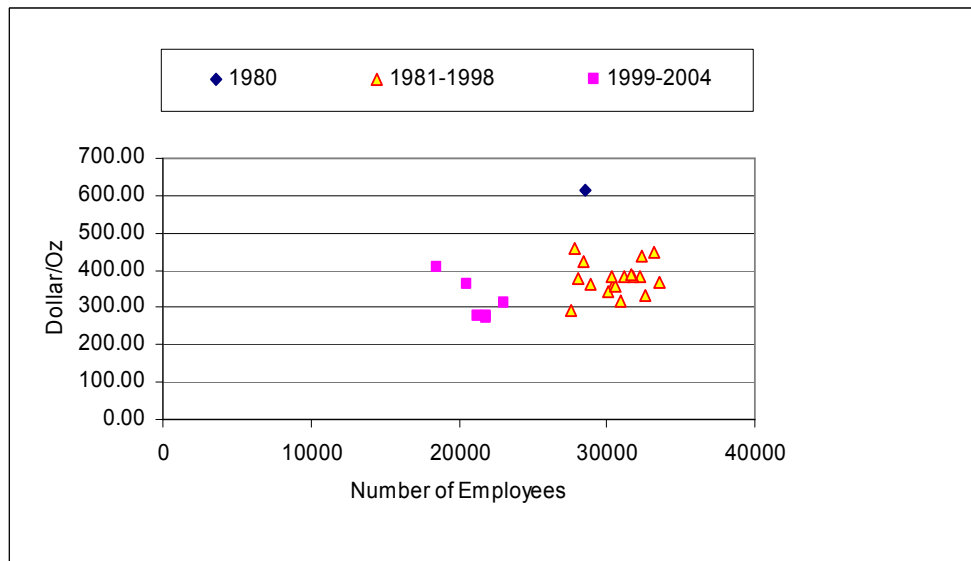


Figure 8.4 Driefontein: Annual average dollar gold price and annual average employment - Scatterplot for 1980-2004 (Data Source: DME).

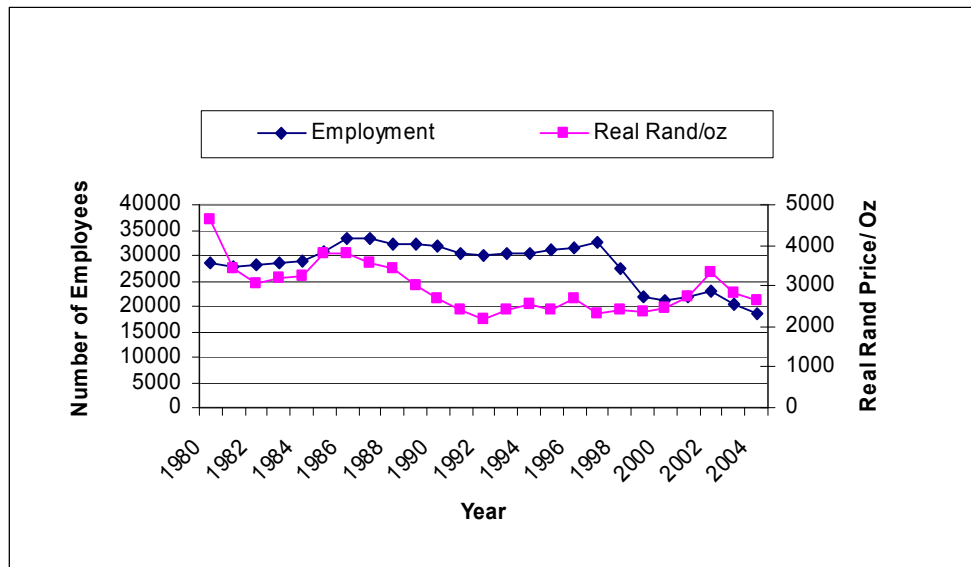


Figure 8.5 Driefontein: Annual average real rand gold price and annual average employment - Linear chart for 1980 - 2004 (2004=100) (Data Source: DME).

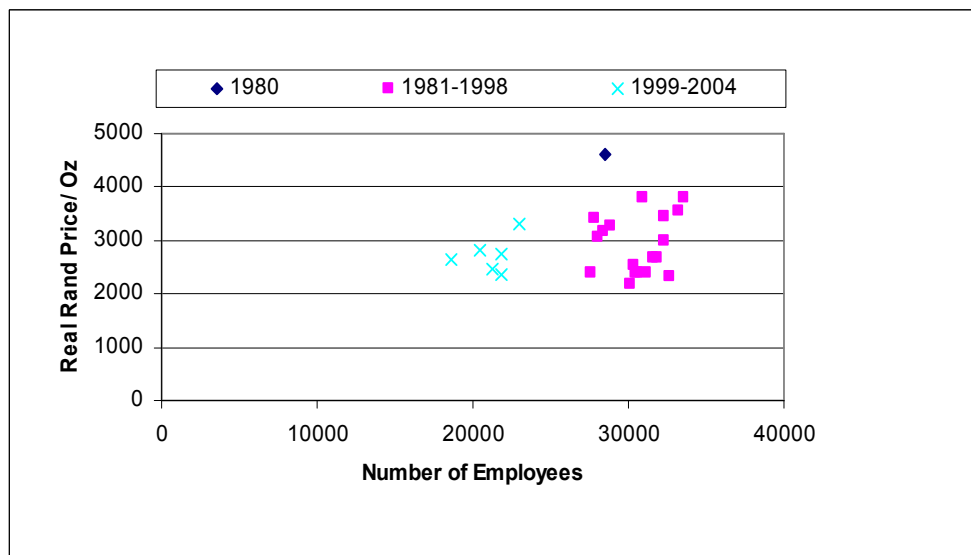


Figure 8.6 Driefontein: Annual average real rand gold price and annual average employment - Scatterplot for 1980-2004 (2004=100) (Data Source: DME).

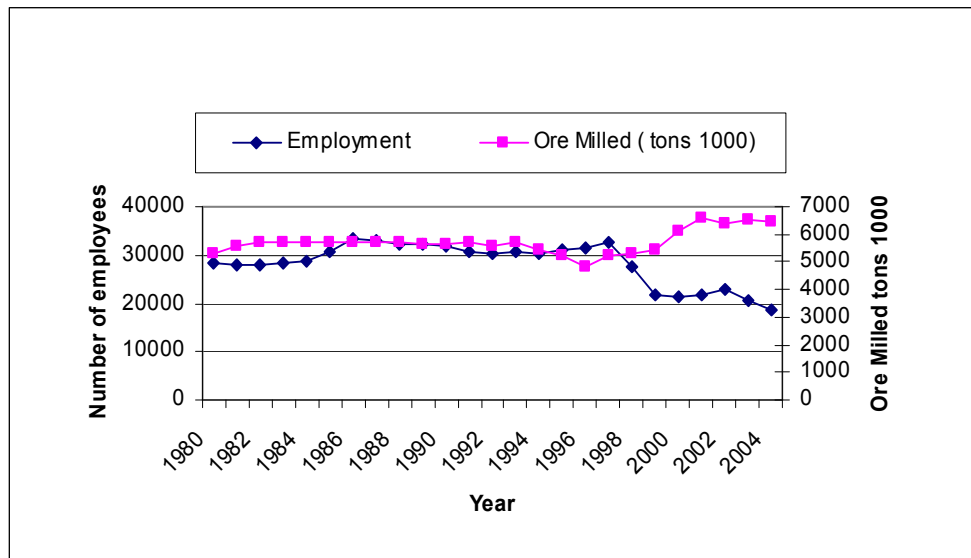


Figure 8.7 Driefontein: Annual average ore milled and annual average employment - Linear chart for 1980-2004 (Data Source: Chamber of Mines; DME).

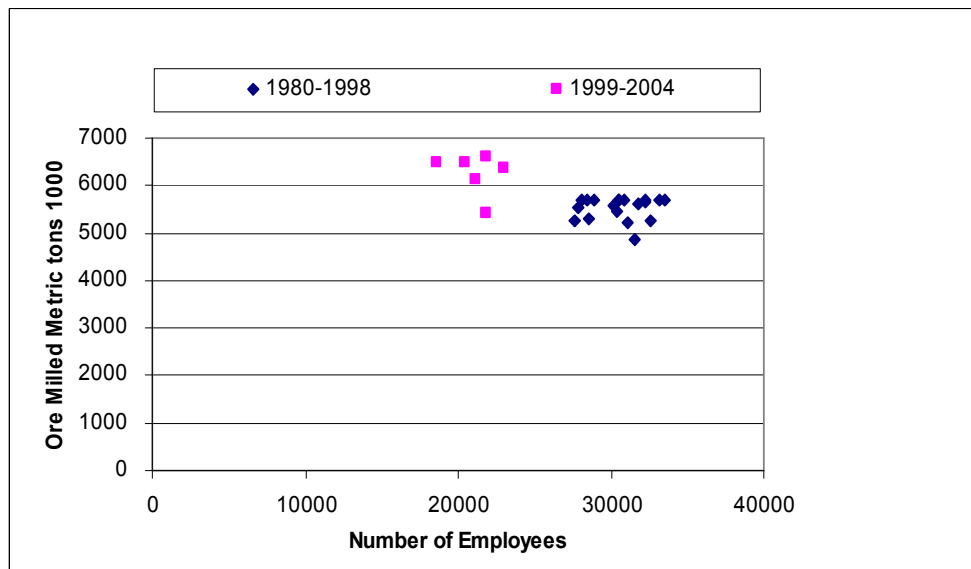


Figure 8.8 Driefontein: Annual average ore milled and annual average employment - Scatterplot for 1980-2004 (Data Source: Chamber of Mines; DME).

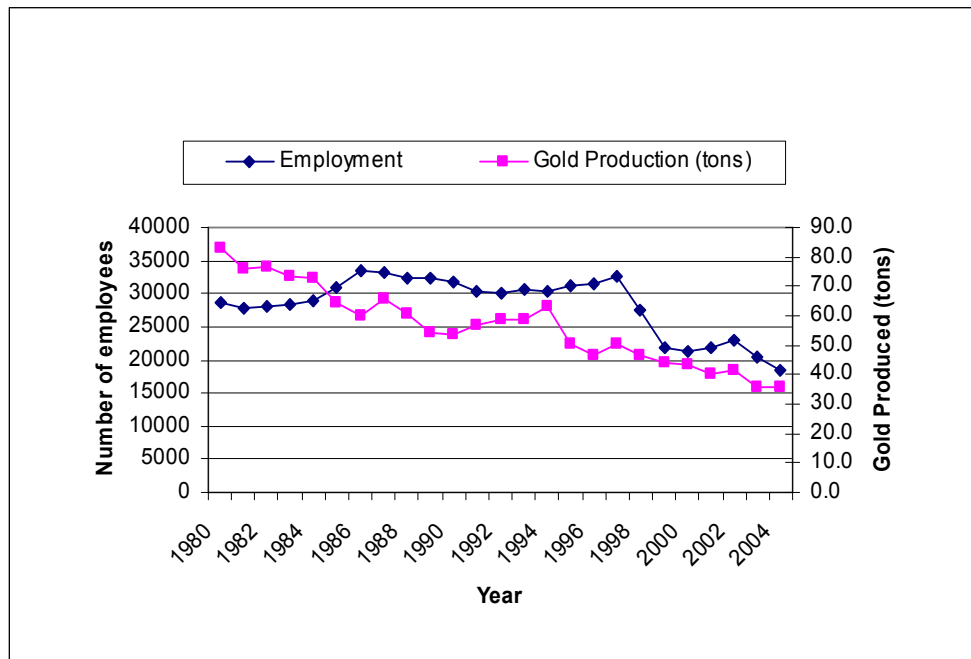


Figure 8.9 Driefontein: Annual average gold produced and annual average employment - Linear chart for 1980-2004 (Data Source: Chamber of Mines; DME)

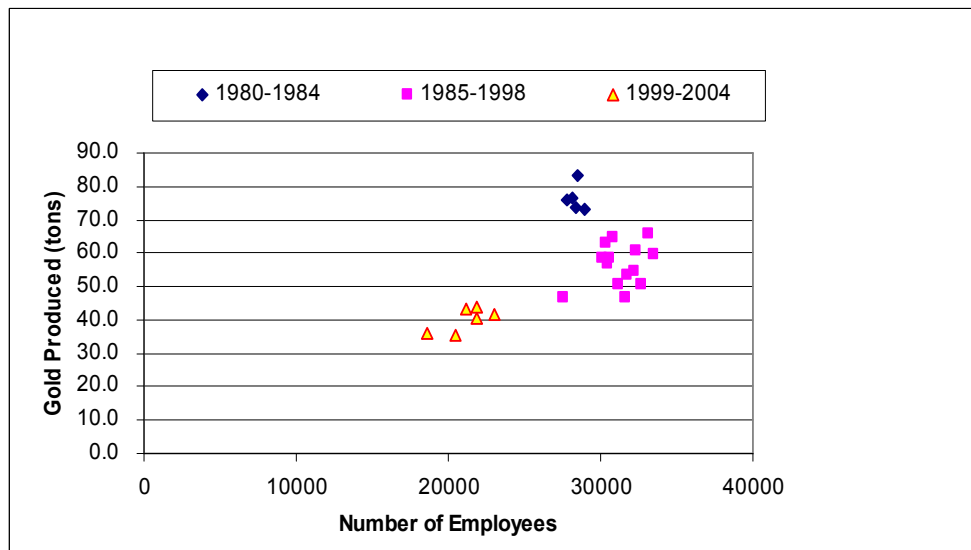


Figure 8.10 Driefontein: Annual average gold produced and annual average employment - Scatterplot for 1980-2004 (Data Source: Chamber of Mines; DME).

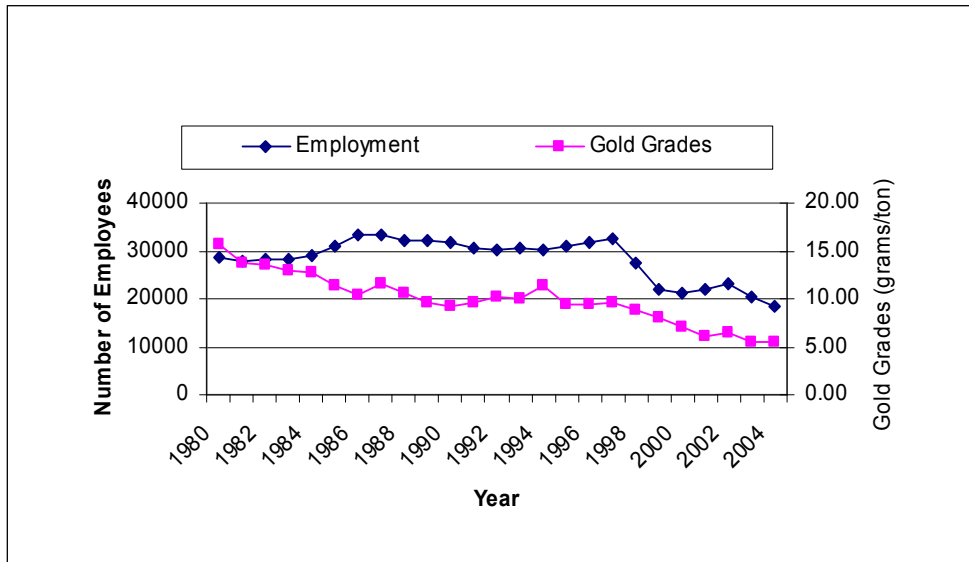


Figure 8.11 Driefontein: Annual average gold grades and annual average employment - Linear chart for 1980-2004 (Data Source: Chamber of Mines and DME).

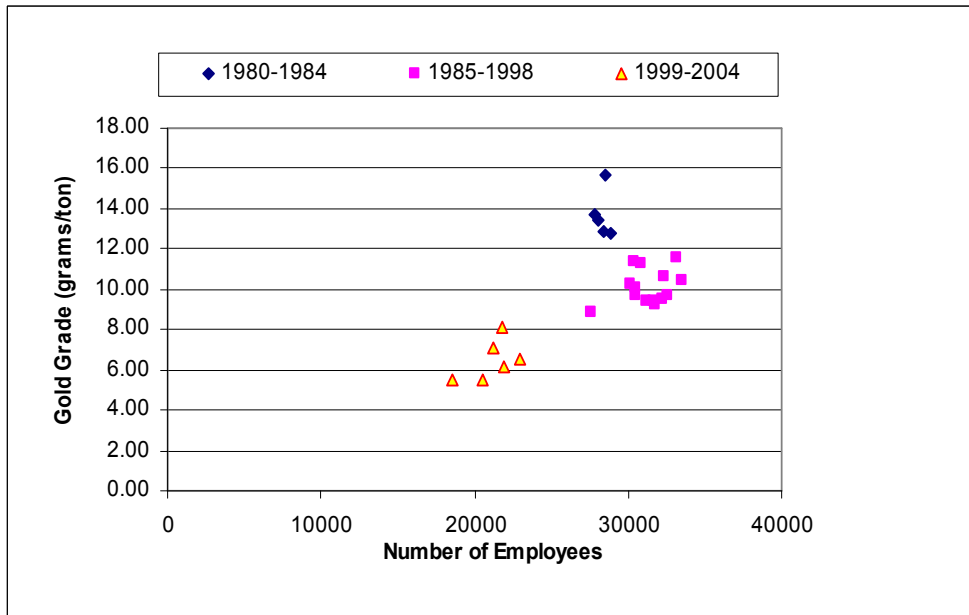


Figure 8.12 Driefontein: Annual average gold grades and annual average employment - Scatterplot for 1980-2004 (Data Source: Chamber of Mines and DME).

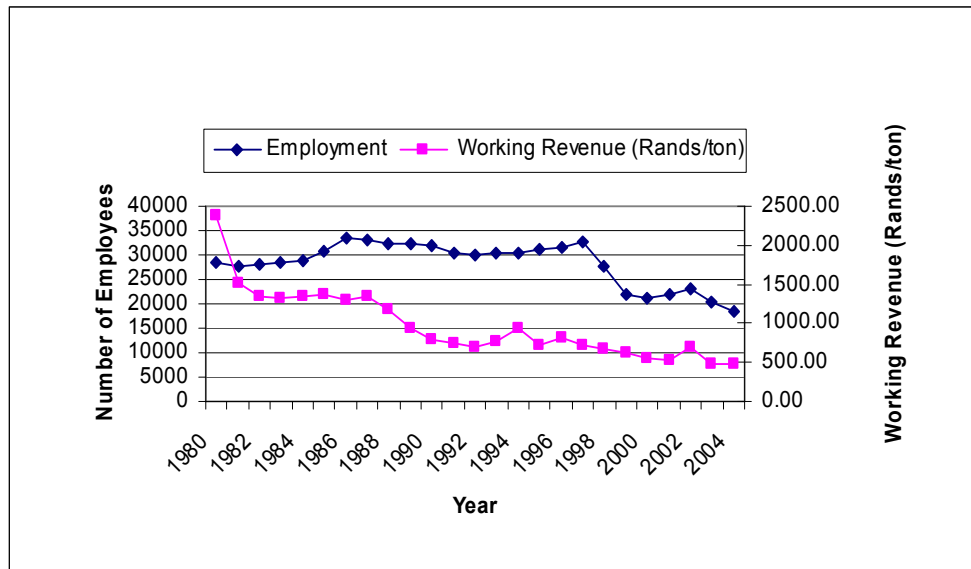


Figure 8.13 Driefontein: Annual average real rand working revenue and annual average employment - Linear chart for 1980-2004 (2004=100)
(Data Source: Chamber of Mines; DME).

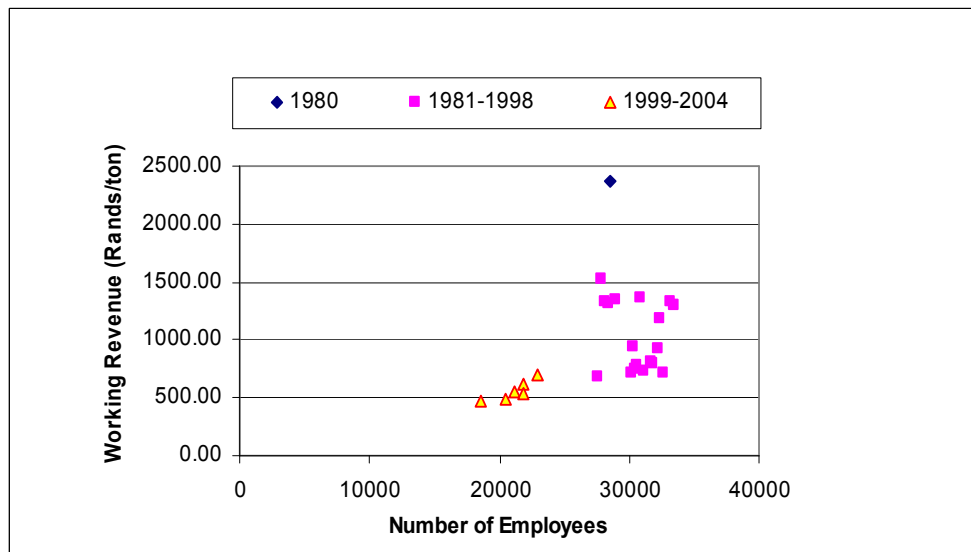


Figure 8.14 Driefontein: Annual average real rand working revenue and annual average employment - Scatterplot for 1980-2004 (2004=100). (Data Source: Chamber of Mines; DME).

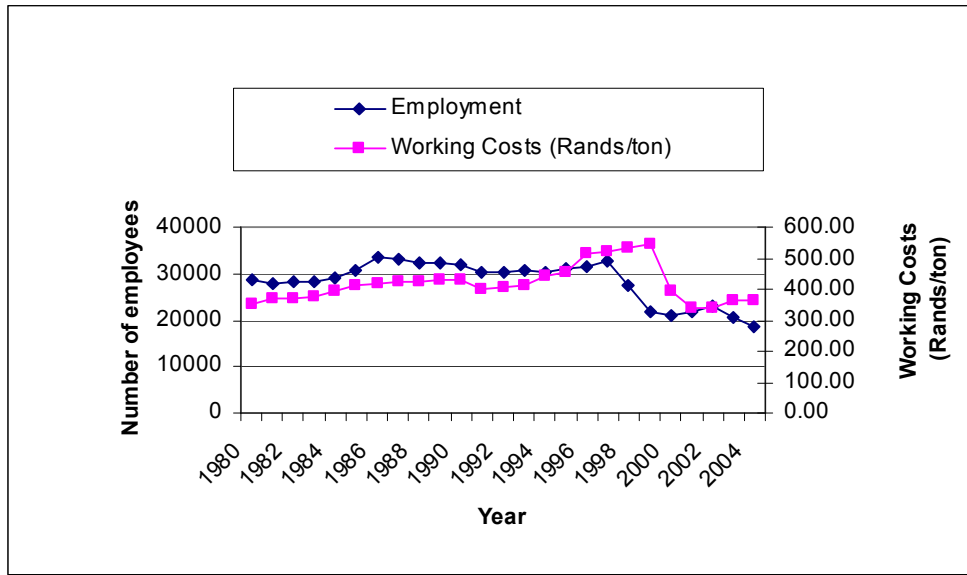


Figure 8.15 Driefontein: Annual average real rand working costs and annual average employment: Linear chart for 1980- 2004 (2004=100)
 (Data Source: Chamber of Mines; DME).



Figure 8.16 Driefontein: Annual average real rand working costs and annual average employment - Scatterplot for 1980-2004 (2004= 100)
 (Data Source: Chamber of Mines; DME).

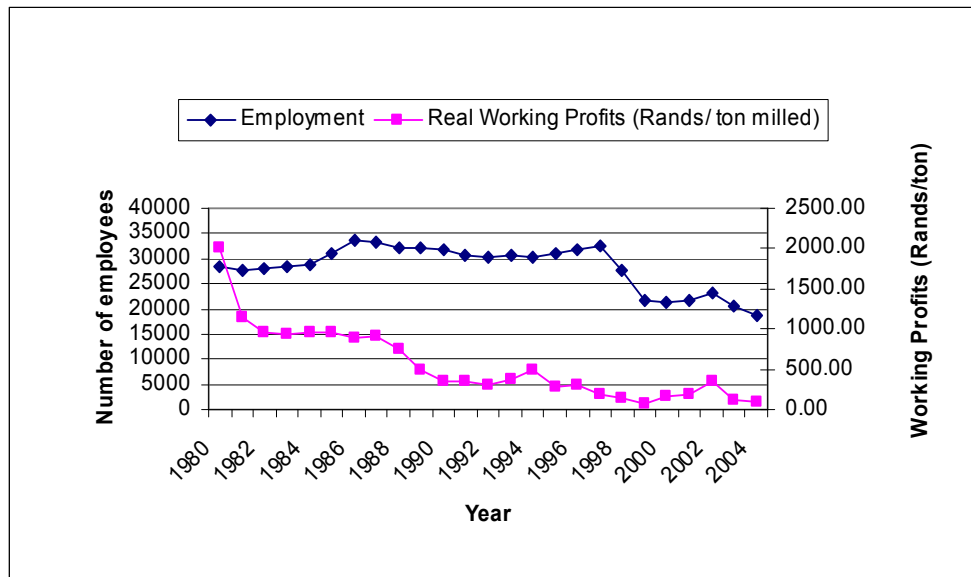


Figure 8.17 Driefontein: Annual average real rand working profits and annual average employment: Linear chart for 1980 - 2004 (2004=100)
(Data Source: Chamber of Mines; DME).

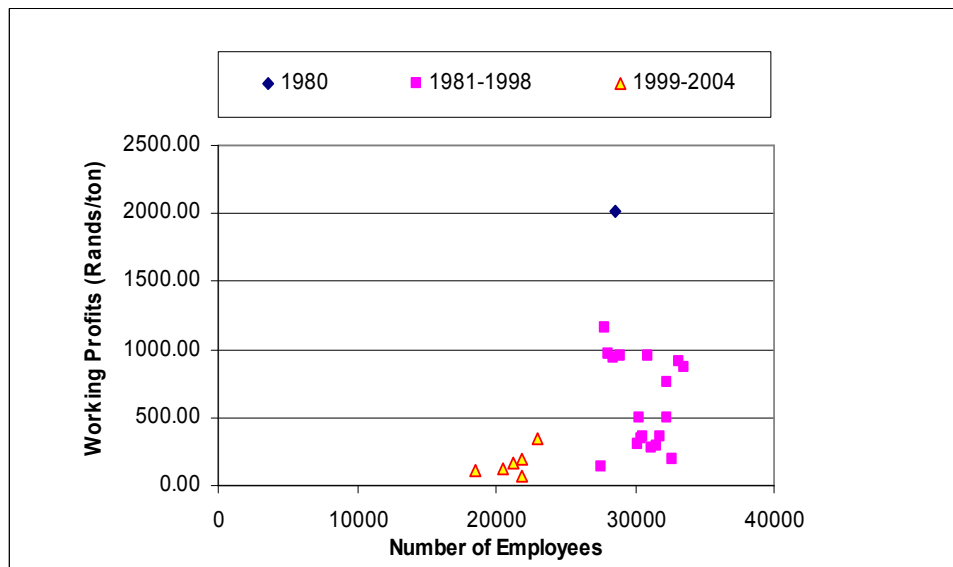


Figure 8.18 Driefontein: Annual average real rand working profits and annual average employment: Scatterplot for 1980-2004 (2004=100)
(Data Source: Chamber of Mines; DME).

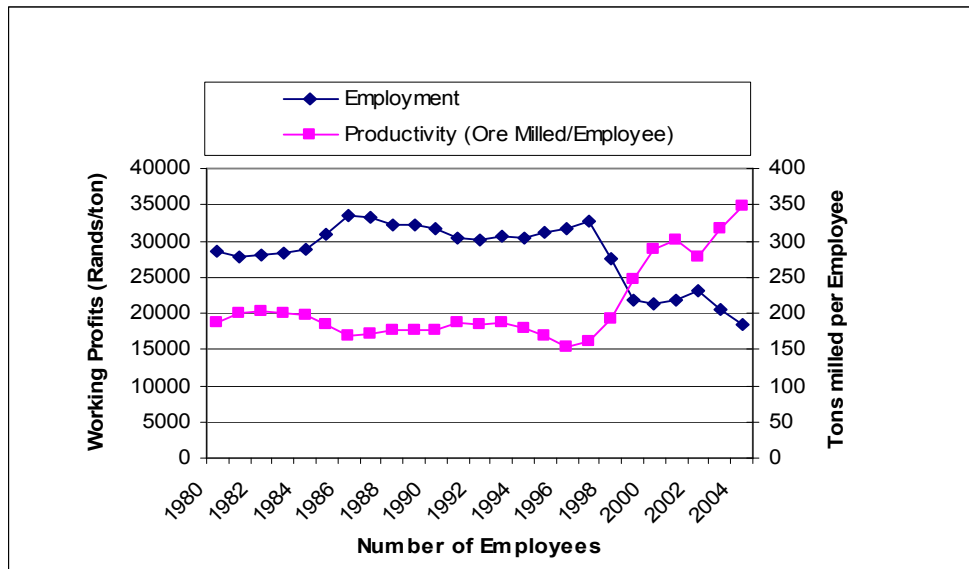


Figure 8.19 Driefontein: Annual average productivity (ore milled per employee) and annual average employment - Linear chart for 1980-2004 (Data Source: Chamber of Mines; DME).

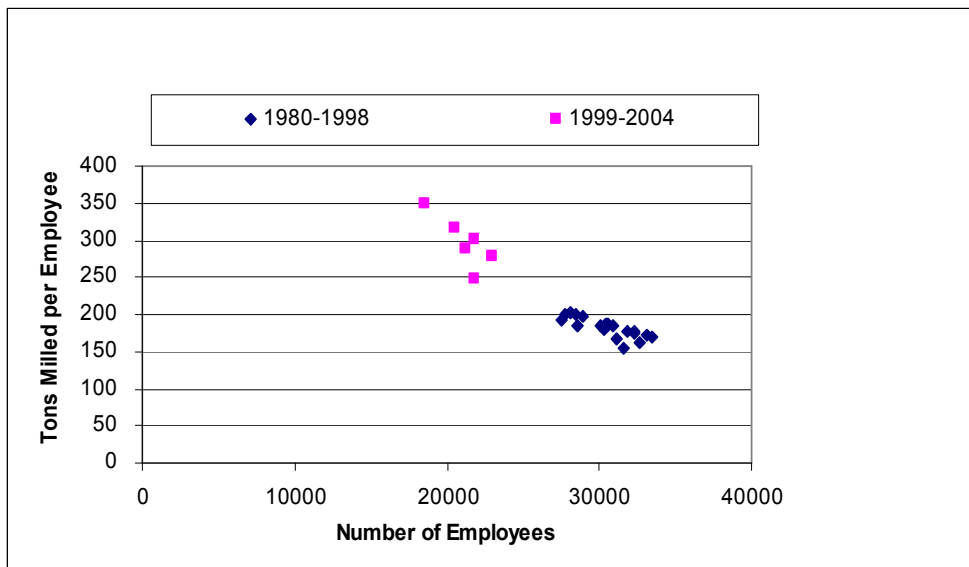


Figure 8.20 Driefontein: Annual average productivity (ore milled per employee) and annual average employment - Scatterplot for 1980-2004 (Data Source: Chamber of Mines; DME).

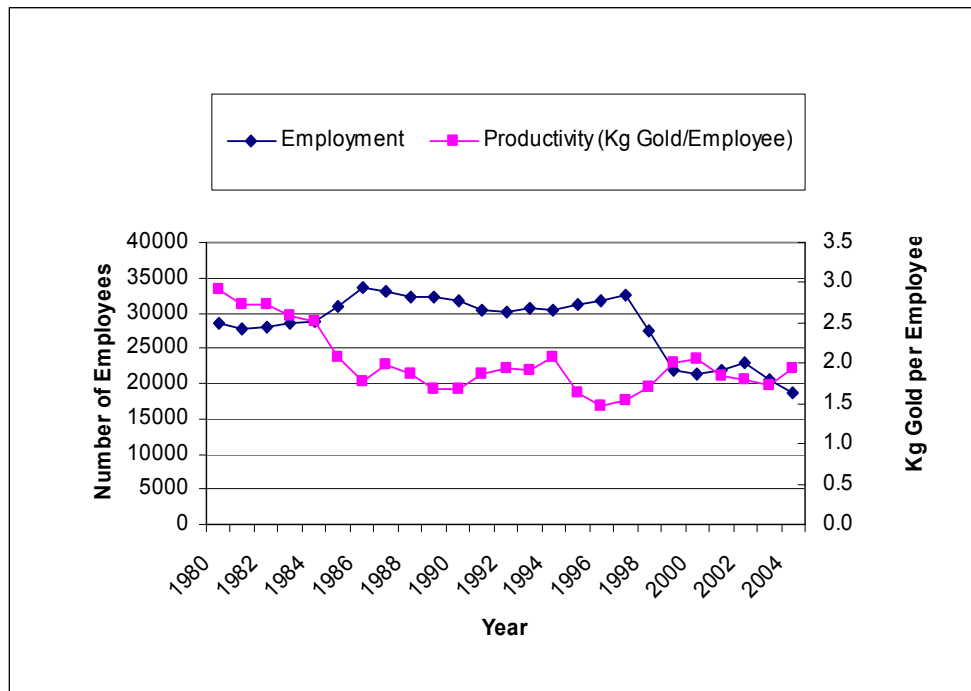


Figure 8.21 Driefontein: Annual average productivity (gold per employee) and annual average employment: Linear chart for 1980-2004 (Data Source: Chamber of Mines; DME).

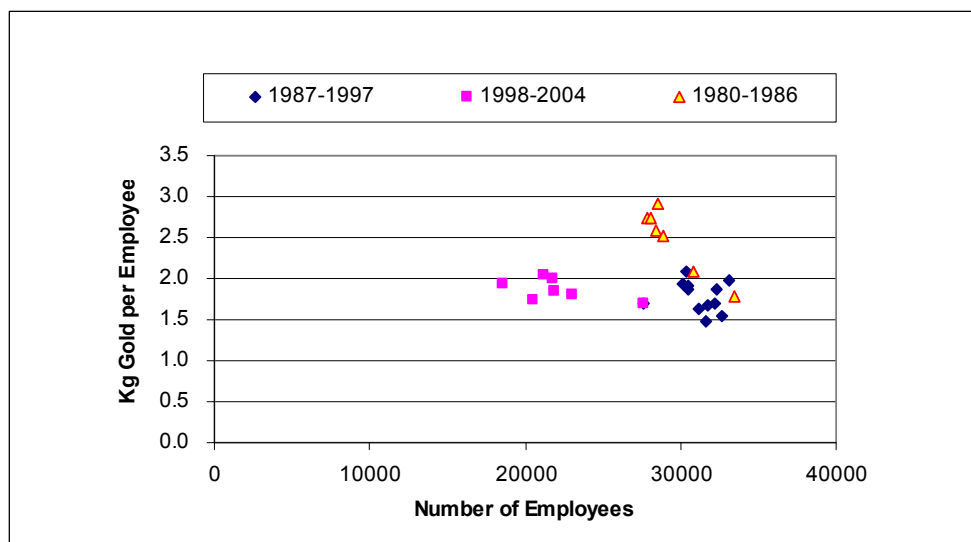


Figure 8.22 Driefontein: Annual average productivity (gold per employee) and annual average employment - Scatterplot for 1980-2004 (Data Source: Chamber of Mines; DME).

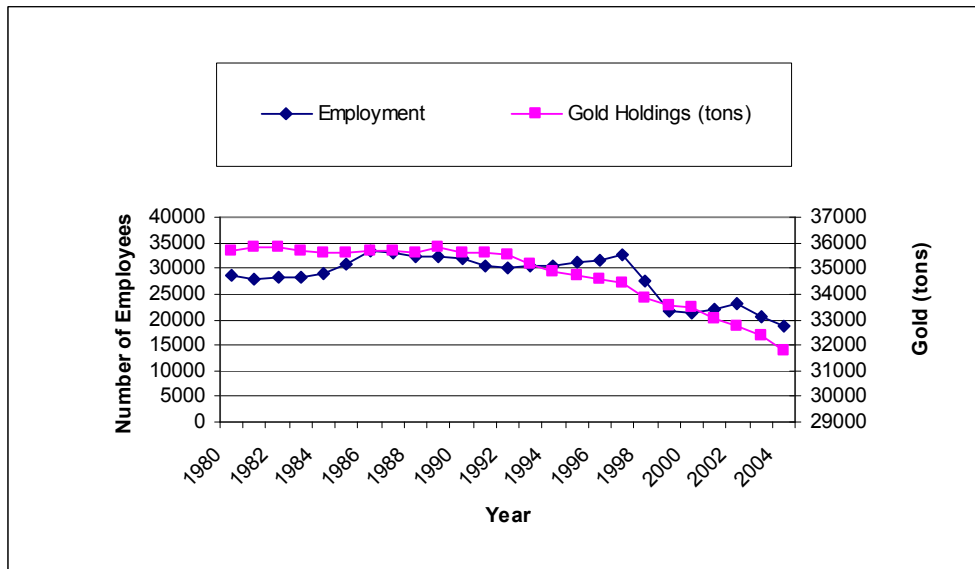


Figure 8.23 Driefontein: Annual average institutional gold holdings and annual average employment: Linear chart for 1980-2004 (Data Source: DME and GFMS Ltd, 2005)

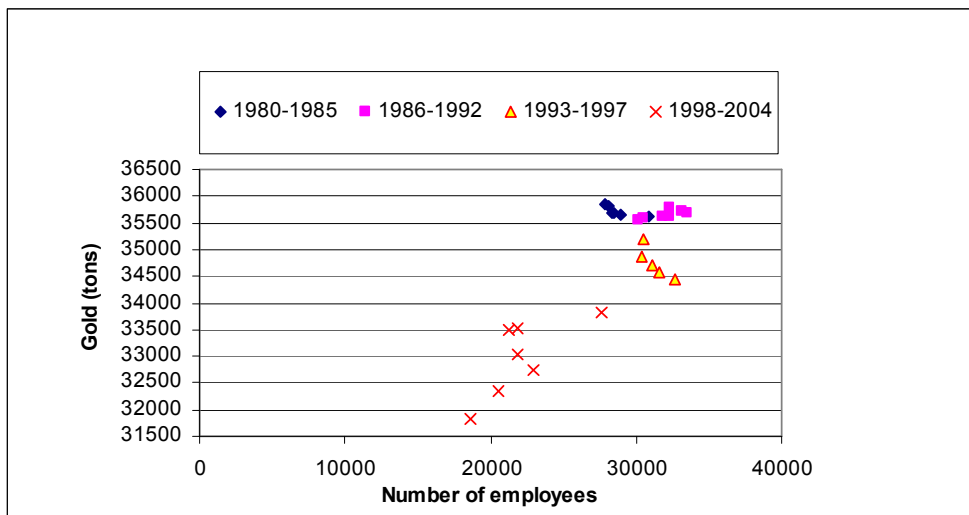


Figure 8.24 Driefontein: Annual average institutional gold holdings and annual average employment - Scatterplot for 1980-2004 (Data Source: DME and GFMS Ltd, 2005).

CHAPTER 9

INTERNATIONAL EXAMPLES ON THE MANAGEMENT OF DOWNSCALING

“All mines have one thing in common – no matter how long they last, they all will close” Government of Canada (2006)

9.1 Introduction

Problems relating to downscaling and closure of mines are not confined to South Africa, but also occur in many other mining countries. The reason behind this is that all mines have a finite life and will, at one point or another, cease to exist. Despite this commonality, the management of downscaling and mine closure processes will depend on, amongst others: the size of the mine, number of employees, type of commodity being mined, prevailing national laws, political and socioeconomic considerations, and the extent of involvement of various stakeholders in the mining industry. In this chapter, which is largely based on a literature review on downscaling, initiatives for managing downscaling and closure in selected countries are discussed and compared with the South African situation. In this regard, Canada, the United Kingdom, Poland and Australia were selected on the basis of their long history of mining and reasonably well documented and accessible information.

9.2 Canada: Management of Downscaling in the Mining Industry

9.2.1 Background

Canada produces a wide range of minerals and in 2006, the value of minerals mined in the country amounted to 33 603 million Canadian dollars (McMullen and Birchfield, 2006). The value was about 60 per cent more than the value of South Africa’s mineral sales in 2006. Gold and coal mining are some of the most important commodities in the country and can provide examples of downscaling in the mining industry. In 2006, the country produced 103 tons of gold and 65 million tons of coal (McMullen and Birchfield, 2006). In this section, selected

information relating to gold and coal was analysed to assess national initiatives put in place to promote downscaling and thereby address downscaling. The analysis was followed by investigation of selected case studies on downscaling and closure of mines. The case studies were chosen on the basis of ease of availability of data. In this regard, one gold mine, two coal mines and two base metal mines were analysed.

9.2.2 Downscaling in Canada's gold and coal mining industries

Despite the relatively high production levels of gold and coal, the country has, in recent years, experienced downscaling in the gold and coal mining industries (Figures 9.1 and 9.2). Although there is an overall downscaling trend in respect of the gold mining industry between 1961 and 2006, two prominent downscaling periods can be observed: between 1961 and 1980 and between 1989 and 2006 (Figure 9.1). Employment dropped by 60 per cent from 15 994 in 1961 to 6 380 in 2006; and by 71 per cent between 1961 and 1977; and by 49 between 1989 and 2006 (Figure 9.1). Whilst employment levels in the gold mining industry recovered briefly between 1993 and 1996, the loss of jobs recommenced in 1997 and continued well into recent times (Figure 9.1). The post-1997 decline in employment was accompanied by a decline in production during the same period – production dropped by 39 per cent between 1997 and 2006 (Figure 9.1). The decline in gold production and employment levels during the post-1997 period can be attributed to the closure of several mines. McMullen and Pepin (1997) point out that the Canadian mining industry experienced difficulties in 1997 due to a combination of some of the following factors:

- The negative perceptions associated with the Asian financial and economic crisis of late 1997 – resulting in investors being reluctant to put money into the exploration sector.
- Declining commodity prices.
- The negative sentiments associated with the 1997 Bre-X scandal in Indonesia. The scandal was in respect of a misleading announcement by Bre-X Minerals Limited, a Canadian company, that it had proven reserves of 71 million oz of gold at its operations in Indonesia. Brown Jr. and

Burdekin (2000) also support the argument that the events of the Bre-X scandal negatively affected the Canadian mining industry.

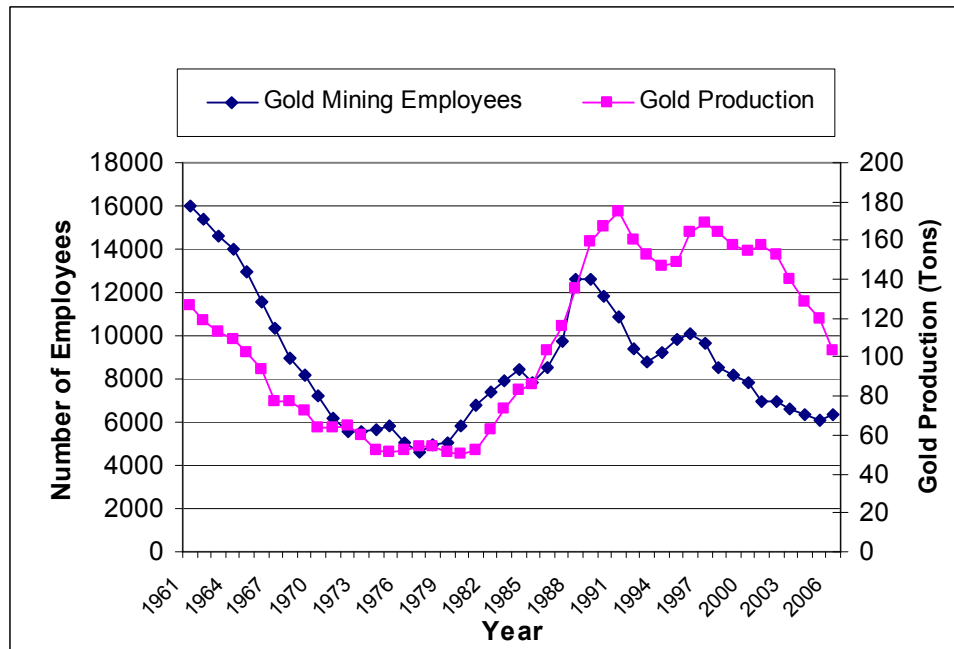


Figure 9.1 Canada's gold mining: Annual average employment and production for 1961-2006 (Data Source: Government of Canada, Natural Resources Canada).

Miron (2002) discusses some of the causes of the decline in gold production and points out that between 2000 and 2002 some 13 Canadian gold mines closed their operations due to the (then) depressed gold prices or depletion of economic ore. Some of the mines that closed operations were McWatters Mining Inc.'s Kiena mine and Barrick Gold Corp's Bousquet mine. In his annual review of the gold mining sector in Canada, Chevalier (2003; 2004; 2005) pointed out that the decline in gold production was caused by closure of a number of mining operations in the provinces of Quebec, Ontario, Newfoundland, Nunavut, Northern Territories and Manitoba. He furthermore stated that some of the mines that closed down in 2004 included Hammerdown mine in Newfoundland, Giant mine in Northern Territories, New Britannia mine in Manitoba, Sigma mine in north western Quebec and Kiena mine complex in Quebec.

The coal mining industry of Canada has also experienced downscaling in recent years, as shown in Figure 9.2. Although significant loss of jobs in the coal mining industry commenced in 1982, the rate of job losses increased immediately after 1997 when production started to decline consistently on a year to year basis. Coal production dropped from 101.7 Mt in 1997 to 64.8 Mt in 2006 – a decline of 41 per cent. McMullen and Birchfield (1998) attributes the 1998 decline in Canadian coal production to: reduction in industrial activities in some of the importing countries, such as Japan; advances in steel-making technology, demanding smaller amounts of high grade metallurgical coal; and price cuts on metallurgical coal. Coal mines that closed included, amongst others: Phalen coal mine in Nova Scotia, Cape Breton – closed in 1999; Prince coal mine in Nova Scotia, Cape Breton – closed in 2001, Coal Creek mine in New Brunswick – closed in 2001 (Jen, 2001).

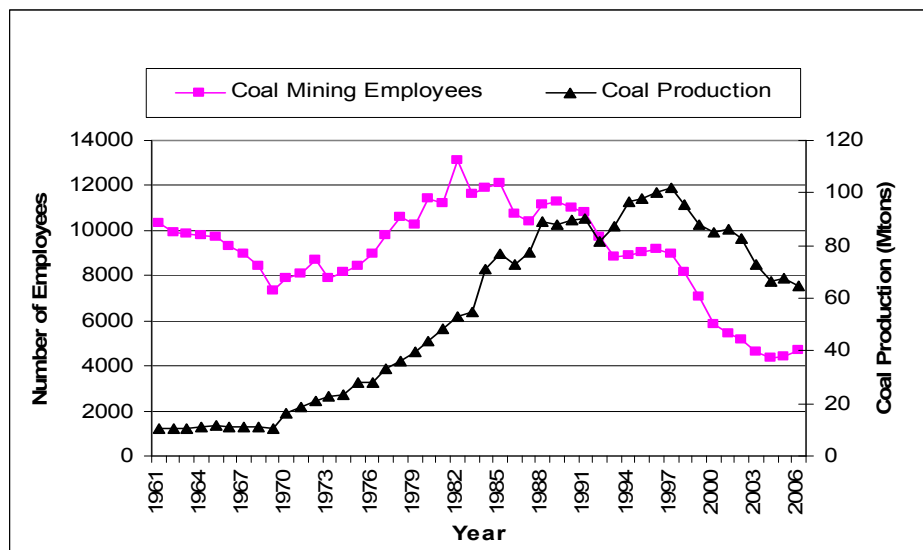


Figure 9.2 Canada's coal mining: Annual average employment and production for 1961-2006 (Data Source: Government of Canada, Natural Resources Canada).

9.2.3 Selected national, provincial and territorial initiatives to promote mining and address downscaling in Canada

The government of Canada, in partnership with other stakeholders, continuously puts in place initiatives and measures to attract investment into the mining industry. These initiatives and measures, which directly or indirectly address issues relating to downscaling, include: studies commissioned, mining research programs, tax incentive schemes, capacity building and support to communities affected by mining, and mining promotional programs. Some of the important initiatives and measures put in place between 1996 and 2006, which was noticeably a period of consistent downscaling in both the coal and gold mining industries of Canada, are discussed below.

Studies Commissioned

Community Resiliency, Transition and Recovery Project

In 2003, Canadian Ministers responsible for local government raised their concerns about the economic circumstances of many mining towns relying on a single-industry (Walisser et al., 2005). In response to the concerns, the Ministers commissioned a study known as Community Resiliency, Transition and Recovery Project (Walisser et al., 2005). The study's aim was to investigate:

- the context, circumstances and actions influencing recovery of small rural resource-dependant towns; and
- tools and strategies needed for the management of downscaling in communities that were facing downscaling.

A total of 16 Canadian towns, which experienced economic depression as a consequence of closure of their main industrial activities, were investigated (Walisser et al., 2005). According to Walisser et al.(2005) there were four core lessons that can be learned from Canada in respect of managing downscaling and closure in resource-based communities i.e.:

- 1) Stakeholders must anticipate and plan for closure as part of normal processes in the life cycle of a resource industry. In this regard,

stakeholders should be proactive and should not wait for closure to take place before addressing the issues.

- 2) After closure, all stakeholders should collaborate in respect of regeneration and restructuring of the economy of a resource-based community.
- 3) The regeneration and recovery can be made easier by implementing a variety of actions, such as:
 - Providing support for affected workers.
 - Maintaining community morale.
 - Planning the diversification of the economy.
 - Providing industry incentives.
 - Maintaining public services during the transition period.
 - Ensuring that municipal finances are stabilised.
- 4) Sustainability of affected communities can be achieved through provision of appropriate financial support for a limited period and also by ensuring that all stakeholders work together in terms of managing available financial resources and spreading of investment over a period of time.

Mining research programs

As part of Canada's strategy to attract investment into the mining sector, and improve efficiency and sustainability of the sector, various research programs were put in place. These programs played a vital and a proactive role in addressing downscaling. Some of the more significant research programs, which were implemented since 1996, include the following:

a) Assistance to gold miners

According to McMullen and Birchfield (1998), in 1998 the Canadian government provided assistance to small gold mining companies to improve efficiency of mining operations and thereby sustaining the operations. A total of 2.5 million Canadian dollars was given over three years to Canada Centre for Mineral and Energy Technology (CANMET) to undertake innovative

research on the automation of the extraction of gold from narrow veins (McMullen and Birchfield, 1998).

b) Geoscientific survey research programs

The Canadian government places great emphasis on the continuous upgrading of Canada's geoscientific infrastructures and in this regard funds are always made available for various geoscientific programs such as geological, geochemical and geophysical surveys. Examples of some of the important programs are presented below:

- In 1996, a 19 million Canadian dollars investment attraction program was put in place in the province of Ontario. It involved conducting geochemical and geophysical surveys to provide geoscientific data to the public (Greenwell, 1999).
- In 2000, some 15 million Canadian dollars were given to the Geological Survey of Canada for targeted geoscience research projects (McMullen and Birchfield, 2000). The initiative, which was known as Targeted Geoscience Initiative (TGI), was undertaken over a three-year period and focused on improving the geoscientific infrastructure of Canada.

c) Promotion of mining innovation and bridging research between researchers and industry

A partnership program, known as Mining Innovation, Rehabilitation and Applied Research Corporation (MIRARCO), was established to provide a bridge between knowledge providers and users of knowledge in respect of innovation in mining and rehabilitation (McMullen and Birchfield, 1998). According to McMullen and Birchfield (1998), the program was initiated as a tripartite partnership, involving Laurentian University, private companies and government and is located in Sudbury, Ontario in Canada. The MIRARCO website states that the partnership is in the form of a non-profit organisation and is involved in mining research projects which include:

- Engineering, research and development in the geotechnical field to promote safer and economical mining; and
- Environmental monitoring research in ecosystem remediation, rehabilitation and restoration.

d) Improving Accessibility of Geospatial Data

The government established a geospatial initiative known as GeoConnections. The initiative improved the accessibility of geospatial data to industry and other users (Greenwell, 1999). Most geological data is in the form of geospatial information and improved access to such data plays an important role in attracting investment into the exploration sector.

e) Mineral Processing and Deep Mining Research Programs

In the province of Quebec, a consortium of applied research for the treatment and processing of mineral substances (COREM) was established in 1999 to improve competitiveness in the field of mineral processing (COREM, 2008). COREM is a non-profit organisation comprising the government of Quebec, mining companies and universities (COREM, 2008; Greenwell, 1999).

In 2002, the Ontario government, in collaboration with the private sector, put in place a deep mining research initiative, which aimed at identifying economical methods of mining below 2000 meters (McMullen and Birchfield, 2002).

Tax incentive schemes

Tax incentives are one of the most important instruments used by the Canadian government to attract investment into the exploration sector. These incentives play a critical role in mitigating against possible downscaling and loss of jobs in the mining industry. One of the most important incentive schemes is the flow-through share scheme. The scheme provides investors with tax breaks and an opportunity for possible capital appreciation (Cornell, 2006). Examples of some of the incentives, which often change on an annual basis, are presented below:

- In 2001, the Department of Indian Affairs and Northern Development (DIAND) signed an agreement with Miramar Giant Mine Ltd. to extend the life of Giant gold mine and thereby protect jobs. In terms of the agreement, DIAND would contribute 300 000 Canadian dollars per month towards environmental compliance and holding costs (McMullen and Birchfield, 2001).
- In 2001, the Federal government announced that investors in the flow-through share incentive scheme would be given a 15 per cent tax credit for investing in exploration companies. The scheme, which was known as Investment Tax Credit for Exploration (ITCE) was aimed at assisting junior companies to raise equity through the issuance of flow-through shares (McMullen and Birchfield, 2001). According to McMullen and Birchfield, 2001, some provincial and territorial governments also complimented the federal government on the ITCE scheme. For example, the Ontario government provided a 5 per cent tax credit for investors in the flow-through share scheme. Similarly, the Saskatchewan government complimented the ITCE with a 10 per cent tax credit for investors who purchased flow-through shares. The Manitoba government also complimented the ITCE scheme by providing a 10 per cent personal income tax credit for investors in flow-through shares.
- In 2004, the provincial government of British Columbia extended the (then existing) 20 per cent flow-through-share tax credit for another year (McMullen and Birchfield, 2004). According to McMullen and Birchfield (2004), the combination of the provincial tax credit and the federal government's 15 per cent tax credit provided investors in British Columbia exploration sector with up to 63 per cent tax savings. In 2005, the government of British Columbia introduced a ten-year 20 per cent tax credit program to support mining exploration in the province (McMullen and Birchfield, 2005).

Capacity building and support to communities affected by mining

In 1996, the federal government provided an amount of 1.1 million Canadian dollars over a three-year period to the Mining Industry Training and Adjustment Council (MITAC), which is a forum that brings together industry, unions and government in order to increase opportunities for training employees (McMullen and Kokkinos, 1996). According to McMullen and Kokkinos (1996), MITAC provided funding to workers for:

- upgrading of mineworkers' basic skills;
- development of training curricula designed to meet the needs of the mining industry;
- designing courses on environmental safety and health; and
- improving adjustment planning for workers and communities affected by mine closure.

Mining promotional activities

The government of Canada, like many other governments of mining countries, continuously promotes and supports the mining industry by participating at mining investment conferences and undertaking missions abroad to attract investment into the sector (Greenwell, 1999; McMullen and Birchfield, 2002). These conferences include the Prospectors and Developers Association of Canada (PDAC) (in Toronto, Canada) and Mining Indaba (in Cape Town, South Africa).

9.2.4. Case studies on downscaling in Canada's mining industry

Selected mining operations in the gold, coal and base metal industries were examined with the purpose of investigating initiatives put in place to address downscaling in Canadian mines. The selection of the mining operations was largely based on the ease of availability of information relating to downscaling and their relevance to the objective of the study.

a) Case studies of downscaling in the gold mining sector of Canada

New Britannia mine - Snow Lake Community

Background

New Britannia mine is a gold mine located at Snow Lake in Manitoba province in the northern part of Canada. The first gold mining operations commenced in 1949 and employed about 300 people (Snow Lake Mining Museum, 2008). The operations, which initially made profits, experienced financial difficulties and closed down in 1958. Further exploration in the 1980s led to the re-opening of the mine in 1995 until its closure in 2004 (Manitoba Government, 2008a; Snow Lake Mining Museum, 2008).

Initiative to address downscaling and closure during 1995-2004 operations

The closure of New Britannia mine devastated communities and employees associated with the mine. In response to the closure, the provincial government of Manitoba provided financial assistance to residents affected by the closure of New Britannia mine. The assistance to the Snow Lake community was in the form of a once-off payment of 2 500 Canadian dollars for each household affected by the closure of the mines (McMullen and Birchfield, 2005). The provincial government, local town government and management of New Britannia mine established the Snow Lake Community Economic Development Office, which was tasked to implement a long-term development plan for the town. Funding for the projects was sourced from the Mining Community Reserve Fund established in 1970 (Manitoba Government, 2006). The fund was created to help mining communities pursue new economic opportunities and to help maintain municipal services after partial or complete mine closure (Manitoba Government, 2006). In 1998, in his presentation of the Department of Energy and Mines estimates to the Committee of Supply, the then Minister of Energy and Mines of Manitoba, Mr David Newman, pointed out that the purpose of the reserve fund was to contribute to the continued employment and economic well-being and health of communities that suffer from the inevitable closure of mines (Manitoba Government, 2008b).

Money for the Fund came from the provincial mining tax revenues and was fixed at 120 000 Canadian dollars per year (Manitoba Government, 2006). It is currently estimated at between 17 and 19 million Canadian dollars (Manitoba Government, 2008c). In a submission by the Mayor of Lynn Lake to a Manitoba Mining Task Force, the Mayor pointed out that despite the existence of the Mining Community Reserve Fund, many mining communities are not informed about the fund and it was also difficult to obtain information about the fund (Manitoba Government, 2008c). The Mayor furthermore suggested that the management of the fund should be improved by appointing a Board to administer the funds and ensure that communities are represented on the Board.

b) Case studies of downscaling in the coal mining sector of Canada

a) Tumbler Ridge coalfield

Background

Tumbler Ridge is a coal mining town in British Columbia in Canada. It was established in the mid-1970s, during a period of relatively high coal prices and good demand for coal (Walisser et al., 2005). Two major mines, namely, Quintette mine (operated by Denison Mines Inc) and Bullmoose mine (operated by Teck Corporation) were opened after a consortium of Japanese steel milling companies agreed to purchase 100 million tones of coal over 15 years (Wikipedia, 2008a). In support of the project, the government of British Columbia agreed to build two highways, a power line and a branch rail line to facilitate the establishment of the mines (Wikipedia, 2008a). The commencement of coal production in 1981 saw the migration of people into Tumbler Ridge – resulting in the population rising from 1 200 people in 1981 to 4 800 people in 1991 (Walisser et al., 2005). The coal mines were the main employer, with over half of the town's people employed on the mines (Wikipedia, 2008a). However, unlike many mining towns and regions, where planning for ultimate closure was left until the last moment, the British Columbia government tried to avoid this scenario by involving mining companies in the building and development of the town (Walisser et al., 2005).

According to Walisser et al. (2005), despite all the cautionary measures that were put in place to minimise the negative impact associated with downscaling, the town could not escape the economic decline as production started to decline in the early 1990s. The decline in production was caused by declining global coal prices after 1981 and weak Asian markets during the 1990s (Wikipedia, 2008a). Closure of the mines commenced in 2000, which was three years ahead of schedule and the second mine followed in 2003 – the result was that the population in the town dropped to 1 900 by 2003 from 4 800 in 1991 (Walisser et al., 2005). The consequence of a declining economy devastated the community and the town in terms of job losses, shortage of jobs and migration of people to other towns and areas, which could provide a better livelihood.

Initiatives to address the impact of downscaling at Tumbler Ridge

1) Literacy skills program

A literacy skills peer tutoring program was introduced to improve literacy levels of mine employees at Bullmoose Mine, thereby equipping them with new skills in preparation for the closure of the mine (Human Resources and Social Development Canada, 2008). The program involved a partnership amongst relevant stakeholders, which included the Northern Lights College, Tumbler Ridge Literacy Association, Bullmoose Mine Local 443 and Communications, Energy and Paperworkers Union (CEPU) (Human Resources and Social Development Canada, 2008). The government allocated funding for the program and was one of seven similar projects in British Columbia (Government of Canada, 2001). According to Human Resources and Social Development Canada, a coordinator was appointed to:

- assess the needs of the people;
- work with the union and company representatives to develop a plan of action;
- identify suitable workplace literacy program;
- appraise existing syllabuses and associated materials;
- put into practice the literacy program;

- ensure sufficient ongoing support for tutors of the literacy program; and
- prepare and submit a final report on the program.

2) Diversification of the economy

Western Economic Diversification Canada funded a research centre and a dinosaur museum to attract tourists as part of its strategy to decrease the dependence of the economy on coal mining (Wikipedia, 2008a).

3) Creation of North East British Columbia Coal Forum

The North East British Coal Forum was established to provide a platform for stakeholders to discuss relevant issues relating to coal development in North East British Columbia (District of Tumbler Ridge, 2008).

b) Cape Breton Coal Fields

Background

Cape Breton is an island located east-northeast of mainland Canada and is part of the province of Nova Scotia (Wikipedia, 2008b). The island has two major coal deposits: the Sydney Coal Field and the Inverness Coal Field (Wikipedia, 2008b). According to Tupper (1978), most of Cape Breton coal mining occurred in Sydney, Glace Bay, New Waterford and Sydney Mines – the people living in these areas constituted 76 per cent of the population of Cape Breton and their livelihood largely depended on coal mining and steel production. The coal industry in Cape Breton was, for many years, controlled by Dominion Steel and Coal Company, which operated coal mines and steelworks on the island (Tupper, 1978). In 1965, the company employed some 6 500 employees, which was 87 per cent of the coal mining employees on the island (Tupper, 1978). Tupper (1978) points out that coal mining in Cape Breton was labour intensive and operated under, amongst others, chronic financial instability, low productivity, inefficiency and poor competitiveness. The industry relied on a government policy that continuously provided financial assistance to protect jobs and the local economy. According to Tupper (1978), the most important financial aid included:

- freight subsidies to make the coal competitive with imported coal;
- loans for mechanisation of the mine and rehabilitation programs; and
- payment to Canadian steel producers for using Canadian coal.

Despite the abovementioned interventions, the Cape Breton mining industry could not be saved from its troubles. In 1966, the Dominion Steel and Coal Company announced that it intended to close its coal mining operations (Statistics Canada, 2008).

Initiatives to address downscaling on Cape Breton mines

In response to the pending closure of mining operations, the federal government formed the Cape Breton Development Corporation (Devco) to take over the management of the mines and implement a strategy to diversify the economy of Cape Breton (Statistics Canada, 2008; Tupper 1978). Devco was established in 1967 by an Act of parliament and was wholly owned by the government of Canada (Government of Canada, 2003). The problems of declining profitable coal reserves, fatalities, injuries and the closure of mines became too daunting for the government and it subsequently took a decision to stop involvement in the management of the mining operations (Statistics Canada, 2008). In this regard, it was decided to privatise Prince mine and close Phalen mine (Nova Scotia Government: Standing Committee on Economic Development, 1999). According to World Socialist Web Site (2000), Devco lost billions of dollars over several years of operating the mines and hundreds of people lost their jobs. The government refused to guarantee jobs at the privatised Prince mine and the then Natural Resources Minister, Mr Ralph Goodale, was quoted as saying: “I’m not in a position, nor should I be, on behalf of the government of Canada to wade into a commercial negotiating process” (World Socialist Web Site, 2000). The decision to close the mining operations and the threat of job losses resulted in a wildcat strike by 1 600 miners who objected to the offered severance packages (World Socialist Web Site, 2000). According to World Socialist Web Site (2000), the mine had offered the following severance benefits:

- Employees with 25 years services were the only ones offered a pension.
- The remainder of employees were given a once off lump-sum severance package.

As part of the process of managing downscaling at Devco mines, management and other stakeholders put in place several initiatives – these initiatives are discussed in several pieces literature, including by: Nova Scotia Government: Standing Committee on Economic Development (1999); Treasury Board of Canada Secretariat (2004); and Canada Labour Code (1985). These are summarised below:

- A Joint Planning Committee, comprising management and the union was established to develop an early retirement program. The establishment of the committee was in accordance with Canada's Labour Code, which required that such a committee be established in the event of retrenchments of fifty or more employees. The committee's objectives and responsibilities included:
 - elimination of the necessity to terminate employment;
 - minimizing the impact of job retrenchments on redundant employees; and
 - development of an adjustment program.
- Management set aside funds for severance packages for younger employees and put some older employees on an early retirement program.
- The company received 5 million Canadian dollars from the government of Ottawa for re-training of employees – it amounted to about 8 000 Canadian dollars per redundant person.
- Ottawa government also provided 68 million Canadian dollars for community development programs.
- Management tried, without success, to negotiate with miners to extend the working shift from 8 hours to 10 hours.
- Employees were re-trained to improve efficiency, innovation and productivity on the mines. For example, through innovative ideas, the

company doubled the pumping rate and thereby protected the mine from possible flooding.

- The company decentralised its management and downsized to appropriate levels. Decentralisation resulted in management being closer to the operations.
- Cape Breton contractors were employed to undertake remediation/reclamation projects.
- A Mine Water Working Group was formed to address mine water pollution issues and water treatment facilities were developed to treat acid mine drainage.
- A career opportunity center was opened and assisted 800 employees to find alternative employment.
- Enterprise Cape Breton Corporation was given funding by government to assist former mineworkers with employment in community development projects.

Case studies of downscaling in the base metal sector of Canada

a) Ruttan mine in Leaf Rapids

Background

Ruttan mine is a copper-zinc mine located outside the town of Leaf Rapid in northern Manitoba, Canada (Manitoba Government, 2008d; Wikipedia, 2008c). The town was established in 1976 after the discovery of copper and zinc deposits in 1969 (Wikipedia, 2008c; Manitoba Government, 2001). The mine has been threatened by closure since 1987 and was rescued after the provincial government of Manitoba agreed to subsidise exploration on and around the mine to extend the life of mine and therefore save the loss of jobs (Manitoba Government, 2001). Following the agreement in 1987, Hudson Bay Mining & Smelting Co., Ltd (HBM&S) took over the operations of the mine from Sherritt Gordon and continued mining until 2001. In 2001, HBM&S announced that they would be closing the mining operations on 31 May 2002 due to the (then) depressed commodity prices (Manitoba Government, 2001).

Initiatives to address downscaling at Ruttan mine

In response to the (then) imminent closure of Ruttan mine, the provincial government put in place several initiatives, which included the following:

- Creation of a Mining Task Force to explore the future of mining activities in the entire province of Manitoba. The Task Force was mandated to consult with various stakeholders in order to develop appropriate recommendations (Manitoba Government, 2001; Manitoba Government, 2002).
- Establishment of Leaf Rapid Community Adjustment Committee (LRCAC) to address the negative impact of mine closure and develop a long-term plan for the town. A total of 236 000 Canadian dollars were made available to support LRCAC (Manitoba Government, 2002).
- Creation of Ruttan Workers Adjustment Committee, which was subsequently given 130 000 Canadian dollars to assist mineworkers affected by the closure of the mine (Manitoba Government, 2002).
- Providing 100 000 Canadian dollars to fund the establishment of a community development officer for the town (Manitoba Government, 2001; Manitoba Government, 2002).
- Development of strategies to establish new economic opportunities and diversify the economy from mining (Manitoba Government, 2001).
- Initiation of a Manitoba Labour and Immigration adjustment process (Manitoba Government, 2001).
- A community workshop was held to assess the future of Leaf Rapid after the closure of the mine (Manitoba Government, 2002).

b) Iron ore mining sector

The relatively low commodity prices of the late 1990s also affected the iron ore industry in terms of closure of mines and loss of jobs. The problems in the mining sector of Canada during the 1990s are discussed by McMullen and Birchfield (1998), who point out that the Canadian iron ore sector experienced serious difficulties as a consequence of depressed iron ore prices. In 1998 Algoma Steel Inc. closed its iron ore mining operations near Wawa, Ontario in Canada (Miron,

1998). According to Miron (1998), the closure of the mining operations resulted in 220 employees losing their jobs. Miron (1998) and McMullen and Birchfield (1998) state that, in an effort to address problems faced by the iron sector several initiatives were put in place - these included:

- seeking new markets and a reduction of production costs;
- temporarily closing some operation;
- temporarily laying off some employees for extended leave periods.

9.2.5 Summary and comparative analysis between Canada and South Africa on initiatives relating to downscaling

Canada, like many other mining countries, has experienced downscaling in some of its mining industries. Gold and coal mining industries provide good examples of downscaling. Canadian downscaling is largely attributed to a combination of economic factors, for example: the gold mining sector's reasons for downscaling seem be related to a combination of depressed gold prices in the 1990s and early 2000s; negative sentiments associated with the Bre-X scandal; and uneconomic reserves. A comparison of the Canadian gold mining industry and the South African mining industry reveals that whilst the downscaling in Canada is largely driven by the closure of relatively small, individual and isolated mines, the South African downscaling is mainly driven by declining reserves within the large Witwatersrand gold basin. With regard to the Canadian coal mining sector, downscaling is largely related to, amongst others, the (then) uncompetitiveness of Canada's coal mining industry, complex geological conditions and uneconomic reserves (Tupper, 1978).

An analysis of various literature pieces provides an insight into how Canada manages its mining industry, especially in respect of downscaling and closure of mines. The Canadian approach for promoting the mining industry and thereby contributing to the management of downscaling and closure of mines can be grouped as follows (Table 9.1):

- 1) National, provincial and territorial initiatives
 - a) Promotion of the industry
 - b) Research programs to promote the industry
 - c) Tax incentives for exploration
- 2) Mine-focused initiatives
- 3) Community-focused initiatives
- 4) Environmental initiatives

There is remarkable similarity between the Canadian and South African initiatives in respect of the management of downscaling (Table 9.1). For example, both countries place significant emphasis on the promotion of the mining industry and attracting investment into the sector. However, Canada outshines South Africa on exploration tax incentives provided to the exploration sector – this is largely due to the generous flow-through share tax incentive scheme available to investors in the exploration sector. On initiatives aimed at assisting redundant mineworkers, both countries have put in place various measures that address workers' needs – these measures mainly involve re-training of redundant employees and providing mineworkers with portable skills. With regard to communities, both Canada and South Africa have also put in place a wide range of initiatives aimed at supporting affected communities. The initiatives focus on the regeneration of the economies of affected communities through, amongst others, attracting investment and developing regeneration plans.

Table 9.1 Canada and South Africa: Analysis of initiatives to promote the mining industry and address downscaling.

Initiative	Canada	South Africa
1) National, Provincial and Territorial		
a) Mining Promotional Activities	Exhibiting at mining conferences, such as Indaba (in Cape Town, South Africa) and PDAC (in Toronto, Canada).	Exhibits at major mining conferences, such as the PDAC (in Toronto, Canada) and Indaba (in Cape Town, South Africa).
b) Research programs	- The Canadian federal, provincial and territorial governments undertake a number of geoscientific research programs to attract new investment into the mining industry. - Financial support for research on improving efficiency of small-scale miners. - Partnership programs between industry and government to bridge knowledge between industry and knowledge providers - MIRARCO project. - Deep mining research projects supported by the Ontario government.	- The South African government undertakes several geoscientific research projects to attract investment into the mining industry. - Financial support is provided to Mintek and CSIR for various research programs aimed at supporting mining operations, including small-scale mines. - SAMREC is the closest comparison to MIRARCO. SAMREC also supports deep mining research projects.
c) Tax incentives scheme	The flow-through share scheme forms the basis of a variety of other incentive schemes.	South Africa doesn't have special tax incentive scheme for exploration.

Table 9.1 (continue) Canada and South Africa: Analysis of initiatives to promote the mining industry and address downscaling

Initiative	Canada	South Africa
2) Mine-Focused Capacity building and support to employees	- Literacy skills programs provided to redundant mineworkers (e.g. Bullmoose mine) - Mining Training and Adjustment Council – a tripartite organisation was created to provide, amongst others, training to mine employees. It also provides adjustment programs for employees and communities affected by mine closures and downscaling	- Mine Qualification Authority (MQA) operates on a tripartite basis and provides funds for training of mineworkers. It also plays a role in the retraining of redundant employees. - In terms of the new mining legislation's Social and Labour Plan, companies are required to indicate how they will address skills development, including the provision of portable skills.
3) Community Focused Studies commissioned to investigate economic circumstances of towns affected by downscaling.	The Resilient City initiative commissioned by Ministers for local government was an example of such a study.	The Department of Provincial and Local Government provided funds to local municipalities to undertake economic regeneration studies. An example in South Africa is the Matjhabeng (Welkom) Development Strategy.

Table 9.1 (continue) Canada and South Africa: Analysis of initiatives to promote the mining industry and address downscaling

Initiative	Canada	South Africa
• Creation of a Task Force to investigate downscaling issues.	• An example of such a task force was the Manitoba Task Force, which was established to examine, amongst others, the impact of downscaling in the Manitoba province.	• The establishment of the Gold Crisis Committee and Sector Partnership Committees and respective task teams.
• Establishment of Adjustment Committees	• Community Adjustment Committees created to investigate regeneration opportunities (e.g. Leaf Rapids). Workers' Adjustment Committees were also established (eg Ruttan mine).	• Work place forums are established to address redundant workers needs and concerns. • Economic regeneration plans for towns affected by downscaling are developed by local municipalities.
• Environmental issues	• These are addressed through the legislation in terms of the largely practiced "polluter pays" principle. Often addressed through closure plans. The Canadian Environmental Assessment Act of 1995 addresses the issues of mining and the environment.	• These are addressed through legislation in terms of the largely practiced "polluter pays" principle. The new mining code addresses environmental issues effectively.

9.3 United Kingdom: Management of Downscaling in the Mining Industry

9.3.1 Background

Although United Kingdom is considered a highly developed country, with a relatively old history of industrialisation, mining still takes place - the mining industry and quarrying (including oil and gas) accounted for 2.3 per cent of national gross value added in 2005 (Hetherington et al., 2007). During the same year, the value of “solid minerals” (excluding oil and gas) was £3 352 million (Hetherington et al., 2007). Aggregate, at £1 632 million in 2005, was the leading mineral commodity in terms of value. The second most important mineral commodity is coal. The value of coal mining in the United Kingdom was valued at £722 million in 2005. Trends in downscaling in the mining industry of the United Kingdom are best represented by the coal mining industry, hence discussions on downscaling will focus on coal mining.

9.3.2 Downscaling in United Kingdom’s coal mining industry

Coal mining has for many years been an integral part of the United Kingdom’s economic development. Deep coal mining commenced in the late 18th century and became a primary energy source in the 19th and 20th century when the industry was at its peak (Wikipedia, 2008d). In 1947, when the industry provided more than 700 000 jobs, the government decided to nationalise the industry – a situation that remained until the 1980s (Wikipedia, 2008d; United Kingdom House of Commons, 2004). In the 1980s and 1990s, the industry began to experience serious competition from other energy sources such as gas (Energy Information Administration, 2008). A combination of the competition with the decision by the former Prime Minister, Margaret Thatcher, to privatise the mines resulted in the closure of several operations and the downscaling of the industry. The downscaling resulted in the industry shedding more than 250 000 jobs between 1985 and 1997 across coal mining regions such as the North East, the North West, Yorkshire and Humberside, the Midlands and parts of the South East (United Kingdom House of Commons, 2004). The extent of downscaling in the coal mining industry of the United Kingdom since 1960 is shown in Figure 9.3.

Production dropped from 197.8 million tons in 1960 to 18.5 million tons in 2006. Employment dropped from 607 000 employees in 1960 to 4 000 employees in 2006.

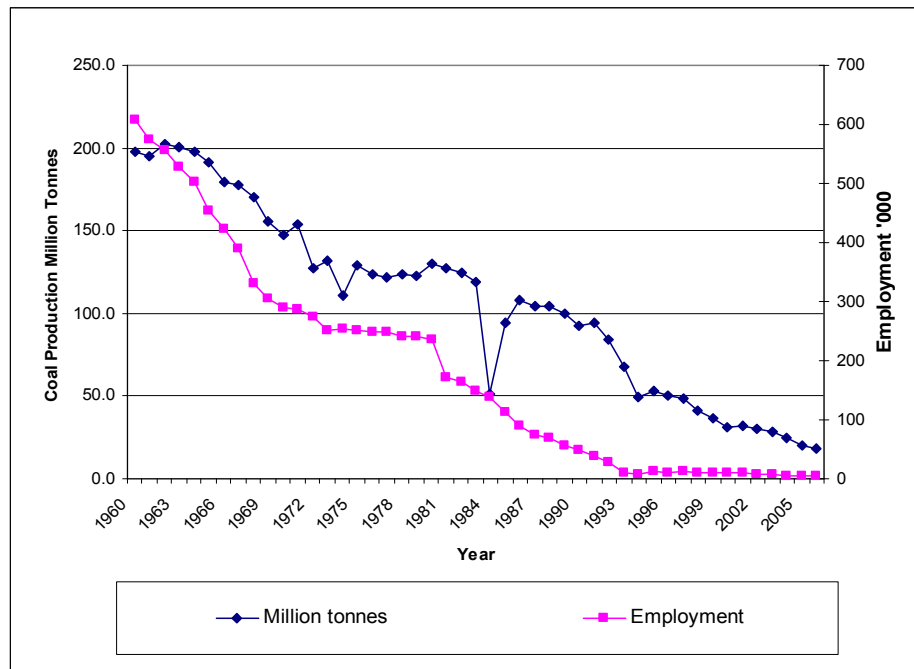


Figure 9.3 United Kingdom's coal mining: Annual average employment and production for 1960-2006 (Data Source: Department of Business, Enterprise and Regulatory Reform, United Kingdom, 2008).

9.3.3 Selected United Kingdom's national initiatives to address downscaling

According to the 9th March 2004 report of the House of Commons, there were many initiatives that were put in place by the government of the United Kingdom and the European Union to address the negative impact of downscaling by the coal mining industry. The following are some of the initiatives stated in the report:

a) Establishment of a Coalfields Task Force

The Task Force was established in 1997 to develop a program of action to assist coal mining communities affected by downscaling and associated job losses (Prescott et al., 1999). The main focus of the Task Force was to empower redundant coal miners and their communities to start a new life. Some of the recommendations of the Task Force included the following:

- The government should develop a set of fiscal incentives aimed at job creation.
- Enterprise Zone status should be awarded to coalfields affected by downscaling.
- Government Departments and related agencies were encouraged to consider relocating their staff to coalfield regions.
- Creation of a Coalfield Enterprise Fund to assist small businesses in the coalfields.
- Small firms should be assisted by the provision of business advice services and premises.
- Provision of education and lifelong learning to affected coal communities.

b) Coal Enterprise Fund

The government provided some £15 million to support small businesses with high growth potential in coal mining areas affected by downscaling (Coal Enterprise Fund, 2006). The fund was later expanded to include private sector participation and involved, amongst others, taking equity in small businesses (Coal Enterprise Fund, 2006).

c) Enterprise Zones

Several countries in the world have created Enterprise Zones in economically depressed areas. The zones offer investors a variety of tax incentives and regulatory relief in order to attract investment into the economically depressed areas (Wikipedia, 2008e). In the United Kingdom, the zones were introduced by the government of former Prime Minister Margaret Thatcher in 1979 as part of a strategy to revitalise depressed economies in industrial and mining towns (Wikipedia, 2008e).

Dawdon Business Park and Fox Cover Enterprise Park are examples of former collieries that were transformed into Enterprise Parks (Dawdon Business Park, 2008; North East England, 2008). The two former coal mining districts were reclaimed and provided with infrastructure under the National Coalfield Program (North East England, 2008). One of the incentives made available to companies operating from the park was a 100 per cent income tax allowance on capital expenditure relating to industrial and commercial buildings (Dawdon Business Park, 2008).

d) European Social Fund and Structural Fund

The fund was created to improve skills of people and thereby improve their employment opportunities (European Union, 2008). In Derbyshire, ex-coalfields communities benefited from the fund, which provided training in Information Communication Technology and desk top publishing (European Union, 2008). The training, which was given by local tutors, was provided from mobile converted buses (European Union, 2008).

e) Single Regeneration Budget

The Single Generation Budget was created to provide support to communities in respect of, amongst others, improving employment opportunities, health and living conditions (Wakefield, 2008).

f) Coalfields Regeneration Trust

Coalfields Regeneration Trust was established in 1999 and provides grants aimed at regenerating the economies of Britain's coalfield communities (The Coalfields Regeneration Trust, 2008). The Trust was created by the British government, in response to the recommendation of the 1998 Coalfield Task Force Report, and was given a budget of about £26.6 million per year (The Coalfields Regeneration Trust, 2008; Communities and Local Government, 2008). According to the Welsh Assembly Government (2008), the aims of the Coalfields Regeneration Trust are as follows:

- Assisting unemployed people to find employment.
- Providing skills training and re-training of the unemployed.
- Provision of housing for the needy.
- Provision of financial assistance and technical assistance for small businesses.
- Provision of training to individuals to improve their prospects of being employed.
- Supporting public recreational facilities.

9.3.4 Case study of downscaling in the United Kingdom

Selby Coalfield

Selby coalfield occurs in North Yorkshire and covers about 285 square kilometers of land (World Bank, 2008). The coalfield was developed in the 1980s and comprised five mines: North Selby, Riccall, Whitemoor, Stillingfleet and Wistow (Shutt et al., 2002a). According to Shutt et al. (2002a), the mines reached their peak production of 12 million tons per annum of coal in 1993-1994 – but soon started to decline due to unfavourable geological conditions (Shutt et al 2002a). By 2002, production had declined to 4.4 million tons (Shutt et al. 2002a) – a situation, which, when combined with the then depressed coal prices, created a crisis for the coalfield.

On 16 July 2002, UK Coal, a company operating coal mines in Selby, announced that it would be phasing out production over 20 months because of deteriorating financial circumstances and geological conditions (Gresty, 2002b). According to Gresty (2002b) the company incurred losses of £35 million in 2001 and £107 million over three and half years. At the time of the announcement of the closure of the Selby mines by UK Coal, it was estimated that some 2 000 mineworkers would lose their jobs and approximately 2 000 indirect jobs would also be lost from industries associated with the mines (World Bank, 2008). Approximately 500 of the 2 000 redundant workers were to be redeployed to other coal mines, whilst the remainder sought new employment opportunities elsewhere (World Bank, 2008).

Initiatives to address downscaling

a) Selby Coalfield Impact Study

Soon after the announcement by UK Coal that it intended to close down its Selby mining operations, the government of the United Kingdom instituted a Selby Coalfield Impact Study to determine the economic impact of the closure (Gresty, 2002a). The impact study pointed out that the closure of the mines would have an adverse effect on economies in the areas in the Yorkshire and Humber regions (Gresty, 2002b; Shutt, et al. 2002a). Some of the recommendations emanating from the impact study are presented below (Gresty (2002b); Shutt et al. 2002a; Shutt et al. 200b):

- A Selby Task Force be established with immediate effect and be mandated to compile best practices from similar situations. The Task Force was also requested to develop a regeneration plan and relevant courses relating to the upgrading of skills and re-training of redundant employees. It was pointed out that the re-training needed to be conducted on the mine premises whilst employees were still in employment. Shutt et al. (2002b) emphasized the need to ensure that training opportunities were given to all employees including skilled staff such as fitters and electricians who may require re-training.

- Capabilities of affected people should be audited and employment opportunities not requiring re-training should be identified. The reasoning behind this approach is that some mineworkers possess skills that are portable and can be used in other environments.
- Setting up business advisory services to provide support to businesses that were likely to be affected by the closure.
- Assessment of current and future health, social and recreational needs should be undertaken. According to Shutt et al. (2002b), past experience had shown that social problems in mining communities often emerge eighteen months to two years after closure of mining operations.
- The Coal Regeneration Trust, which had funded many projects in coal mining communities affected by downscaling, was identified as one of the important programs that could assist affected communities in terms of economic regeneration projects.
- The regional development agency, Yorkshire Forward, should be given the role of coordinating the process of addressing the pending closure.
- It was identified that there was a need to develop a strategy to diversify the economy of Selby district. In this regard, the Sherburn Business Park in Selby district had already been identified as an integral part of a strategy to create new employment opportunities.

The implementation of some of the recommendations suggested by the impact study is discussed by Gresty (2002b) and Shutt et al (2002b) and is summarised below:

- Selby Task Force was constituted and a manager was appointed to coordinate the activities of the Task Force. The Task Force comprised a wide range of stakeholders, such as representatives of Wakefield College, Coalfields Regeneration Trust and Learning and Skills Council.
- Availing premises and offices to the Task Team – the premises and offices were provided for free.

- A plan was put in place to provide a business advisory service to businesses likely to be negatively affected by the closure of the mines.
- A helpline was established to provide advice to people who were likely to be negatively affected by the closure.
- A survey was undertaken by the Selby Task Force to assess the needs of redundant miners. The report on the survey concluded that the skills needs of individual miners should be identified and discussions should be held with other major employers to identify employment opportunities.
- A Selby Job Prospect guide was developed to provide information about job opportunities to redundant mine employees and their families. The guide was divided into two sections – the first section outlined the types of available employment opportunities and the second section provided guidance about actions to be taken by redundant employees and their families (Selby Mine Closure: A Job Prospect Guide, 2008).

9.3.5 Summary and comparative analysis between the United Kingdom and South Africa on initiatives relating to downscaling

The coal mining industry in the United Kingdom provides a good model for investigating the management of downscaling in that country. The industry has been in existence for many years and played an important role in the industrialisation of the country. However, in recent years the industry has been declining as a result of a combination of several factors, including the privatisation and competition from other sources of energy. The decline in the industry is demonstrated by the significant decline in both coal production and employment. Coal production dropped from 197.8 million tons in 1960 to 18.5 million tons in 2006, whilst employment dropped from 607 000 employees in 1960 to 4 000 employees in 2006 (Figure 9.3).

Some of the most important initiatives introduced by the United Kingdom are summarised in Table 9. 2. An analysis of the initiatives reveals that the United Kingdom has put great emphasis on national and community initiatives. With regard to national initiatives, the country does not actively promote the mining

industry on the same scale as South Africa and Canada. Nonetheless, the country does provide some subsidies to its coal mining industry. In 2003, the United Kingdom government introduced a \$111 million Coal Investment Program to create or protect employment in the coal mining industry (Energy Information Administration, 2008). There are a number of national and mine focused initiatives that were introduced in the United Kingdom. Most of them are somewhat reactive measures and are aimed at supporting communities and employees affected by downscaling. The most important of these initiatives are:

- Provision of new skills to affected communities and mineworkers;
- Provision of support and advice to small businesses;
- Addressing health and recreation facilities in the affected communities; and
- Attracting investment into the affected communities through, for example, Enterprise Zones.

With regard to mine and community focused initiatives, the United Kingdom's initiatives are often well structured and resourced and South Africans could learn from their experience and strategies. The United Kingdom has put in place many programs (e.g. The Coalfield Regeneration Trust and Enterprise Zones) to provide support to affected communities.

Table 9.2 United Kingdom and South Africa: Analysis of initiatives to promote the mining industry and address downscaling.

Initiative	United Kingdom (UK)	South Africa
1. National Initiatives		
a) Mining Promotional Activities	• Not taking place in the UK – Promotion of the mining industry seems not to be a priority.	• Exhibiting at mining conferences such Indaba (in Cape Town, South Africa) and PDAC (in Toronto, Canada).
b) Research programs	• No major geoscientific research aimed at attracting mining investment and creating employment take place in the United Kingdom. However, the British Geological Survey undertakes some limited studies on industrial minerals in the UK. • Research programs are mainly focusing on environmental issues.	• The South African government undertakes several geoscientific research projects to attract investment into the mining industry. • Financial support is provided to Mintek, CSIR and Council for Geoscience for various research programs aimed at supporting mining operations, including small-scale mines.
c) Tax incentives scheme and subsidies	• Subsidies provided to the coal industry through the Coal Investment Aid program to protect jobs.	• SAMREC is the closet comparison to MIRARCO. SAMREC also supports deep mining projects. • There are no special tax incentives to attract investment into the mining sector. Gold mines can apply for subsidy in respect of pumping water.

Table 9.2 (continue) United Kingdom and South Africa: Analysis of initiatives to promote the mining industry and address downscaling.

Initiative	United Kingdom	South Africa
2. Mine-focused Initiatives Capacity building and support to employees and communities affected by downscaling.	The Coalfield Regeneration Trust made funds available for training individuals affected by mine closure or downscaling.	- Mine Qualification Authority operates on a tripartite basis and provides funds for the training of mineworkers. It also played a role (though not significant) in the re-training of redundant employees. - In terms of the new mining legislation's Social and Labour Plan, companies are required to indicate their skills development programs, including portable skills.
3) Community -Focused Initiatives Studies commissioned to investigate economic circumstances of towns affected by downscaling.	Government commissioned studies to investigate economic circumstances resulting from closure and downscaling of mines. The Selby Coalfield Impact Study is an example of such studies.	The Department of Provincial and Local Government provided funds to local municipalities to undertake economic regeneration studies. An example in South Africa is the Matjhabeng (Welkom) Development Strategy.

Table 9.2 (continue) United Kingdom and South Africa: Analysis of initiatives to promote the mining industry and address downscaling

Initiative	United Kingdom	South Africa
• Creation of a Task Force to investigate and/or address downscaling issues. • Establishment of Adjustment Committees and other initiatives • Environmental issues	• Establishment of Coalfields Task Force in the UK in 1997 to, amongst others, provide assistance and a wide range of support to redundant employees. • Coal Enterprise Fund was created to support small-business in coal mining areas affected by downscaling. • Creation of Enterprise Zones and Business Parks to attract businesses in some of the affected towns. Examples of Enterprise Zones on former collieries are e.g. Dawdon and Fox Cover Enterprise Park. • These are addressed through legislation in terms of largely accepted “polluter pays” principle. • Establishment of the Coal Authority to, amongst others, address historic environmental issues.	• The establishment of the Gold Crisis Committee and Sector Partnership Committees and respective task teams. The establishment of a Board. • Work Place Forums are established to address redundant workers’ needs and concerns. • Regeneration plans for towns affected by downscaling are developed and led by local municipalities, in collaboration with the mines and other stakeholders. • These are addressed through the legislation in terms of largely accepted “polluter pays” principle. • The new mining code addresses mining environmental issues.

9.4 Poland: Management of Downscaling in the Mining Industry

9.4.1 Overview

Poland is well endowed with important mineral resources, which include bituminous coal, copper, lead and zinc (Steblez, 2007). According to Steblez (2007), gold is produced as a by-product of copper mining and is therefore not a major industry. An analysis of downscaling in Poland can best be achieved through investigation of the coal mining industry, which has, for many years, been a relatively large industry.

9.4.2 Background on coal mining in Poland

Like the United Kingdom, coal mining in Poland has been in existence for many years and has played a key role in the economy of the country. Coal mining is undertaken by 33 coal mines and comprises companies that operate mines only and those that operate mines as well as other businesses (Paszczka, 2007). According to the European Foundation for the Improvement of Living and Working Conditions (2008), under socialist rule (during the 1980s) coal production was relatively high and consistent at about 200 million tons per year – over 400 000 people worked in the industry. Most mineworkers were held in high esteem due to fact that the communist government frequently highlighted the importance of coal mining (European Foundation for the Improvement of Living and Working Conditions, 2008).

The collapse of communist rule in 1989 saw the industry being restructured several times. A combination of these restructurings and the (then) relatively low coal prices resulted in serious financial difficulties for the industry (European Foundation for the Improvement of Living and Working Conditions, 2008). Information from the European Foundation for the Improvement of Living and Working Conditions (2008) reveals that both production and employment declined consistently over the years - it declined from 415 700 employees in 1989 to 118 900 in 2006. Production also declined more or less in line with employment levels – it dropped from 177 400 million tons in 1989 to 94 300 million tons 2006.

9.4.3 Selected Poland's national initiatives to address downscaling

Several initiatives to restructure the coal mining industry and also address the plight of redundant mineworkers were put in place between 1990 and 2006. The information received by the author from the Polish Industrial Development Agency, points out that the restructuring involved many stakeholders and included trade unions, national government, local authorities, coal mining companies and many government agencies. According to the Polish Industrial Development Agency, communication with relevant stakeholders commenced in April 1998 when the Ministry of Economy presented the Unions with the first version of reforms and restructuring. The communication process and proposals were strengthened when an Act of parliament was enacted on 26 November 1998 – the Act required mines contemplating closure to prepare social programs. Furthermore, information from the Polish Industrial Development Agency states that another legal framework was enacted on 20 November 2002 to provide additional measures aimed at protecting and assisting redundant employees. These measures, which are discussed in detail by the European Foundation for the Improvement of Living and Working Conditions (2008), and which were provided to the author by Polish Industrial Development Agency, are summarised below.

Employee benefits

a) Severance Packages

As part of the restructuring of the coal industry, an act was passed in 1998 which, amongst others, provided generous retrenchment packages for redundant miners – miners received an average of €12 000 to €14 000 on condition that they do not return to seek employment in the mining sector (European Foundation for the Improvement of Living and Working Conditions, 2008). According to information from the Polish Industrial Development Agency, the Severance Packages scheme benefited approximately 28 000 mineworkers.

b) Leave from work until retirement for underground workers

Underground employees who were three years from retirement were entitled to take leave and would be paid 75 per cent of their remuneration. Employees who accepted this offer were required to terminate their employment at the end of the leave period. These employees were still entitled to benefits emanating from collective bargaining agreements.

c) Study grant for re-training of surface workers

The grant, which was provided to surface workers, allowed employees to take a maximum of six months leave for studying and retraining purpose. Under this scheme employees were entitled to 100 per cent of their remuneration and also qualified for career advice and a free training course.

d) Vocational retraining for surface workers

The measure gave surface mineworkers, who were not benefiting from the abovementioned study grant, an opportunity to attend free vocational training without working for six months. Such employees were entitled to 100 per cent of their salaries, which could be claimed from the government.

e) Loan for commencement of business activity

Redundant mineworkers, who completed their respective retraining programs, were entitled to loans on preferential conditions in order to start a small business. The loans, which amounted to about €4 600, could be written off completely or partly.

f) Aid for employers employing former surface personnel

The measure allowed employers who employed redundant surface mineworkers to be entitled to reimbursement of their remuneration, in accordance with prescribed amounts and conditions.

g) Aid for employers creating additional jobs for former miners

Employers employing former mineworkers before 1 January 2006 were entitled to reimbursement of the employees' salaries for up to 18 months. The workers were required to be employed for two years and their salaries were not to exceed 75 per cent of their previous remuneration.

Other initiatives

In 2002, the government of Poland introduced other measures to address the profitability and the threat of job losses on the coal mines. These measures included freezing mineworkers' pay until 2006 and allowed for: the privatisation of profitable mines, closure of loss making mines; and implementation of a six-day working week sector (European Foundation for the Improvement of Living and Working Conditions, 2008). Whilst the government had already committed some €10 billion, it was pointed out that there was a lack of funds and/or ideas to create new employment opportunity for the Upper Silesia region, which is a mining region affected by the redundancies (European Foundation for the Improvement of Living and Working Conditions, 2008). According to the European Foundation for the Improvement of Living and Working Conditions (2008), initiatives to create new jobs in the Upper Silesia region have only produced about 18 000 jobs against the 300 000 jobs lost in the mining industry.

9.4.4. Summary and comparative analysis between Poland and South Africa on initiatives relating to downscaling

As in the case of the United Kingdom, the coal mining industry of Poland provides a good model for investigating the management of downscaling in Poland's mining industry. As stated earlier the coal mining industry has been an integral part of Poland's economy for many years and was held in high esteem during the communist rule. However, the collapse of communism, the subsequent restructuring of the industry and other factors, such as relatively low coal prices resulted in downscaling taking place in the industry. Employment levels dropped

from 415 700 employees in 1989 to 118 900 in 2006. Similarly, production levels declined from 177 400 million tons in 1989 to 94 300 million tons in 2006.

In response to the situation relating to the loss of jobs, the government of Poland put in place a number of initiatives to address the downscaling (Table 9.3). An in-depth analysis of Poland's initiatives, as summarised in Table 9.3, reveals that the initiatives are mainly focused on addressing the plight of redundant employees by re-training them and improving their employment prospects. Whilst the re-training of mineworkers in South Africa did take place, it was not coordinated and resourced in the same manner as the re-training in Poland. However, the newly introduced Social and Labour Plan has the potential of addressing the problem – what is needed would be to build on the current framework and develop a more comprehensive re-training strategy.

Table 9.3 Poland and South Africa: Analysis of initiatives to promote the mining industry and address downscaling.

Initiative	Poland	South Africa
1. National Initiatives Promotion of the mining Industry	The country does not actively promote the in the same way as Canada and South Africa. It does not participate in the two most important mining investment forum, namely, Indaba (in Cape Town, South Africa) and PDAC (in Toronto, Canada).	Promotion of the mining industry is a priority and the country is promoted at international conferences such as Indaba (in Cape Town, South Africa) and PDAC (in Toronto, Canada).
2. Mine-Focused Initiatives	- Legislation was put in place requiring mines intending to close their operation to prepare a social program. - Generous severance packages (between €12 000 and €14 000) were given to employees. - Extended leave periods were given to employee as part of the agreement to terminate employment services. - Vocational retraining for mine employees.	- This is similar to the South African new mining code, which requires mines to prepare a Social and Labour Plan. - In South Africa redundant employees received severance packages negotiated between employees and employers. - Although different in nature, extended leave periods were available to employees (e.g. Driefontein applied some of these leave initiatives). - Re-training programs were made available at several mines. In terms of the Social and Labour Plan, companies are required to provide re-training programs for their employees. The Department of Labour subsidises the training.
2. Mine-Focused Initiatives	- Financial support was given to employers employing former mineworkers. - Internal transfer of redundant employees to other mines.	- South Africa does not provide assistance for employers to employ former mineworkers. - South African mines practiced the transfer of employees to other mines in order to save jobs.

9.5 Australia: Selected Examples of Downscaling in the Mining Industry

9.5.1 Introduction

An overview of the management of downscaling and the closure of mines at selected Australian mines is discussed by Laurence (2002). In this study, initiatives put in place to manage downscaling at two of the mines investigated by Laurence are discussed and compared with the South African situation. The two selected mines are: Tennant Creek Gold Mine, which is in the Northern Territories on a goldfield that was discovered in 1930; and, Oakdale Collieries, occurring in New South Wales (Laurence, 2002). As stated earlier, the choice of the mines is largely based on ease of availability of information and relevance of the information to the objective of this study. According to Laurence (2002) the two mines closed down due to depletion of economic reserves. The initiatives put in place at the two mines were discussed in detailed by Laurence (2002) and are compared to the South African situation in Table 9.4.

9.5.2 Summary and comparative analysis of the management of downscaling at selected Australian mines and South African mines

According to Laurence (2002), the management of redundancies at Tennant Creek and Oakdale involved consultations and negotiations between workers and management. At Tennant Creek, a stakeholder forum was established to develop a closure plan. This type of consultative approach is similar to the South African situation, which involves consultation amongst stakeholders on downscaling. Similarly, the creation of economic development committees to address problems associated with downscaling were also created in Australia (Tennant Creek created one) and South Africa. A similar committee was established in Welkom/Matjhabeng and played an important role in identifying regeneration projects (the author participated in the committee's activities).

Table 9.4 Australia and South Africa: Comparison of initiatives to address closure/downscaling at selected Australian mines and selected South African initiatives (Australian case studies adapted from Laurence, 2002).

Initiative	Australia	South Africa
1. National Initiatives • Mining Promotional Activities (Proactive and Indirect Initiatives)	• The country actively promotes mining at major mining conferences such as Indaba (Cape Town, South Africa) and PDAC (Toronto, Canada).	• Promotion of the mining industry is a priority and the country is promoted at international conferences such as Indaba (Cape Town, South Africa) and PDAC (Toronto, Canada).
2. Mine Focused Initiatives a) Tennant Creek, Northern Territory, Australia	• A mine closure group was formed and a draft closure plan involving all stakeholders was developed for each mining site. • Highly skilled employees were transferred to other mining operations. • Government established an economic development committee with the private sector and also formulated a regional development plan.	• In South Africa, negotiation committees and Future Forums were established to discuss and negotiate on the pending redundancies. • The transfer of redundant employees to other mines has been successfully used in South African mines. • Regeneration plans for towns affected by downscaling are developed and led by local municipalities in collaboration with the mines and other stakeholders – this can be improved. • Redundant employees received severance packages as negotiated between employees and employers.

Table 9.4 (continue) Australia and South Africa: Comparison of initiatives to address closure/downscaling at selected Australian mines and selected South African initiatives (Australian case studies adapted from Laurence, 2002).

Initiative	Australia	South Africa
b) Oakdale Colliery, New South Wales, Australia	• Company continuously informed workers. Prior to closure, at least three crisis meetings were held between management and employees. • It is alleged that the Local Government failed to support the company's applications for new leases and could have indirectly contributed to the closure. The government focused mainly on the closure plan and ensured that negative environmental impacts were minimized. • Employees publicised and politicised the retrenchments in order to ensure payment of their entitlement. The Unions made sure that workers were paid their entitlements and long service leave funds were paid to employees.	• In South Africa, it is a norm that negotiations on redundancies take place between employees and employers. • Legislation to address possible negative environmental impacts exists. However, there is still room to improve the implementation of the legislation. • Most of the redundancies in South Africa are often politicised and publicised. Unions often try to obtain the best deal for their employees.

9.6 Discussion

Reasons for closure of mines or downscaling of operations

The issue of closure and downscaling of mining operations is not confined to South Africa, but occurs or has occurred in many other mining countries. Countries such as Canada, the United Kingdom, Poland and Australia have all experienced downscaling in one way or another. An analysis of the selected case studies from the aforementioned countries reveals that downscaling is often a result of a wide variety of factors, which include unfavourable commodity prices, depleted economic reserves, unfavourable geological conditions, low investor confidence, privatization and inefficient administration. The main factors that caused downscaling in respect of selected minerals and mines in the abovementioned countries, as well as in South Africa, are summarised in Table 9.5. These factors can, furthermore, be grouped into four main groups, namely: economic, political, administrative and catastrophic (Table 9.6).

Canadian mines analysed in this chapter closed down or downscaled largely due to a combination of economic circumstances – these included: low commodity prices, lack of investment and lack of economic reserves. For example: New Britannia gold mine (in Snow Lake) closed down due to financial difficulties resulting from depletion of economic reserves; Ruttan copper-zinc mine (in Leaf Rapids) closed its operations due to the (then) depressed commodity prices; Tumbler Ridge coalfield closed down due to the relatively low coal prices and weak Asian markets. On the other hand, the United Kingdom's and Poland's coal mines closed due a combination of economic circumstances and political influence. In the United Kingdom, political influence resulted in policy changes and subsequent privatisation of coal mines by the government of former Prime Minister Margaret Thatcher. In Poland, political changes in respect of the collapse of communism resulted in policy changes and subsequent restructuring of the coal mining industry. The restructuring was accompanied by massive downscaling of the coal mining industry.

Table 9.5 Factors that caused downscaling in respect of selected minerals in Canada, United Kingdom, Poland, Australia and South Africa.

Canada	United Kingdom	Poland	Australia	South Africa
Gold Mining • Relatively low gold prices. • Negative perception associated with the 1997 Bre-X Scandal and Asian markets. • Financial difficulties (New Britannia closed in 2004) Base Metals Mining • Ruttan mine closed due to depressed prices in 2002. • In 1999, Algoma Steel Inc. closed its iron ore mine due to depressed prices. Coal Mining • The two mines in Tumbler Ridge closed in 2000 and 2003, respectively, due to low coal prices and weak Asian markets. • Cape Breton coalfields. Closure due to unprofitable reserves and privatisation.	Coal Mining • Privatisation and competition from other energy sources, such as natural gas, oil and nuclear energy led to downscaling of the coal industry. • Selby coalfield closed down due to unfavourable financial circumstances and poor geological conditions.	Coal Mining • Collapse of communism, restructuring of the industry and low coal prices led to downscaling.	Gold Mines • Tennant Creek mine is an example of a mine that closed down due to depletion of ore reserves and problems in acquiring new exploration rights as a result of native title registration. The mine closed down in 1998. • Oakdale closed due to a lack of reserves and support from the local authority.	Gold Mines • Depressed gold prices, deep orebody and uneconomic reserves and the (then) political uncertainty. • Declining grades and gold production.

Table 9.6 Summary of generic factors likely to cause downscaling.

1. Economic Factors	2. Socio-Political Factors	3. Administrative Factors	4. Catastrophic Factors
a) Unfavourable commodity prices b) Uncontrollable, high costs c) Low profits d) Declining production e) Uneconomic reserves f) Unfavourable geological conditions (eg declining grades and production) g) Substitution h) Lack of markets i) Competition from other producers j) Lack of investment	b) Privatisation c) Changing economic priorities d) Change in governments e) Change in mining policies f) Pandemic g) Shortage of skills on the mines and in government	a) Slow decision making b) Cumbersome administration c) Lack of enabling environment d) Corruption e) Lack of transparency	a) Flooding of a mine or sections of a mining operation b) Seismic tremors destroying working faces/stopes

Australian case studies discussed in this chapter provide examples of situations where mines closed down due to economic circumstances and alleged lack of support from authorities. For example, Tennant Creek gold mine in the Northern Territory closed down due to depletion of economic reserves. However, according to Laurence (2002), at Oakdale Colliery one of the reasons for closure related to the failure by the local authority to support the company's application for new leases, which could have allowed the company to undertake exploration and possibly extend the life of the mine. In Chapter 5, it was argued that downscaling in South Africa's gold mining industry was associated with a combination of economic circumstances (e.g. declining gold grades, gold production and the (then) depressed gold prices) and possibly political influence (uncertainty associated with the changing political environment). Other factors that could have also acted as catalysts include the Bre-X scandal and the Asian economic melt-down of the late 1990s.

National Initiatives to address downscaling

The discussions in this chapter and in Chapter 8 indicate that countries affected by downscaling in the mining industry do try to put in place initiatives to address negative impacts associated with the downscaling. These initiatives differ from one country to the other - they are largely dependant on the causes of downscaling, national economic objectives and pressure from stakeholders (eg communities and workers). Active mining countries such as South Africa, Canada and Australia address downscaling issues by putting in place all three types of initiatives, namely: national initiatives (mainly indirect and proactive initiatives), mine focused initiatives (often direct and reactive) and community focused initiatives (often direct and reactive) (Tables 9.1, 9.2, 9.3 and 9.4).

Most of the national initiatives are proactive and indirect in nature and are aimed at attracting investment into the mining industry through, amongst others: promotion of the mining industry; public funded research; and tax incentives. Whilst all three countries (Canada, Australia and South Africa) are actively involved in the promotion of the mining industry and various research programs (e.g. geoscientific research), Canada is the only country that has a significant tax incentive scheme aimed at encouraging exploration. Both South African and Australian stakeholders have been lobbying their respective countries to introduce tax incentives schemes for exploration projects (ABC News, 2008). European countries (United Kingdom and Poland) investigated in this study seem not to actively promote their mining industries in the same manner as Canada, Australia and South Africa. Nonetheless, the United Kingdom still provides subsidies to its coal mining industry to protect or even create jobs.

With regard to the mine-focused and community focused initiatives, all five countries investigated in the study (Canada, Australia, South Africa, United Kingdom and Poland) respond to downscaling or closure of mines by putting in place a wide variety of initiatives in their respective countries. Mine-focused initiatives often involve: the provision of severance packages to employees; retraining of employees; and support for starting small businesses. Whilst most

employees affected by downscaling are often compensated in terms of severance packages, the packages are often a result of stiff negotiations between employees and employers. However, the matter is also often driven by political consideration, especially where the government is an employer. Poland is an example of such a case – government enticed employees to accept separation by providing generous severance packages.

Re-training seems to be one of the most important initiatives put in place to address the issue of downscaling. For example, it was implemented at Tumbler Ridge coalfield in Canada, in the United Kingdom's coalfields and in Poland's coalfields. In South Africa, the re-training of employees is legislated in terms of the new Social and Labour Plan and is supported by the Department of Labour. In terms of the Labour and Social Plan requirements, employees are required to incorporate the provision of portable skills to employees in their respective plans – the Department of Labour subsidises the training on a 50:50 basis. Whilst the re-train policies and support structures are in place, the challenge for South Africa is to effectively implement the training programs. It would benefit South African stakeholders to benchmark their programs with Poland, the United Kingdom and Canada. The MQA has also, in the past, financially supported the re-training of retrenched mine employees in, for example, jewellery manufacturing. The Mine Development Agency (MDA), an NUM funded agency, also contributes extensively to the retraining of retrenched rural mineworkers – the agency focuses on supporting small poverty alleviation businesses in rural areas.

With regard to programs aimed at providing support to communities, the local authorities play a vital role. In South Africa, most local municipalities affected by downscaling often actively explore initiatives for regenerating their respective towns by undertaking local economy development studies. An example of a municipality that developed such a strategy is the Matjhabeng/Welkom municipality - it developed a strategy to regenerate the economy in its region (Urban-Econ Development Economist, 2005). It is the opinion of the author that South Africa falls short when it comes to the implementation of the regeneration

and economic development strategies. Some of the strategies, especially with regard to implementation, can be improved by incorporating strategies implemented in Canada and the United Kingdom. The establishment of dedicated funds for regeneration programs and the provision of financial and technical support to small businesses are the critical elements in the United Kingdom and Canadian regeneration programs. In addition the establishment of Enterprise Zones in South Africa have the potential to attract investment into towns affected by downscaling.

Environmental issues associated with current operating mines are often properly addressed by most mining countries through their respective national environmental plans and are based on the “polluter pays” principle. However, the legacies of the past are often a problem. In South Africa, environmental issues relating to downscaling are currently being addressed through government sponsored research projects aimed at addressing polluted water and abandoned mine workings. The Chamber of Mines and government are also exploring initiatives to partner in addressing historic liabilities. In the United Kingdom, a government agency known as the Coal Authority was established to, amongst others, deal with historic liability issues, including treatment of minewater discharge (Coal Authority, 2008). The concept of creating a dedicated agency to deal with mine downscaling issues is an important one and should be explored by South African authorities. Such an agency can be mandated to monitor downscaling in all South Africa’s mines and to develop systems and strategies to address negative impacts associated with downscaling. It is also important that national guidelines and individual mine closure plans be developed in consultation with affected communities. In this regard, the World Bank sponsored report on Zakład Górniczy in Poland provides a comprehensive example of a mine closure plan, which could be useful (Spolka Restukturyzacji Kopalni S.A, 2004).

A summary of key initiatives introduced by Canada, United Kingdom, Poland, Australia and South Africa is presented in Figure 9.4.

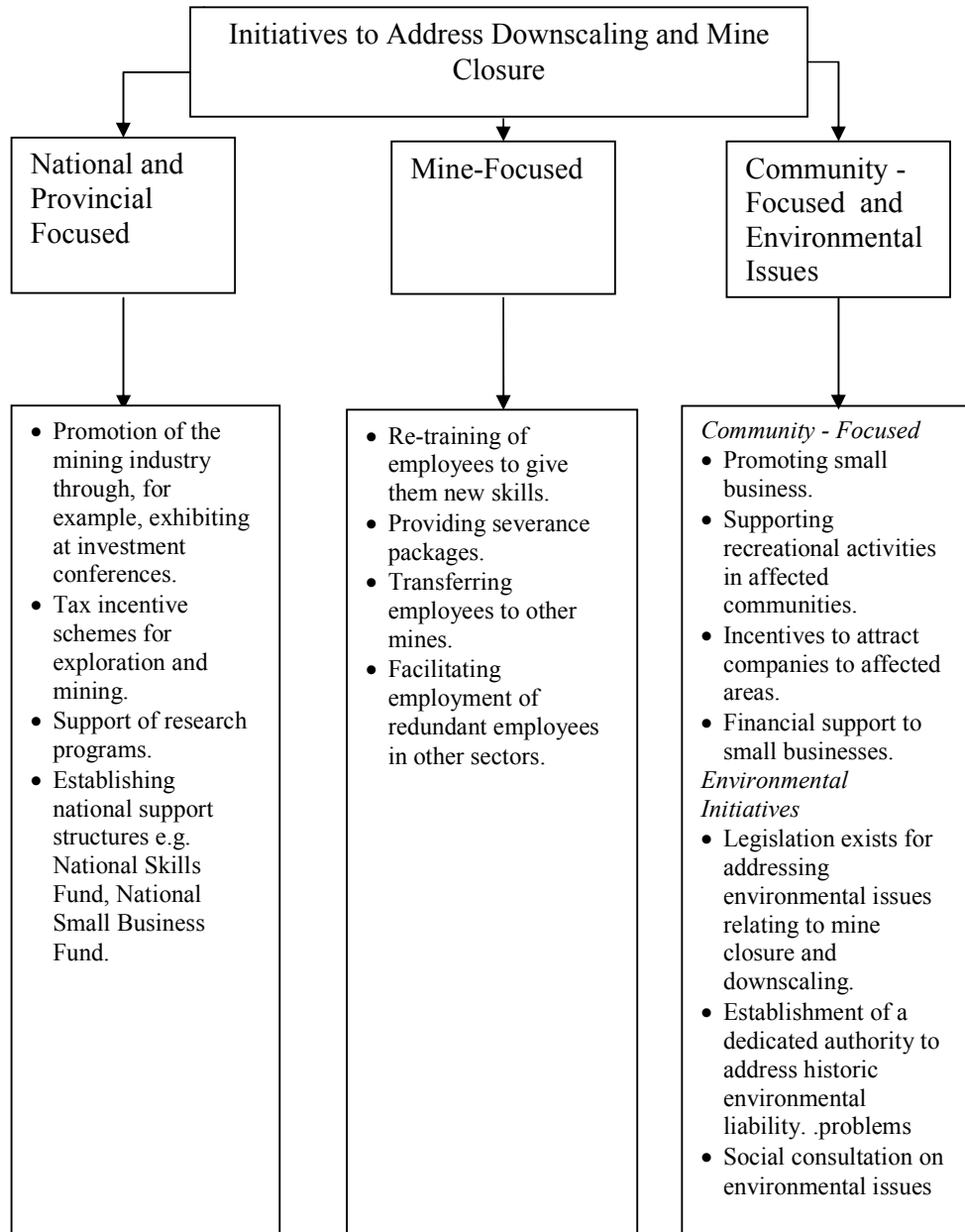


Figure 9. 4 Summary of key initiatives implemented in Canada, Australia, South Africa, United Kingdom and Poland.

9.7 Summary

Downscaling and its associated problems are not confined to South Africa, but occur in all mining countries. The factors that are likely to cause downscaling can be subdivided into four groups, namely: economic, political, administrative and catastrophic. However, most downscaling and mine closures are often the result of economic circumstances and changing political situations. The case studies in Canada show that downscaling in the gold and coal mining industries was a result of a combination of economic circumstances. On the other hand, downscaling in the United Kingdom and Poland was a result of economic and political influence. In both Australian case studies (Tennant Creek and Oakdale Colliery), the mines closed down as a result of economic and administrative factors of the mines. For example, administrative bureaucracies played a role at Oakdale Colliery – where local authorities failed to support the company's applications for new leases (Laurence, 2002). With regard to South Africa, downscaling in the gold mining industry was caused by a combination of economic circumstances and political influence. The lack of confidence in the mining industry, together with sentiments relating to the Bre-X scandal and depressed Asian markets during 1997, could also have contributed to the downscaling.

Whilst there are a number of initiatives that are implemented by countries facing downscaling and mine closure, these initiatives can be grouped into:

- National initiatives
- Mine-focused initiatives
- Community-focused initiatives
- Environmental focused initiatives

National initiatives are mainly indirect and proactive in nature. Most of the initiatives aim at attracting investment into the exploration and mining sectors. Mine-focused and community-focused initiatives are largely reactive in nature and often focus on providing support to redundant employees and communities affected by downscaling. Environmental focused initiatives, which are not discussed in detailed in this study, are mainly addressed by individual countries

through the universally accepted principle of “polluter pays”. South Africa has developed comprehensive legislation to implement this principle – however, the challenge for the country is to effectively implement and also “police” the legislative requirements. The various international experiences and initiatives discussed in this chapter are important in developing a new strategy for the management of downscaling in the South African mining industry. However, the study will first investigate future scenarios before a strategy is suggested. In this regard, the next chapter will discuss the future in respect of the employment situation in South Africa and will be followed by a proposed strategy to manage downscaling.

CHAPTER 10

FUTURE DEVELOPMENTS IN EMPLOYMENT IN SOUTH AFRICA'S GOLD MINING INDUSTRY

“Now, I’m not going to attempt to predict the price of gold into the future, all I will say is that Gold Fields are very positive on the upward secular trend.” Ian Cockerill, CEO of Gold Fields, 2006.

10.1 Introduction

There are several socio-political and economic factors that could influence the future of employment and downscaling in the gold mining industry. These factors were discussed in Chapter 9 and grouped into four groups, i.e.: economic factors, socio-political factors, administrative factors and catastrophic factors (Table 9.6).

10.2 Economic Factors

10.2.1 Gold price

The price of gold is one of the critical factors that will determine the future of the South African gold mining industry in terms of employment levels. Its importance in influencing employment levels has been demonstrated in Chapter 5 (Figure 5.3 and 5.6) and in regression models in Chapter 6. It is not the intention of this the study to predict the price of gold, however, it would be useful to examine historic trends of the gold price and also to discuss views on the possible future trends of the gold price. Despite the difficulty associated with predicting the gold price, basic economic principles in respect of supply and demand of gold, as well as historic price trends, provide some hint as to the possible future direction of the gold price.

Historic trend of the gold price

Since the anomalously high 1980 gold prices, prices have fluctuated between an average annual price of US\$270 and US\$700 per ounce (Figures 5.2 and 10.1). If the pre-1981 data is ignored, Figure 10.1 reveals that recent relatively high gold prices are now indicating an upward trend in respect of the gold price. Based on

the historic trend, it can be accepted that there is a strong probability that future annual average gold prices could fluctuate between US\$270 and US\$700 per ounce. In fact, this forecast is fairly conservative and the world renowned gold analyst, Dr David Davis, is predicting an upward trend in the gold price for the foreseeable future (Davis, 2006).

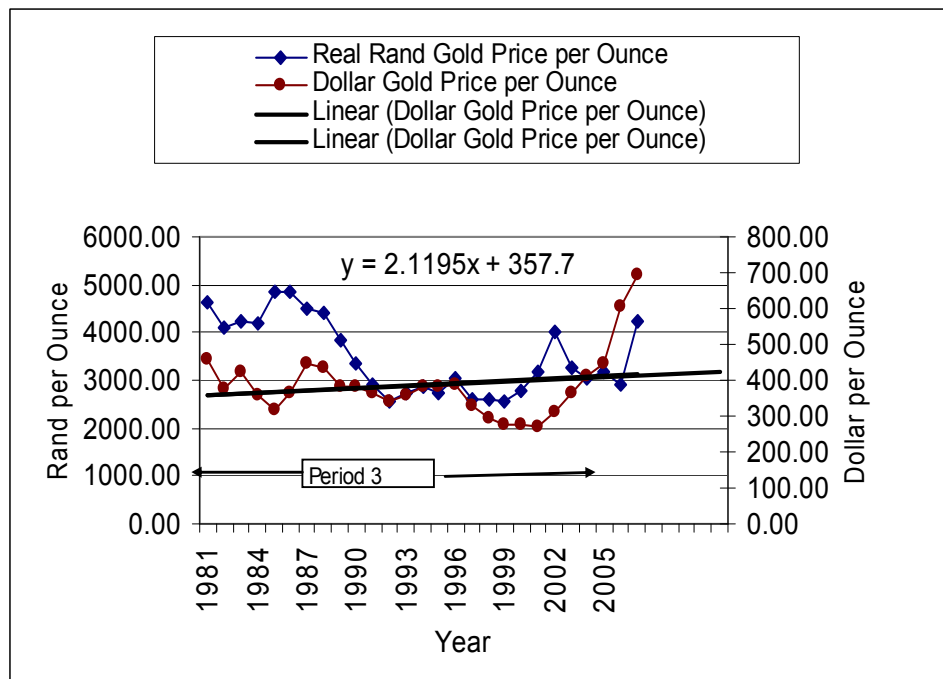


Figure 10.1 Annual average dollar gold price and real rand gold price for 1981-2007 (2004=100) (Data Source: DME).

Supply and demand of gold

The source of global supply of gold comprises mine production, official sector sales, old gold scrap, and net producer hedging and implied net disinvestment (GFMS Ltd, 2006). Mine supply represents the bulk of global gold supply, which was at 62 per cent of the total supply in 2005 (GFMS Ltd, 2006). Total demand for gold is, however, driven by fabrication, bar hoarding, net producer hedging and implied net investment. Fabrication accounts for the majority of the demand

and accounted for 81 per cent of global gold demand in 2005. Figure 10.2 reveals a structural change in respect of the supply and demand for gold and most of post-1989 is characterised by a deficit in respect of mine supply and in respect of demand for jewellery fabrication, because the amount of gold being mined does not meet the demand for jewellery fabrication (Figure 10.2). It is this very deficit in gold mine supply that suggests that proponents of future higher gold prices may well be correct. However, the issue is not as simple as presented here – other factors such as institutional holdings (e.g. reserve banks holdings) and the global financial situation will always play an important role in determining the future of the gold price.

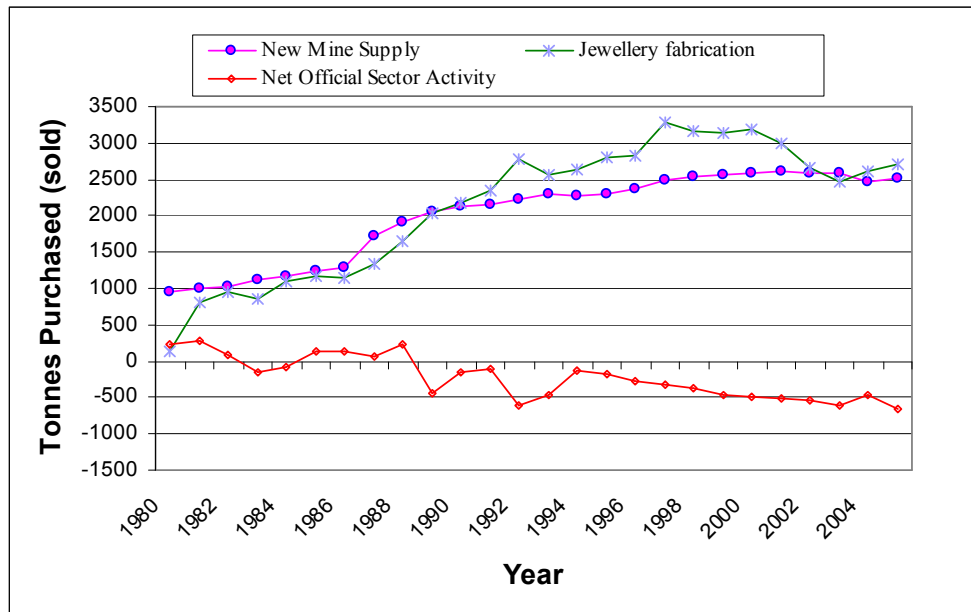


Figure 10.2 Changing structure of demand in the gold market: 1980-2005
(Source: Chamber of Mines - Courtesy of Mr R Baxter)

10.2.2 Working costs

Containment of working costs is critical for maintaining sustainability of the gold mining industry. Figure 10.3 shows that the industry is battling to contain real costs in South Africa's gold mining industry. The situation is a worrying one for the industry. The challenge for the industry will be how to deal with the problem

of costs. In this regard wage increases, which are most likely to continue rising in line with the historic above-inflation increases will be a serious challenge for the industry. This matter of rising wages was highlighted by Malherbe (2000), who points out that wages amongst skilled mine workers have risen more than four-fold, in real terms, through the last three decades.

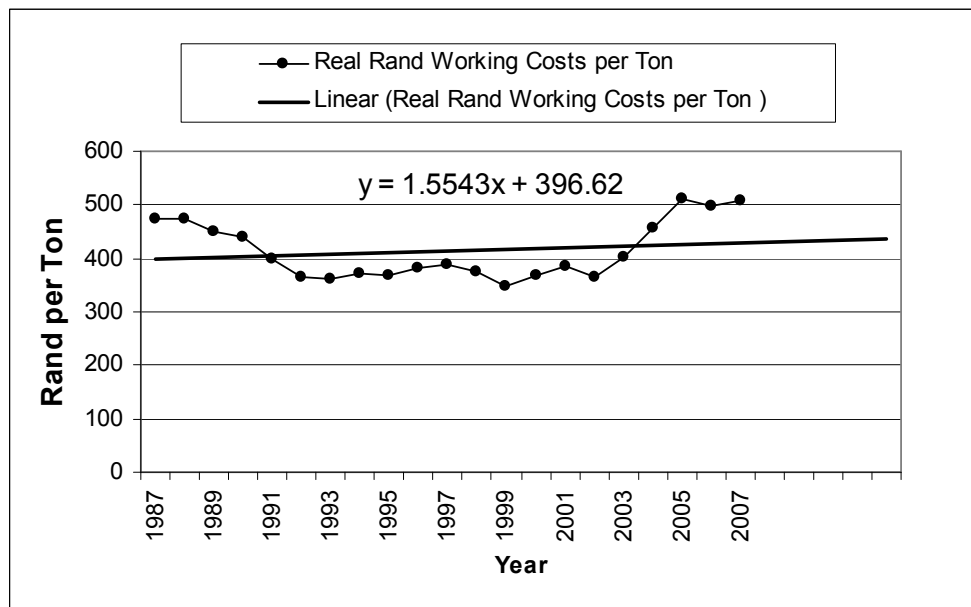


Figure 10.3 South Africa's gold mines: Annual average real rand working costs for 1987-2007 (2007=100) (Data Source: Chamber of Mines; DME).

10.2.3 Working profits

As with real working costs, real working profits also demonstrate a disturbing situation in terms of a downward decline during recent years. Moreover a five-year forecast shows that profits could continue to be under severe pressure (Figure 10.4). This will certainly have a negative impact on employment, as previous practice has shown that reduction in labour is often used to reduce costs and improve profitability. The declining profits will have serious consequences for the South African gold mining industry as investors will not take kindly to low returns – they will simply invest their money elsewhere. The challenge for the

industry, together with government, is to ensure that the decline in profitability is reversed, or at least contained. The issue here is ensuring that the industry remains globally competitive. Virtual Metals Research and Consulting Limited (2006) have demonstrated that the global competitiveness of South Africa's producers has deteriorated significantly in terms of global cost curve. Several initiatives could be investigated to address declining profits – these should focus, on, inter alia, research into the mechanisation of the industry.

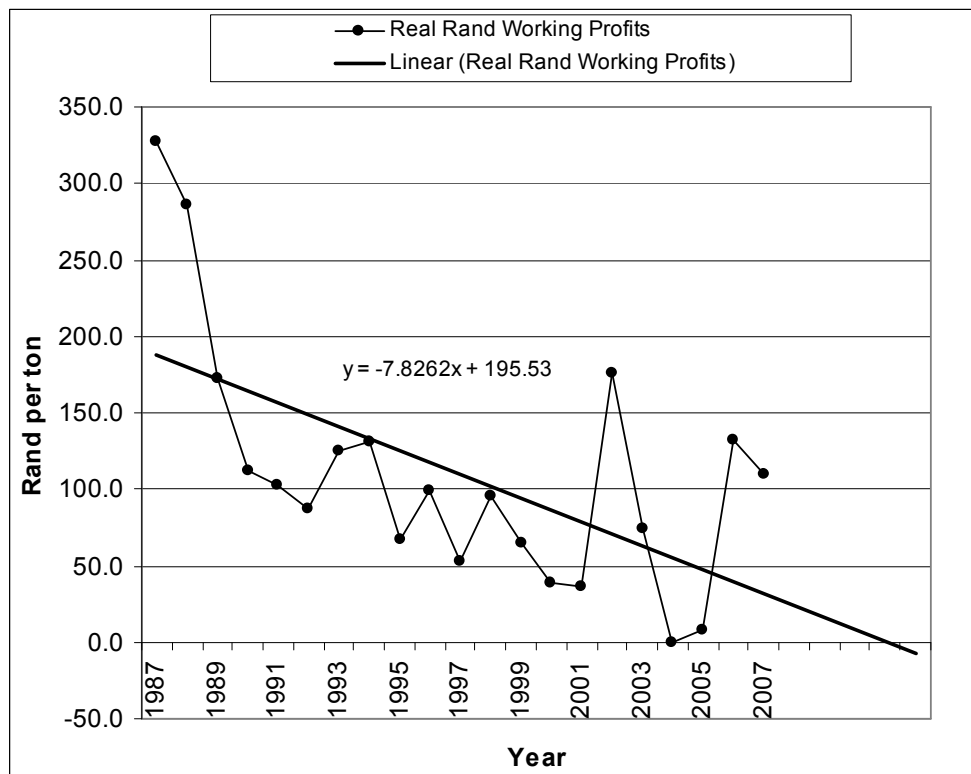


Figure 10.4 South Africa's gold mines: Annual average real rand working profits for 1987-2007 (2007=100) (Data Source: Chamber of Mines; DME).

10.2.4 Ore milled, Ore treated and Gold produced

Both ore milled and ore treated show a downward trend; this will most certainly continue well into the future in line with the overall downscaling that is taking place in the gold mining industry. The continued decline in gold grades, ore milled and ore treated will also result in a decline in gold production and employment levels.

10.2.5 Geological conditions

Ore Resources and Reserves

It is unfortunate that there appears to be no accurate data on South Africa's resources and reserves. Davis (2006) estimated that South Africa's gold reserves and resources stood at 5 000 tons and 26 000 tons respectively in 2006. The USGS and the DME give a figure of 6 000 tons for reserves and 36 000 tons for resources. Virtual Metals Consulting Limited (2006), reports that South Africa's resources are currently estimated at 40 000 tons. With such a large degree of variation in the reporting of reserves and resources, it would be better to use the more conservative figures of Davis for purposes of assessing the future.

Figure 10.5 shows that South Africa's gold reserves declined by 51 per cent between 1989 and 2005. The rate of decline is approximately 270 tons per annum. Ironically, the world's gold reserves increased steadily between 1989 and 2005 – suggesting that the downscaling being experienced in South Africa's gold mining industry is not necessarily a reflection of the global gold mining industry, but rather a situation which demonstrates that South Africa is progressively losing out in respect of the creation of new gold reserves.

Davis' (2006) estimates of the reserves of South Africa's major mining companies are presented in Table 10.1. The table suggests that South Africa's major gold mining operations will cease to operate in the next 24 years. If this scenario holds, the country will face serious problems relating to downscaling, especially in respect of job losses, loss of revenue, loss of fixed direct investment and negative environmental legacies.

Table 10.1 South Africa's gold reserves and life of mines of major companies (Source: Modified from Davis, 2006).

Company	Reserves million Oz	Life of mine (Years)
Anglogold Ashanti	27	15
Gold Fields	47	14
Harmony	51	21
Western Areas/Barrick	29	24
Total	154	

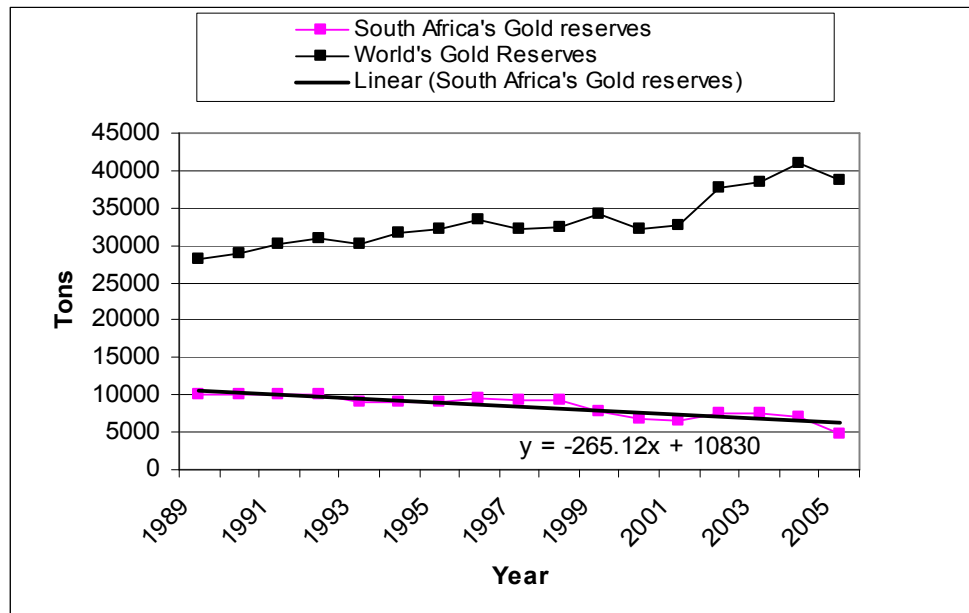


Figure 10.5 World's and South Africa's gold reserve for 1989-2005
(Source: Davis 2006).

Deep Mining

Whilst South Africa still possesses the largest gold resource in the world – a situation that will remain for many years to come, the problem is that most of the resources are deep and costly to mine. Some of South Africa's gold mines are currently the deepest mines in the world. For example, TauTona is an Anglo Ashanti mine that is expected to be the deepest mine in the world by October 2009 when operations on the mine reach a depth of 3 902 meters (Copans, 2008). Mponeng mine (also an AngloAshanti mine) has already planned to reach 4 300 meter (Creamer, 2008). It is clear that the future sustainability of the industry lies in its ability to mine at “ultra deep” levels – mining at these levels can only be sustained by continued innovation and the introduction of new technology. The country should, therefore, focus on mining technology research to ensure the future viability of the industry.

10.2.6 Investment in exploration and geological infrastructure

Whilst exploration investment plays a critical role in identifying new deposits, resources and reserves, it can only be optimally successful if it is underpinned by a world-class geological infrastructure. Many countries have benefited in terms of attracting investment into their mining industry and examples of major successful state-funded geoscience programs (aimed at upgrading geological infrastructure and, therefore, attracting investment) are highlighted below (Council for Geoscience, 2006a).

- In the early 1980s, the government of South Australia launched a major detailed airborne geophysical survey to attract investment into the exploration sector. The survey resulted in a significant increase in exploration investment and within a few years the renowned Olympic Dam copper-lead-zinc deposit was discovered.
- Likewise, in Namibia, the Geological Survey of Namibia embarked on a high density airborne geophysical survey, which resulted in increased exploration investment. Figure 10.6 shows how investment in exploration and the number of exploration licenses increased with increasing airborne surveys.
- Similarly, the recent program to upgrade the geological infrastructure of Mozambique by the government of that country has borne fruit. Figure 10.7 shows the positive impact of the program on attracting investment into the exploration sector – the number of exploration licenses has increased significantly since the commencement of the program in 1997.

Whilst South Africa has been developing its geological infrastructure for over 90 years, it is now apparent that the data needs to be upgraded. In some cases (e.g. geophysics), the data has already become obsolete as only about 30 per cent of the country has been covered by high density geophysical mapping (200m line spacing). The low coverage of the country in respect of geophysics makes it uncompetitive in terms of attracting investment. Perhaps this is one of the areas

that need to be addressed if the country hopes to attract investment into the gold exploration sector and ensure a brighter future for the industry.

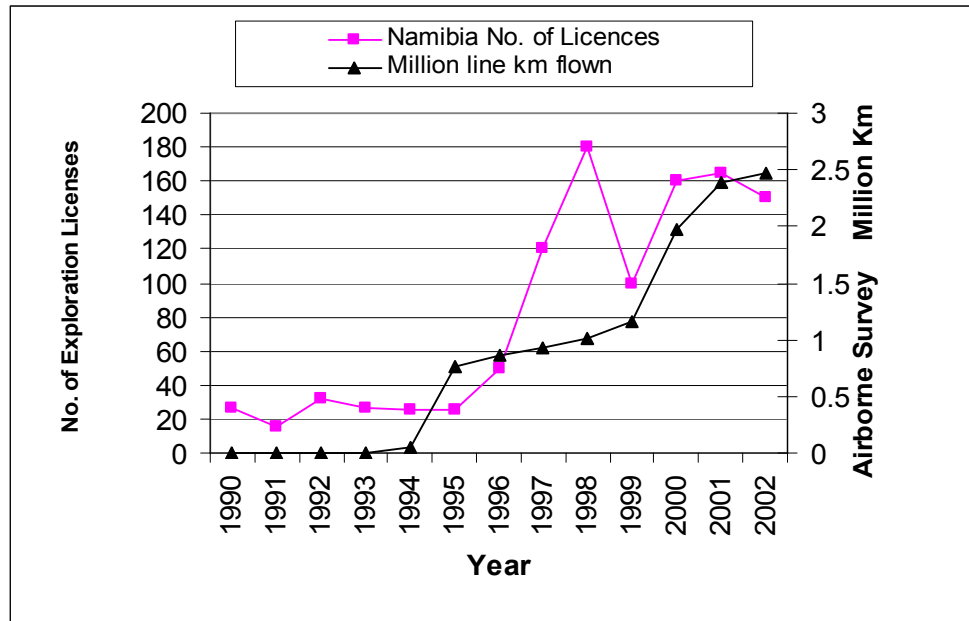


Figure 10.6 Airborne geophysical survey and exploration activities in Namibia for 1990-2002 (Data Source: Geological Survey of Namibia).

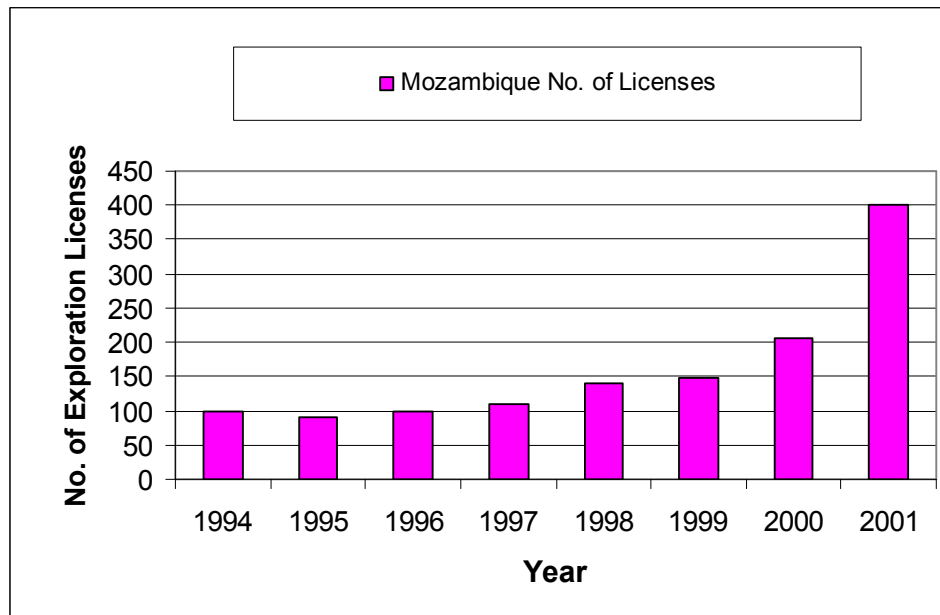


Figure 10.7 Exploration activities in Mozambique for 1998-2005
(Data Source: Directorate of National Geology, Mozambique).

10.3 Socio-Political Environment

10.3.1 Policy and stable political environment

The future of South Africa's gold mining industry will depend not only on economic and geological attractiveness, but also on how the country's political environment unfolds in the next few years. According to the 2005/6 annual publication of The Fraser Institute, in today's globally competitive economy, where mining companies may be examining properties located on different continents, a region's policy climate is taking on increasing importance in attracting and winning investment. An example of this is Zimbabwe, which has a fairly attractive geological terrain, but which is viewed by investors as a no-go area. According to The Fraser Institute (2006), with a score of 7.6 out of 100, Zimbabwe scored last in respect of policy potential index – this is a composite index that measures the effects on exploration of government policies, including, amongst others, uncertainty regarding the administration, interpretation and enforcement of existing laws and environmental regulation.

With a score of 45, South Africa is not necessarily doing well and although the policy potential index is based on perceptions, it is an important tool in investment decision making. It is important, therefore, that South Africa addresses these perceptions as they might impair future investment into the country's exploration and mining sectors. Some of the country's competitors are doing fairly well in this regard. For example Chile scored 88, Mexico scored 84 and Quebec scored 86 on the index.

10.3.2 Social environment and human resources

a) Employment

Figure 5.1 shows that employment in the gold mining industry declined consistently over the last 20 years. A simple linear trend line suggests that the downward decline will continue well into the foreseeable future. However, as demonstrated earlier, the matter is not that simple, since a number of factors affect employment in the industry. In this regard multivariate regression can provide a better tool for predicting employment. Employment can be predicted by using models for the overall period (3) and Period 3 (6) in sections 6.3.2 and 6.3.5 (Chapter 6). The models provide relatively good fits in respect of actual and predicted employment (Figures 6.1, 6.2, 6.5). The two models are presented below:

Overall period:

$$\hat{Y} = 379995 + 417.35 X_4 - 446.89 X_7 - 5.59 X_{11} + 6.37 X_{12} + 0.50 X_{13} - 217838 X_{15} + 2754.71 X_{16} - 2734.06 X_{17} \quad (3)$$

($\hat{Y}$ = Employment; X_4 = Nominal rand revenue per ton milled; X_7 = Nominal rand working costs per ton milled; X_{11} = Ore milled; X_{12} = Ore treated; X_{13} = Gold production; X_{15} = productivity in terms of gold produced per employee; X_{16} = productivity in terms of ore milled per employee; and X_{17} = productivity in terms of ore treated per employee).

Period 3:

$$\hat{Y} = -253372 + 643.34x_5 + 7.24x_{11} \quad (6)$$

($\hat{Y}$ = Employment; X_5 = Real rand revenue per ton milled ; and X_{11} = Ore milled)

b) Availability of workforce – HIV/AIDS pandemic

The problem of availability of workforce is of concern to stakeholders in both developed and developing countries. In developed countries, there is growing evidence that the workforce is aging and there are not enough young people entering the industry, as demonstrated by Figure 9.8 (Engineering and Mining Journal, 2006). According to the article in the Engineering and Mining Journal, in 2004, the median age for hard rock miners in the USA was 44 years and 46 for coal miners.

In contrast, in South Africa, the issue of aging employees (unskilled to semi-skilled) is not of great concern, as is evident by the age profile of COSATU members. Figure 10.9 shows that the average age of COSATU members is between 36 and 45 years. However, the biggest concern for the country is the impact of the HIV/AIDS pandemic. Unfortunately, there is a lack of freely available information regarding the impact of the disease on South Africa's gold mining industry, despite the known social and economic impact associated with HIV/AIDS. According to a confidential report from one mining company, the reason for the lack of information relates to a fear of legal liability arising from discrimination, privacy, human rights issues, lack of funds and other practical constraints. Nonetheless, some mining companies use fairly accurate computer models to estimate current HIV+ prevalence and projection of future prevalence.

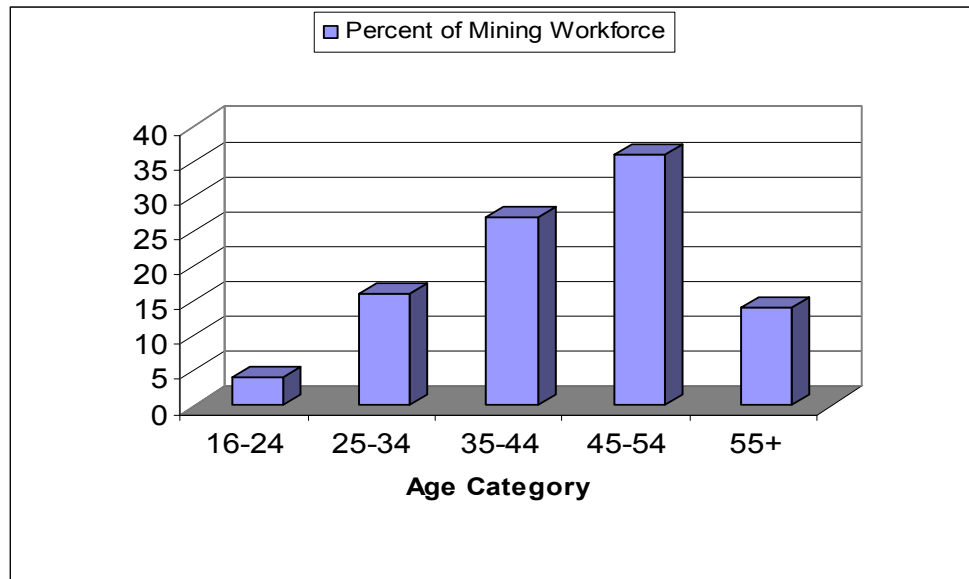


Figure 10.8 Age profile of USA mining workforce (Source: *Engineering & Mining Journal*, 2006).

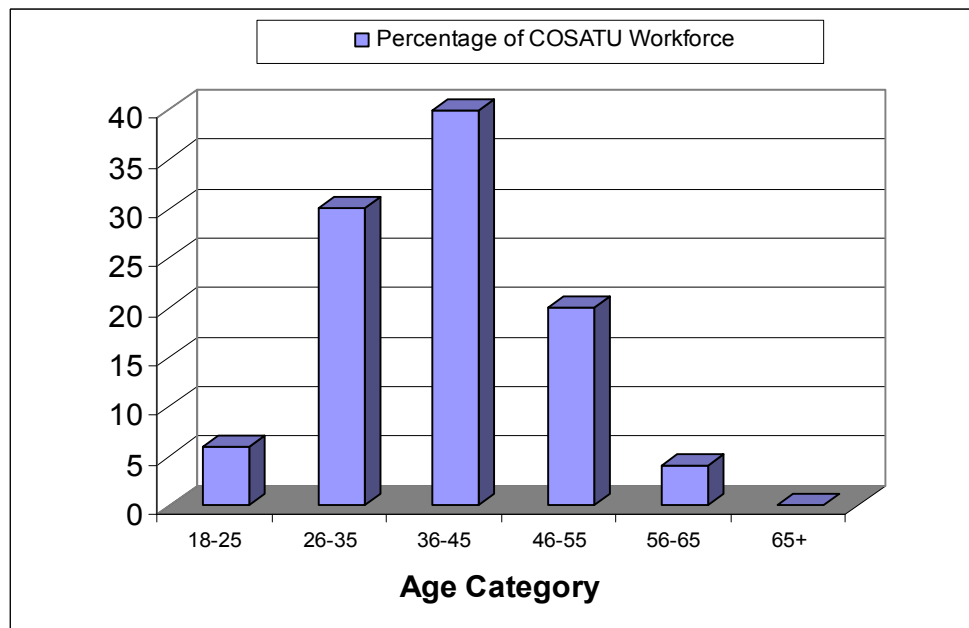


Figure 10.9 Age profile of COSATU workers in 2004 (Source: *Buhlungu*, 2006).

HIV+ prevalence

A confidential report provided to the author by one of the largest mining houses in South Africa details HIV+ prevalence on three of its mines. These mines, which employ a total of 44 000 employees, have an estimated HIV+ prevalence of between 31 per cent and 33,4 per cent for employees in the 3-8 job categories – categories for unskilled and semi-skilled workers. The prevalence is much lower amongst skilled employees - at 8,3 per cent. Table 10.2, shows that HIV+ prevalence is more or less the same on all three mines.

Table 10.2 Projected HIV+ prevalence as at July 2004 (Source: Confidential Report).

Division	Job Category	Total no of employees	No of HIV+ employees	% of employee who are HIV+
Mine A	3 to 8	14 055	4 355	31%
Mine B	3 to 8	13 992	4 043	31.1%
Mine C	3 to 8	10 111	3 379	33.4%
All three mines	9 and above	6 344	12 306	8.3%

Projection of future HIV+ prevalence

Figure 10.10 shows that although the percentage of HIV+ prevalence is currently relatively high, future projections suggest it might drop due to increased awareness amongst employees of the need to prevent infection. In term of the projections, new HIV infections will drop from 2,05 per cent to 1,36 per cent in 2018. The AIDS mortality rate is expected to increase marginally from 0,28 per cent in 2006 to 0,62 per cent in 2018. These statistics suggest that although HIV/AIDS is of great concern, its impact on the South African mining industry might not be devastating. The marginal increase in mortality is attributed to the provision of Anti-Retroviral medicines and aggressive education by employers.

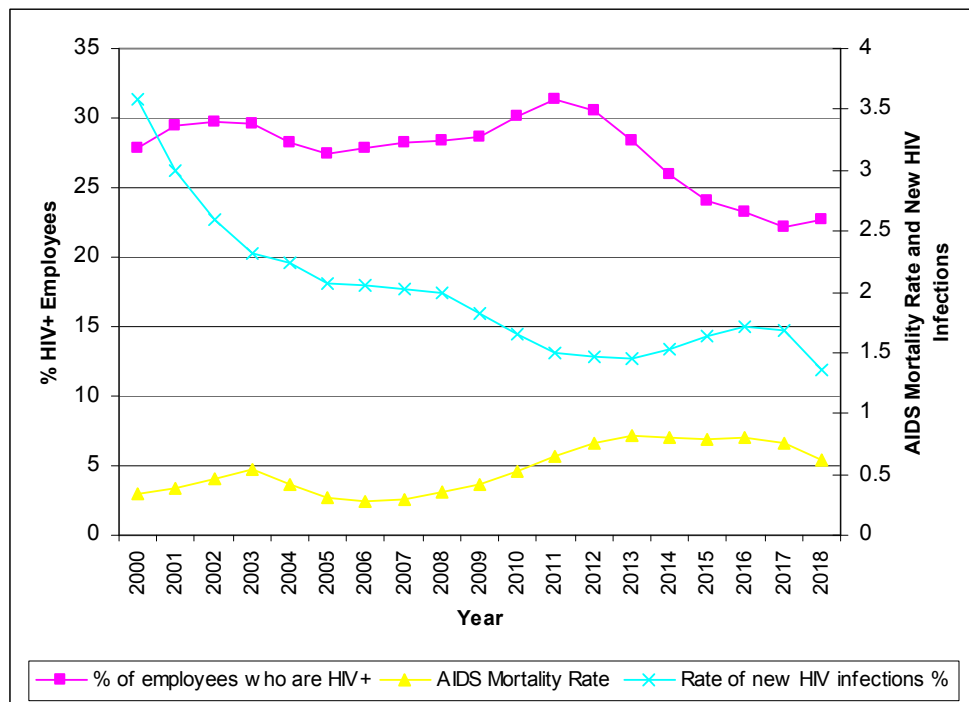


Figure 10.10 Projection of HIV+ prevalence, mortality and rate of new infections at selected gold mines (Source: Confidential report of a mining company).

c) Availability of workforce - Artisans and professionals

Whilst there is no shortage of low-skilled labour to work on the mines, the industry is facing serious problems with regard to availability of highly skilled officers – these are mainly artisans and professionals such as surveyors, engineers and geologists. The seriousness of the matter, especially with regard to artisans, was raised by the former president of the Chamber of Mines, Dr Con Fauconnier. He stated that more than 33 000 apprentices were registered in 1975, most of them by the mining, engineering and motor industries, Iscor and the then South African Railways (Smith, 2006). He furthermore stated that by the year 2000 only 3 000 apprentices were registered in South Africa and the number dropped to 1 440 by 2005 (Smith, 2006). The situation is a major challenge for the country’s mining industry and it is bound to be exacerbated by the current commodity price boom.

d) Legacies: Occupational injuries and diseases

The recent successful claim suit against Gencor and Cape Plc, by ex-mineworkers suffering from asbestosis, has highlighted the plight of former and current gold mineworkers. On a daily basis, mineworkers in the gold mining industry are exposed to dust particles, largely made of silica (SiO₂), and continuous exposure to silica has resulted in many former and current workers being in danger of suffering from silicosis. A number of former employees suffering from silicosis have already instituted litigations against some gold mining companies. This scenario does not bode well for the future of the industry as the claim suite, if successful, could amount to millions of rands.

10.3.3 Administrative factors

Countries that need to attract investment into their mining sector need to be aware that there is competition for limited global investment funds. Mining companies are global in their nature and, as discussed earlier, their available investment funds are often channeled to countries that provide an enabling environment. It is, therefore, important for South Africa to ensure that its administrative systems are always efficient and transparent. This will prove to be one of the important factors that will determine the future of the South African mining industry. As the economic reserves of the gold mines, and even the platinum mines, become depleted, large investments will be needed for further exploration and mine development – such investment will depend on, amongst others, the availability of an enabling administrative environment.

10.3.4 Catastrophic factors

Catastrophes that are cable of shutting down mines on a permanent basis are not common; however, there is the possibility of catastrophes such as seismic events closing down large sections of the mines. Occurrences in South Africa, of large seismic events capable of closing large sections of a mine for extended periods, are possible. It is, therefore, important that mining companies put in place a strategy that will address an unforeseen shut-down of some of their operations. The strategy should be an integral part of all disaster management plans of individual mines.

10.4 Discussion

The future of labour in South Africa's gold mining industry will depend on the behaviour of a number of factors, such as: the gold price, working costs, working profits, ore milled, ore treated, ore resources and reserves, gold production, socio-political issues and an enabling administrative environment.

Prices

Predictions by economists on the future of the gold price are littered with uncertainties and guess-work. However, an analysis of historic trends, as well as the current and future supply and demand for gold, provides insight into possible future trends. Whilst there are many factors that can affect the gold market, the current deficit that exists between newly mined gold and demand for the metal, coupled with declining world class gold discoveries, may provide support for the gold price. If this scenario holds, South Africa's gold mining industry could benefit profoundly and some of the mothballed mines and shafts could be re-opened. This could slow down the current downscaling and jobs could be saved or perhaps created. Current relatively high gold prices have already prompted several companies to consider re-opening some closed mines. For example, an Australian company (Rand Quest Syndicate) is planning to re-open some of the mines and shafts in the Central Gold Field. Despite the above positive view about the gold price, it has to be kept in mind that many global factors play a role in determining the price of gold – the most important being the gold reserves held by financial institutions and global financial trading.

Working costs and working profits

The future sustainability of the gold mining industry will also depend on the ability of the industry to contain costs and provide sustainable profits. The successful containment of costs will depend on how the industry manages the issue of labour costs, which comprises the bulk of the industry's costs. However, it must be realised that working costs also depend on changes in the techniques used in mining through the introduction of innovative systems. For example, the introduction of the jack-hammer drill in place of the old hand-drill, in the 1920s,

resulted in reduction of substantial costs (Katzen, 1964). It is, therefore, imperative that the industry explores innovative technologies through R&D to ensure future survival of the gold mining industry.

The worrying issue is the declining profits demonstrated in Figures 5.24 and 8.17. The industry will have to address this matter in a serious manner if it hopes to minimise or delay future downscaling. If profitability of the industry continues to decline, investors will seek other investments, possibly in countries where profitability would be higher.

Ore milled, ore treated, gold produced, resources and reserves

The current nationwide data on ore milled, ore treated and gold produced points at a downward trend in respect of these factors. Although Driefontein has opted for the economies of scale approach, by increasing ore milled, this is not a sustainable approach, as Figure 8.9 shows that gold production is not increasing. The continued gold production decline (nationwide and at Driefontein) is of great concern and the industry needs to urgently find solutions to this problem, which is definitely a threat to the future of the industry and one that will exacerbate the current downscaling.

The problem of declining gold production lies with the fact that very few reserves are being found. The country has significant resources, which need to be turned into economic reserves. However, new reserves and resources can only be created through significant investment in: greenfield exploration, minesite-related exploration, and infrastructure development. Unfortunately, there is very little investment going into South Africa's gold exploration and mining, as pointed out by the Metal Economics Group. According to Metals Economics Group (2006), gold mining attracted only 10 per cent of South Africa's exploration expenditure in 2005. Sadly, more than half of the expenditure is being invested into minesite-related exploration. This implies that it is unlikely that the country will discover new deposits and increase its reserves significantly in the near future. It is also unfortunate that some the large mining companies, which traditionally invested

large amounts of money in the gold mining industry, are now investing relatively modest amounts. For example, Gold Fields invested \$4.9 million in minesite-related exploration during 2005, whilst AngloGold Ashanti invested \$1.9 million (Metals Economics Group, 2005).

Geoscientific infrastructure

As stated earlier, the future of any mining industry lies with, amongst others, investment in the national geoscientific infrastructure. It has been shown that appropriate investment in geoscientific infrastructure has benefited countries such as Australia, Namibia and Mozambique. South Africa needs to upgrade its current geoscientific infrastructure to improve its competitiveness in respect of attracting exploration investment, especially in the gold sector.

Political stability and an enabling policy

The mining industry has become a global and extremely competitive one. Countries are competing for limited and mobile investment funds and investors, who are pursuing profits, are loathe to invest in politically unstable countries. Fortunately, the current political climate in South Africa is relatively stable and this should bode well for the future of the mining industry in the country.

With regard to policy issues, the rating of South Africa by The Fraser Institute (South Africa rated 45 out 100 in 2006) is of concern and needs to be addressed by stakeholders. This low rating is to be expected as the country is undergoing unprecedented mining and minerals policy reforms, which involve the introduction and implementation of the following new legislations:

- Minerals and Petroleum Resources Development Act 28 of 2002;
- Diamonds Amendment Act 29 of 2005.
- Diamonds Second Amendment Act 30 of 2005.
- The Diamond Amendment Act 30 of 2005; and
- Mineral and Petroleum Resources Royalty (Administrative) Bill 60 of 2008.

Despite the many legislative changes taking place, it is imperative that the confidence of investors is maintained through, amongst others, ensuring that an enabling and transparent administrative system always exists. It is comforting to note the DME currently addressing this matter through the creation of a multi-stakeholder forum that will specifically promote South Africa's mining industry and also explore ways of attracting investment into the sector.

Social environment and human resources

Although the issue of HIV/AIDS is a serious matter in South Africa and of particular concern in the mining industry and the gold mining industry, there is no evidence to suggest the industry will experience an uncontrollable crisis as a result of the pandemic. Available statistical information suggests that the industry will be able to manage the pandemic. Moreover, most of the labour needs of the gold mining industry are for unskilled to semi-skilled workers and it will, therefore, not be a major problem to replace employees who may be affected by the disease. However, if the industry decides to introduce mechanization, the issue of availability of skilled labour could be a problem. The problem of shortage of skilled labour and artisans is already emerging and has been highlighted by the former president of the Chamber of Mines, Dr Con Fauconnier.

10.5 Summary

Despite the complexity associated with prediction of future developments in the gold mining industry of South Africa, historic employment trends suggest that downscaling will continue well into the near future (Figures 5.1 and 8.2). However, as in the present situation, future downscaling will be influenced by a combination of economic and socio-political factors. Some of the most important economic factors include, inter alia: declining ore milled (Figure 5.7), declining ore treated (Figure 5.9), declining gold production (Figure 5.11), declining gold grades (Figure 5.13), declining and low profits (Figures 5.24 and 10.4) and declining reserves (Figure 10.5).

Socio-political factors are more difficult to predict, as they are largely influenced by the political and policy decisions of ruling political parties. Nonetheless, despite the current changes in the leadership of the ruling party and associated concerns, the country is currently politically stable and there are no indications of serious political instability in the near future. On policy issues, the implementation of the new mining code has been praised and criticised by stakeholders, who have a multiplicity of interests. It is important for the country to manage concerns raised by the critics of the new mining code, as they could negatively affect future investment into the mining industry.

With regard to the availability of labour, there are no indications of labour shortage for many years to come, as there is abundance of labour in southern Africa. Moreover, most of the skills required to operate gold mines can be acquired in a relatively short period. Whilst the issue of HIV/AIDS is a serious matter, which will negatively affect mining operations, there is no evidence to suggest that the industry will experience an unmanageable crisis as a result of the pandemic. Nonetheless, the threat of HIV/AIDS needs to be monitored and managed to avoid a possible future negative impact on labour availability, costs and profitability.

However, at a professional level (geologists, surveyors, engineers, etc), there are indications of a shortage of skills in the country. The shortage is a global phenomenon attributed to the current commodity boom. The country should address this issue by ensuring that tertiary institutions are properly resourced in terms of, amongst others, developing strategies to retain and attract lecturers and providing appropriate resources for the institutions.

CHAPTER 11

STRATEGY FOR MANAGING DOWNSCALING IN SOUTH AFRICA'S GOLD MINING INDUSTRY

“All mines have one thing in common – no matter how long they last, they all will close.” Natural Resources Canada (2006)

11.1 Introduction

A strategy to address downscaling should be based on a thorough understanding of the causes of downscaling, understanding of possible impacts, international experiences from other countries and the principle that all mines have a limited life and will close at some stage. The aforementioned issues will be taken into consideration in the development of a strategy and proposing recommendations to manage downscaling in the gold mining industry of South Africa. It is also important to take into consideration the newly implemented Social and Labour Plan guidelines for managing retrenchments – hence a review of the current Social and Labour Plan will be done in the following section.

11.2 Current Official Government Process of Managing Retrenchments in Terms of the Social and Labour Plan Guidelines in South Africa

The current official process for managing retrenchments in South Africa's mining industry is an integral part of the newly introduced Social and Labour Plan (DME, 2006). The framework of the process is outlined in the Department of Minerals and Energy Social and Labour Plan Guidelines (DME, 2006). In terms of the guidelines, the process of managing retrenchments can be subdivided into three phases, namely; Saving jobs (Phase 1), Finding alternatives to job losses (Phase 2), and Amelioration of social and economic impact (Phase 3). Whilst the guidelines are useful, they are largely reactive and do not provide a comprehensive approach that incorporates proactive measures to manage downscaling.

11.3 Proposed New Strategy for Managing Downscaling in South Africa's Gold Mining Industry

The main framework of the proposed strategy to manage downscaling is based on creating a three-pronged management processes, namely: national management process, mine management process, and local community management process (Figure 11.1a and 11.1b). All three processes require the implementation of appropriate measures, initiatives and processes to manage downscaling. Some of the proposed measures are based on international experiences from countries such as Canada and the United Kingdom.

11.3.1 National management process

National Institutional Structures

At national level, appropriate institutional structures should be established to effectively manage and monitor downscaling. The existence of such structures is important in ensuring efficient monitoring and implementation of downscaling strategies and the creation of a national institutional memory. In addition, the structures will allow for the transfer of knowledge from one downscaling area or mining sector to another. In this regard, it is, therefore, recommended that the following structures and programs be established:

- National Downscaling Agency
- National Downscaling Skills Fund
- National Downscaling Enterprise Fund
- Enterprise Zones
- National Program to Address Factors Influencing Downscaling

a) National Downscaling Agency

The most important element of the proposed new strategy is the establishment of a National Downscaling Agency, which should be a government funded agency with a board comprising representatives from government, unions and the private sector. Taking into consideration the current and future challenges that the country will be facing in respect of downscaling, it will, therefore, be prudent for the country to establish such an agency that should be mandated to address all aspects

of downscaling in the entire mining industry. The United Kingdom established the Coal Authority to, amongst others, address historical liabilities relating to coal mining (The Coal Authority, 2008). The proposed South African agency would form strong partnerships with local authorities and mining companies to develop and put in place nationwide measures during the various phases of mining development (Figures 11.1a and 11.1b). Other functions of the agency should include the following:

- Development of national guidelines on the management of downscaling.
- Providing advice to local authorities and mines on the management of downscaling.
- Managing national funds to support small businesses in towns affected by downscaling.
- Managing funds for the provision of skills to redundant employees and affected communities.
- Assessing reports from the mines on economic aspects of their respective operations.
- Establishing national early warning systems for all mining sectors and advising relevant authorities. The national early warning system should be able to pick up national trends in respect of individual mining sectors. The regression models in Chapter 6 can play a useful role in this regard.
- Organizing annual national mining sector stakeholder forums to discuss developments in respect of downscaling and other mining issues, such as management of costs and productivity.
- Undertake a national skills needs assessment and provide information to relevant mines and local authorities to assist them in planning and developing re-training skills programs for employees.
- Maintain a database of job opportunities in the mining industry and, where possible, other sectors of the economy. A well maintained database, which can be expanded to include information about job seekers in the industry, can generate substantial income for the agency; other employers could use the database for purposes of recruiting staff and would be willing to pay for such services.

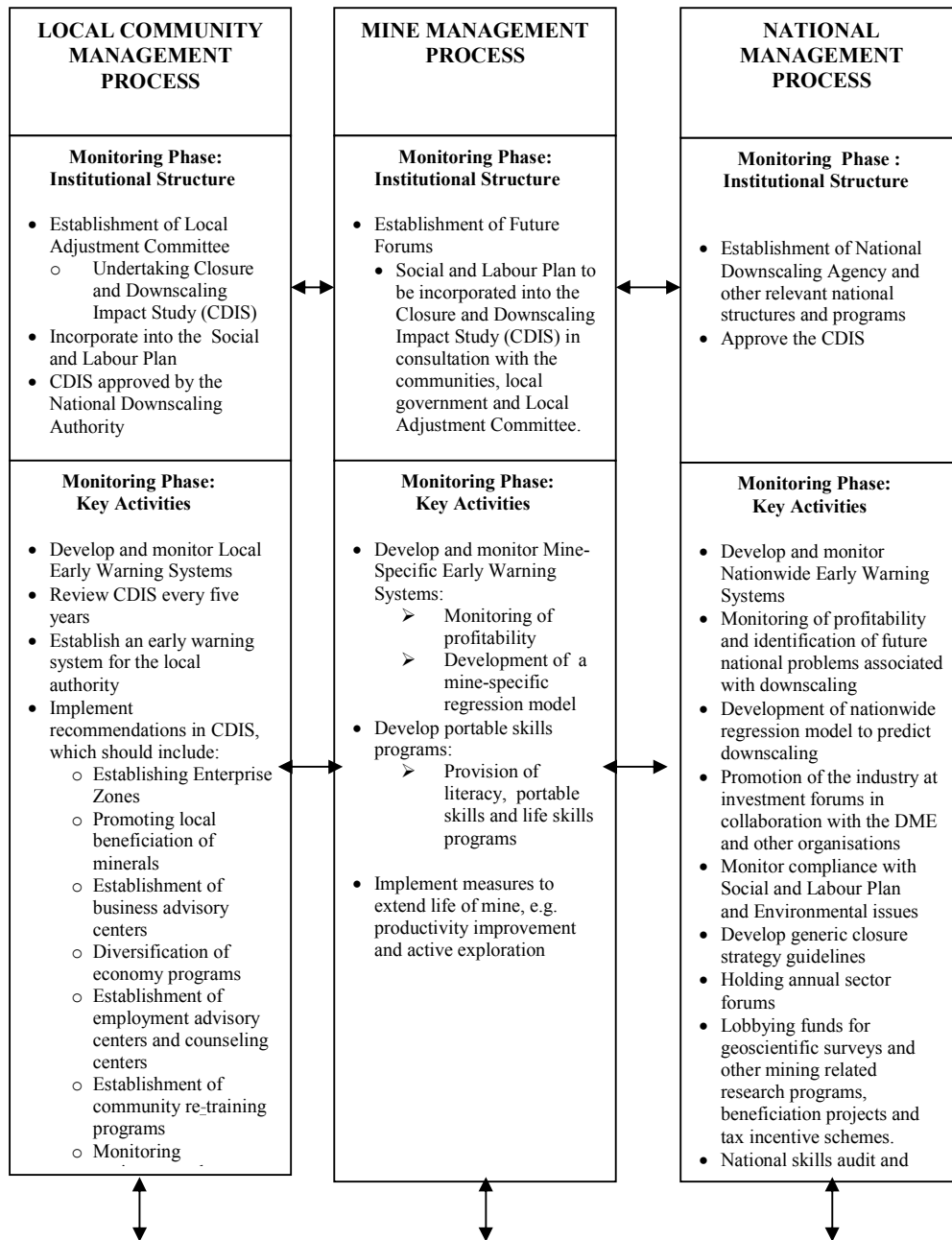


Figure 11.1a Strategy to manage downscaling in South Africa's gold mining industry: Monitoring phase.

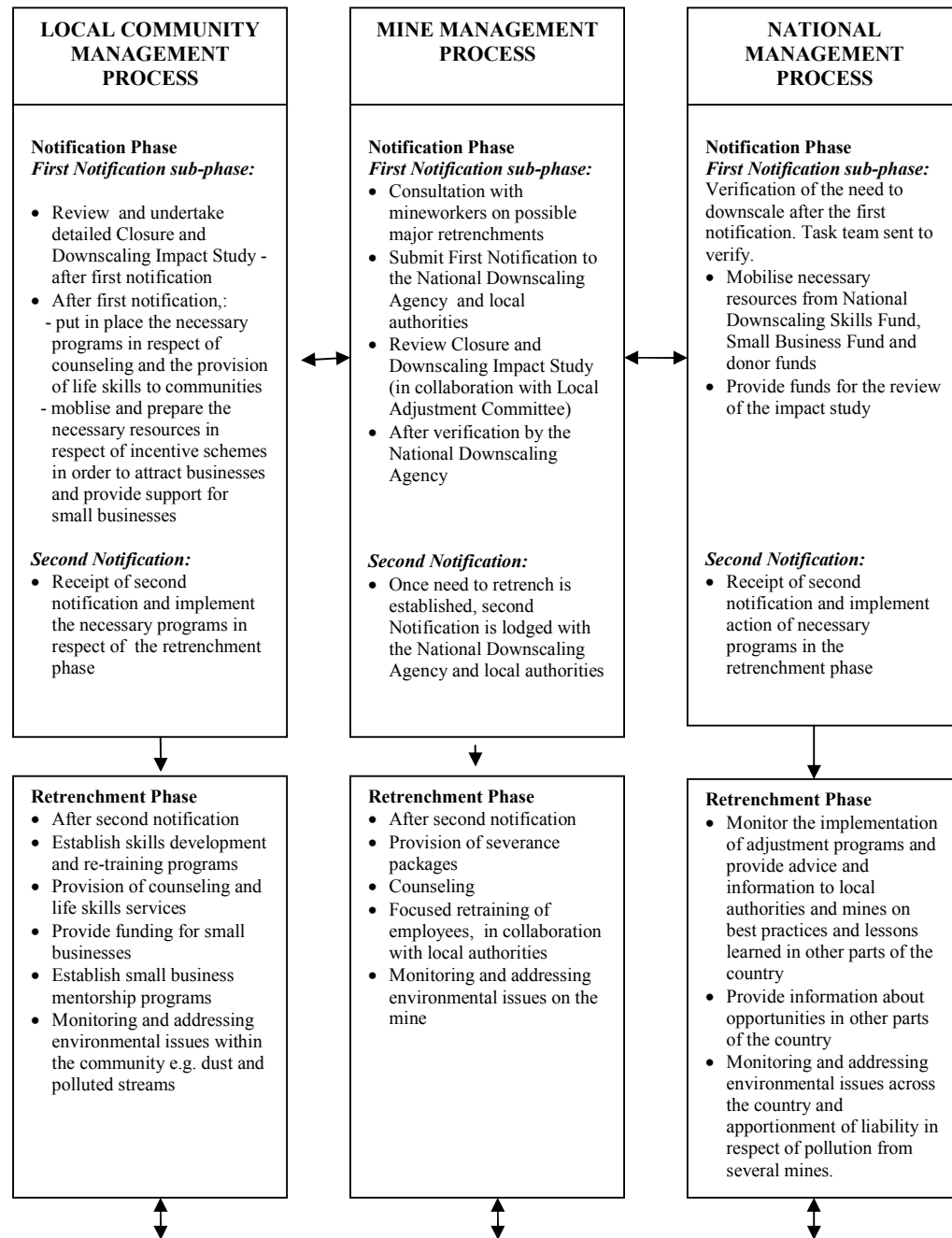


Figure 11.1b Strategy to manage downscaling in South Africa's gold mining industry: Notification and Retrenchment phases.

b) National Downscaling Skills Fund

The National Downscaling Agency should be mandated to establish and oversee the National Downscaling Skills Fund, which will focus on skills development and re-training of redundant mineworkers. The Fund should be financed through the skills development levies paid by companies to the MQA. The MQA should, therefore, ring-fence some of its funds and transfer these to the proposed agency. The National Downscaling Skills Fund should also be used to train communities affected by downscaling in respect of new skills that will not depend on mining operations. In the United Kingdom, the Coalfields Regeneration Trust is an example of a fund that was created specifically to provide new skills to individuals negatively affected by downscaling of the coal mining industry (The Coalfields Regeneration Trust, 2008).

c) National Downscaling Enterprise Fund

The National Downscaling Agency, in collaboration with perhaps the Industrial Development Corporation, should also be tasked to put in place a National Downscaling Enterprise Fund, which could be accessed by communities and towns affected by downscaling. Such a fund could be used to provide financial and technical support to small business in communities and towns affected by downscaling. In the United Kingdom, a Coal Enterprise Fund was created to provide support to small-businesses operating in coalfields that were affected by downscaling (Prescott et al, 1999). Similarly, in Canada, the Mining Community Reserve Fund was created to support mining communities affected by downscaling or closure – the Snow Lake mining community benefited from such a fund (Manitoba Government, 2006).

d) Enterprise Zones

Enterprise Zones have been successfully introduced in the United Kingdom to regenerate economic activities of economically depressed areas. In this regard, Enterprise Zones were established in some coalfields and have managed to attract investment into these towns. Dawdon Business Park, on the coast of East Durham in the United Kingdom, is an example of such an Enterprise Zone (One

NorthEast, 2008). Businesses are attracted to the Enterprise Zones by generous tax incentive schemes and less onerous regulatory requirements. There is no doubt that South Africa could benefit from establishing Enterprise Zones in towns such as Carletonville/Merafong and Welkom/Matjhabeng. The proposed National Downscaling Agency should play a role in identifying and designating Enterprise Zones.

e) National Programs to Address Factors Influencing Downscaling

Factors that are likely to influence or cause downscaling were discussed in Chapters 5, 6 and 9. Table 9.6 provides a generic summary of the factors. A co-ordinated approach, in terms of putting in place national programs, is needed to monitor and address these factors on a continuous basis. Examples of the programs, which are largely proactive, are discussed below:

- ***National Research Programs to support the gold mining industry***

The issue relating to lack of economic reserves and declining grades requires a coordinated national approach in respect of instituting and supporting mining research programs throughout the value chain. Appropriate financial support should be made available for research programs that are aimed at addressing the issue. In this regard, targeted gold exploration research programs should be introduced to develop new knowledge about gold, both inside and outside the Witwatersrand basin. In addition, mineral processing and mining research projects (especially deep mining programs) should be encouraged and financially supported. Canada provides good example of numerous research programs aimed at supporting the mining industry in terms of exploration and mining technology research.

- ***National Investment Attraction Programs***

One of the most effective and important ways of addressing downscaling is through ensuring that investment continues to flow into the mining industry. The deep gold mining industry of South Africa requires large

investment and there is a need to ensure that such investments continue to flow into the industry. However, there is serious competition for global investment funds and South Africa should seriously consider introducing the Canadian-style flow-through share schemes to attract investment into the gold mining industry.

- ***National Program to Promote the Usage of Gold***

A national committee must be created to coordinate programs that promote the usage of gold. Such programs should be aligned with activities of the World Gold Council, which is a global organization that was created to promote usage and maximize the demand of gold (World Gold Council, 2008). At national level, the committee should be involved in lobbying of funds from stakeholders for various national scientific research programs. In addition, the committee could monitor and encourage new research in this field.

- Although there is no conclusive evidence that gold sales impact negatively on employment, there is a need to continuously ensure that confidence in gold as a store of wealth is maintained, as well as to avoid sudden “dumping” of gold onto the market. Therefore, the functions of the committee should include continuous lobbying of Central Banks and other relevant institutions (such as the IMF) to ensure that future sales of gold holdings takes place in a structured manner.

National level management processes

The process of managing downscaling leading to actual retrenchments can be subdivided into three phases, namely: the monitoring phase, notification phase, and retrenchment phase (Figures 11.1a 11.1b). All three phases comprise specific measures to manage downscaling.

National level: Monitoring phase

During the monitoring phase, various proactive measures must be put in place by relevant stakeholders. At national level, the measures will largely be initiated and

managed by the proposed National Downscaling Agency. The agency's tasks should include the following:

- Approve the Closure and Downscaling Impact Study (CDIS) that should be undertaken for all gold mining regions / municipalities. The responsibility of undertaking the CDIS and updating it should lie with the mines and the local authorities; they will, in turn, submit the information to the National Downscaling Agency. The CDIS should be reviewed and updated every five years and submitted to the agency.
- Establishment of national early warning systems to monitor national trends in respect of downscaling in the gold mining industry - and even other mining sectors. In this regard, the regression model developed in Chapter 6 for the overall period, could be one of the tools used to warn stakeholders about future downscaling.

National level: Notification and retrenchment phases

The notification phase involves submission of the first and second notifications by the mines of their intention to retrench employees. Submission of the notifications will only be required where significant numbers of employees are to be retrenched over a specific time period. A reasonable number and time would be 100 or more employees over a one year period. The purpose of the first notification is to warn relevant stakeholders about the possibility of retrenchments taking place and the second notification would aim at informing stakeholders about the actual implementation of retrenchments.

The role of the National Downscaling Agency during the notification phase would involve receiving notifications from the mines about their intention to retrench employees and thereafter verifying the need to retrench. Once the agency receives the first notification to retrench, it would then send a task team to the affected mine to verify the need to retrench. If the need is established, the agency would then liaise with the local authorities through their Local Adjustment Committee to ensure that the necessary support programs are in place.

After the second notification, the key role of the agency would include the following:

- Provide assistance to the affected local authorities and mines, in respect of employment opportunities for redundant employees on other mines and in other sectors.
- Provide support on re-skilling training programs, including training in terms of business skills.
- Provide support in respect of small businesses opportunities.
- Monitor environment impact issues on a national basis and address the issues with the affected mines.

11.3.2 Mine management process

Mine level: Monitoring phase

At mine level, the monitoring phase should involve the establishment of the necessary institutional structures that will facilitate and improve dialogue between mine management and mineworkers. In addition programs that are needed to provide support to future redundant employees should be put in place. In this regard, the following are some of the key structures and programs that must be established:

- Future Forums (these are committees that comprise management and mineworkers)
- Skills development programs
- Business skills development programs
- Life skills training programs

Future Forums

Mine-specific processes should be anchored on the creation of Future Forums. These forums have already been established in some mines, however, it is important that their role be revisited and changed to ensure that their activities are linked with the broader management strategy. The mandate of the forums should include a legislated process for monitoring activities of the mine in terms of profitability, potential future risks and consulting, on a regular basis, with both the

National Downscaling Agency and affected communities. In this regard, it is proposed that Future Forums should hold structured meetings on a quarterly basis and provide relevant information to the National Downscaling Agency and the affected communities – quarterly reports on the financial status of the mine should be submitted to the two entities. Such continuous consultation processes will ensure that any signs of downscaling are picked up at an early stage by all relevant bodies. In addition, the forums should monitor the implementation of on-mine training and re-training programs.

Skills development programs

On-mine skills development programs should be developed in respect of literacy and portable skills programs. In this regard, collaboration with MQA is needed to avoid duplication of activities and ensure efficient utilization of resources. The development of portable skills programs should be the responsibility of Future Forums and should be based on the skills needs of the country. In this regard, it should be mandatory for all mines to undertake skills audits as part of a 5-year review of the Closure and Downscaling Impact Studies, which should be an integral part of the Social and Labour Plan.

Business skills development

Mineworkers should be encouraged to learn new skills - including entrepreneurial skills. A national, co-ordinated program by the National Downscaling Agency should be developed to educate mineworkers about small business opportunities in various sectors, such as agriculture and tourism. The proposed National Downscaling Enterprise fund will play a major role in terms of providing the necessary funds.

Life skills training programs

Mineworkers should be provided with life skills training programs that include investment and saving programs, HIV/AIDS education and management of severance or retirement packages. In this regard, education brochures and training programs could be developed and coordinated by the National Downscaling

Agency. On the issue of HIV/AIDS, government and mines should develop partnership programs for education and the provision of anti-retroviral medicines. Each mine should undertake an annual survey on HIV/AIDS prevalence in order to continuously monitor the situation.

The issue of severance packages for redundant employees is a thorny one and often results in disputes. In terms of the Basic Conditions of Employment Act an employer must pay an employee, who is dismissed for reasons based on operational requirements, at least one week's remuneration for each completed year of continuous service (Republic of South Africa, 1997). Clearly, the packages are insufficient and innovative measures need to be explored to augment the packages. In this regard, the abovementioned educational programs on investment and savings need to be introduced on the mines. The programs should be part of the broader life skills training programs for mine employees and should include the management of retirement packages. There is also a need to explore the possibility of establishing an insurance scheme specifically aimed at redundant mine employees.

Mine level: Notification and retrenchment phases

Once a mine decides to downscale by retrenching its employees, management should first consult with the affected employees and submit a first notification to both the National Downscaling Agency and the Local Adjustment Committee. The Local Adjustment Committee should undertake the following, in collaboration with the Future Forum (representatives of mine management and employees):

- Commission a detailed Closure and Downscaling Impact Study, which should be based on the already-existing studies that were undertaken during the monitoring phase.
- Mobilise funds for counseling and re-training programs.
- Mobilise funds for advising affected people on possible new business opportunities.

After the second notification, and during the retrenchment phase, the recommendations of the detailed CDIS must be implemented. The recommendations should include the following:

- Establishment of Advisory Centers to advise affected people about job opportunities and small business opportunities. The centers should also provide on-mine counseling to affected employees. Counseling must be given on financial and social matters.
- Implementation of re-skilling programs.

11.3.3 Local community management process

Local community: Monitoring phase

As with national and mine levels management process, the local community process requires the establishment of the necessary institutional structures and programs during the monitoring phase. In this regard, Local Adjustment Committees have to be established and Closure and Downscaling Impact Studies have to be undertaken in collaboration with the Future Forums on the mines.

Local Adjustment Committees

Local Adjustment Committees should be established to facilitate the management of downscaling in the affected mining communities. The composition of the committee should include local government representatives, local business leaders and mine management representatives. In this regard, the committee should be mandated with the following:

- Review of CDIS in collaboration with the Future Forums on the mines. The reviews should be done every five years.
- Exploring the possibility of transforming affected mining towns into Enterprise Zones. This has to be done in collaboration with the National Downscaling Agency. Government, especially the Departments of Finance

and Trade & Industry must be lobbied to agree to the concept of transforming mining towns into Enterprise Zones.

- Developing local early warning systems. This should involve developing future scenarios in respect of the local economy and possible impacts of downscaling on the local community.
- Establishing advisory centers on available skills development and re-training programs, job opportunities and small business opportunities.
- Promoting and encouraging diversification of the economy through, amongst others, beneficiation, tourism and agriculture.

Closure and downscaling impact study

Communities associated with mining are always affected negatively by downscaling and closure of mines. International examples of such communities were discussed in Chapter 9 and include the Snow Lake community in Canada and the Selby community in North Yorkshire, United Kingdom. South African examples are the Merafong/Carletonville and Matjhabeng/Welkom communities. The management of downscaling in these communities requires foresight on the part of all stakeholders – most importantly the local authorities. Some of the critical measures for managing downscaling at community level should involve conducting a CDIS during the monitoring phase. The studies should be undertaken collaboratively by local communities and mine based Future Forums and should involve community representatives. The impact study must be reviewed on a five-year basis.

Local community: Notification and retrenchment phases

Once a mine decides to downscale by retrenching its workers, management should submit a first notification to both the National Downscaling Agency and the Local Adjustment Committee. The Local Adjustment Committee should undertake the following in collaboration the Future Forum (representatives of mine management and employees):

- Commission a detailed Closure and Downscaling Impact Study.
- Put in place counseling and re-training programs for affected communities.

- Put in place programs for advising affected people on possible new business opportunities. The programs should support the entire community and not only mine employees.

After the second notification and during the implementation sub-phase the following must be implemented:

- Implement the recommendations of the detailed CDIS.
- Whilst the recommendations of individual impact studies will differ from one mine to another, the study must include the following key measures:
 - Measures to attract investment into the affected towns.
 - Measures to mitigate against possible environmental impact. This should largely involve ensuring that the mine meets its obligations in terms of environmental liability and the principle of “polluter pays”.
 - Establishment of Advisory Centers to advise affected people about job opportunities and small business opportunities.
 - The Advisory Centers must also provide counseling to affected people, especially families. Counseling must be provided on financial and social matters.

11.3.4 Environmental issues

Polluter pays principle

Environmental issues are currently addressed through the principle of “polluter pays”. The new strategy should focus on the implementation and “policing” of the relevant legislations, especially the MPRDA and National Environmental Act (Republic of South Africa, 1998 and 2002b). The Local Adjustment Committees are in the best position to ensure that environmental issues are addressed by the affected mines, as they are the people who often bear the brunt of a polluted environment. It is thus important that both the Local Adjustment Committee and the National Downscaling Agency be given legislative powers in respect of being consulted on environmental issues resulting from downscaling and even closure.

Legacies of the past (environment)

As discussed in Chapter 4 (section 4.6), there is no doubt that the environmental degradation that started some 100 years ago will remain a challenge for the country for many years to come. Environmental problems, including polluted ground water and dust pollution, are likely to increase with the expected increase in downscaling. It is recommended that the country should put a comprehensive strategy in place to deal with environmental legacies and the looming problem of polluted groundwater – fortunately the DME has already started with this process.

Possible future occupational health litigation

Former and present mineworkers are becoming increasingly aware of their rights in respect of occupational diseases; the likelihood is that employees might feel aggrieved at contracting diseases related to their working environment and could institute legal proceedings against mining companies. The industry should prepare itself for the possibility of an increase in litigations in future, especially from former retrenched employees who often become destitute after a few years. It is, therefore, imperative that appropriateness and adequacy of current compensation for people who contracted occupational diseases, such as silicosis, should be assessed. Companies should also consider the possibility of investing sufficient funds to cater for possible future litigation in respect of occupational diseases.

11.4 Discussion

There is a need for South Africa to develop and implement a comprehensive strategy that will incorporate international best practices and proactive measures to manage downscaling. It is against this background that a new strategy to manage downscaling is proposed. The proposed new strategy for managing downscaling is based on the following:

- Addressing the likely causes of downscaling.
- Addressing the impacts of downscaling.
- Incorporating international best practices and lessons.

An analysis of the South Africa situation reveals that the current and future causes of downscaling will mainly be related to a combination of economic circumstances (Table 9.6). Political influences can play a role if political uncertainty arises in the future – the current change in leadership of the ruling party needs to be managed properly, as it could impact negatively on potential investment. Catastrophes can always occur at any time and it is, therefore, important to ensure appropriate disaster management plans are put in place.

The proposed strategy to manage downscaling comprises a three-pronged approach, i.e. national management process, mine management process, and local community management processes. Each of the processes requires the implementation of appropriate measures, initiatives and processes to manage downscaling. The entire management process is outlined and presented in the downscaling management model in Figures 11.1a and 11.1b.

The primary feature of the national management processes involves the establishment of a proposed National Downscaling Agency. The processes also require that national adjustment funds, such as skills re-training fund and small business fund, be created to provide support to redundant employees and affected communities. National processes also include implementation of proactive measures, such as promotion of the mining industry through:

- participation at mining investment conferences;
- undertaking geoscientific and other mining related research programs;
- introducing exploration and mining tax incentives;
- the creation of an enabling investment climate through the creation of a stable political climate and efficient administrative processes.

The aforementioned measures form an important part of the Canadian mining strategy used to promote its mining industry and South Africa should incorporate these measures into its strategy to manage downscaling. The measures are

proactive in nature and are, perhaps, important for the long-term sustainability of the South African gold mining industry and the mining industry as a whole.

The establishment of national institutional structures, such as the National Downscaling Agency, will benefit the country in the long run, as downscaling will remain part of the country's reality for many years to come. The agency should also be involved in other industries, such as coal and platinum industries, which are currently still expanding, but which will, at some stage, downscale. Mine management and local community processes should be based on the creation of Future Forums (committees comprising representatives from mineworkers and mine management) and Local Adjustment Committees (committees comprising local representatives and mine personnel). All three structures (National Downscaling Agency, Future Forums and Local Adjustment Committees) have well defined roles that contribute towards the management of downscaling. The committees are also critical in planning the future of mines and affected communities.

The important element of managing downscaling in the mining industry is the creation of early warning systems to warn stakeholders of possible downscaling. All three management process (national level, mine level and local community) require the development of early warning systems. Scenarios in respect of the various business factors need to be established and regression models developed, as per equations in Chapter 6, can play an important role in predicting employment levels and therefore downscaling. The first and second notification to retrench employees also serves as a good early warning system and should form an integral part of the downscaling strategy. Committees and structures in the three management processes could also act as early warning systems, as discussed below:

- Future Forums - the committees will have first hand information about developments on the mines. The committee must monitor business development and warn relevant authorities about pending difficulties.

- Local Adjustment Committees - the committees must monitor development in local communities and provide necessary warning to relevant authorities.
- The National Downscaling Agency – it should monitor national trends in respect of downscaling and also warn the relevant authorities

Some of the most important mine and community management initiatives to address downscaling can be learned from Canada, the United Kingdom and Poland. The three countries have put in place several positive and effective measures to support redundant employees and communities affected by downscaling. The measures include the re-training of redundant employees and providing various support mechanisms in terms of social facilities and new opportunities for affected communities. In this regard, the proposed strategy should provide a socioeconomic net and structural adjustment programs for employees and communities affected by downscaling. At community level, the implementation of structural adjustment programs should be led by Local Adjustment Committees, which should comprise local authorities, mine management representatives and business leaders.

Despite the many measures that have been put in place to manage downscaling, South Africa lacks experience in terms of practically implementing sustainable measures. The starting point for managing the current situation at mine and community level should be to undertake detailed Closure and Downscaling Impact Studies, which will provide a better understanding of the situation as well as recommendations for each mine and mining town. In this regard, it is recommended that international experts from the United Kingdom and Canada be involved in enhancing the studies and bringing international experience. One important measure, which should be explored by affected gold mining communities, should be the establishment of Enterprise Zones in affected towns. As stated earlier, Matjhabeng/Welkom and Merafong/Carletonville could be ideal pilot projects for the establishment of Enterprise Zones in downscaling mining areas. However, the adjustment and regeneration programs can only succeed if

skilled officials are employed at local government level. This matter should be given priority by the authorities, as it could be a hindrance to the entire management process of downscaling. The management of downscaling in the gold mining industry of South Africa is also made complex by the fact that a large number of the labour force comprise migrant workers from neighbouring countries. It will, therefore, be difficult for the South African government to impose its programs to manage downscaling on other sovereign countries. Extensive negotiations between the South African government and affected neighbouring governments will have to take place, especially in respect of establishing structural adjustment programs, such as the provision of new skills. The challenge will be in finding funding for the adjustment programs – donor countries will have to be approached for assistance.

With regard to skills development programs on gold mines, the re-skilling of mineworkers and communities affected by mining should be an integral part of the management of the downscaling strategy. However, it should be pointed out that re-training should not only be introduced at the time of downscaling, as this might be too late to train some of the redundant employees. Re-training and the provision of portable skills should be part of the overall skills development program of any mine – mineworkers should be encouraged to acquire portable whilst still working. Such skills could be used either when mineworkers are retrenched or when they are on pension. The issue of ensuring availability of skilled workers and artisans should also be addressed by providing appropriate incentives – a further investigation of the matter is needed.

There is no doubt that the environmental degradation that started some 100 years ago will remain a challenge for the country for many years to come. Unfortunately, the issue often affects local communities, as is evident in many Witwatersrand communities. Environmental problems, including polluted groundwater and dust pollution, are likely to increase with the expected increase in downscaling. The country should put a comprehensive strategy in place to deal with environmental legacies and the looming problem of polluted groundwater –

fortunately the DME has already started with this process. Policing of the legislation based on the “polluter pays principle” must be intensified.

Former and present gold mineworkers are becoming increasingly aware of their rights in respect of occupational diseases; the likelihood is that employees might feel aggrieved at contracting diseases related to their working environment and could institute legal proceedings against mining companies. The industry should prepare itself for the possibility of an increase in future litigations, especially from retrenched former employees, who often become destitute after a few years. In this regard, the appropriateness and adequacy of current compensation for people who contracted occupational diseases, such as silicosis, should be assessed. Companies should explore the possibility of investing sufficient funds to cater for possible future litigation in respect of: occupational diseases for employees and environmentally related disease for local communities.

11.5 Summary

The gold mining industry of South Africa has been downscaling since 1987 and thousands of jobs have been lost. The downscaling trend is expected to continue well into the future and a comprehensive strategy needs to be developed and implemented.

Discussions in this chapter proposed a strategy that incorporates international experience from other countries and measures that are needed to address some of the important factors that can influence downscaling. The proposed strategy comprises three processes, namely: national management process, mine management process, and community management process (Figures 11.1a and 11.1b). All three processes involve the establishment of institutional structures. For example: the local community process requires the establishment of Local Adjustment Committees; mine level processes require the establishment of Future Forums; and national level processes entail the creation of a National Downscaling Agency. The three processes involve implementation of various measures to address downscaling. Some of the measures include: re-training and

counseling of redundant employees, retraining and counseling of affected communities, providing mechanisms to support affected communities in terms of job opportunities and business skills, the establishment of Enterprise Zones to attract investment in affected towns, and addressing environmental issues.

These measures, which are largely reactive in nature, must be complimented by proactive measures such as the following:

- Promotion of the mining industry through, amongst others, participation at mining investment conferences.
- Undertaking geoscientific research to: upgrade the geoscientific infrastructure of South Africa, attract investment, and improve the competitiveness of the country's mining industry.
- Undertake mining and mineral processing research programs to improve the competitiveness of South Africa's mining industry.
- Introduce tax incentive schemes for exploration projects in order to attract investment into the exploration sector.

CHAPTER 12

CONCLUSION AND RECOMMENDATIONS

12.1 Importance of Labour in Pre-modern Mining and Early Modern Mining

In Chapter 2, it was demonstrated that both indigenous mining and early modern mining played a crucial role in the economic development of South Africa and southern Africa. However, in both cases, mining activities were labour intensive and the availability of labour was critical to the success of mining operations. Whilst information regarding the availability of labour during the ancient mining era is sketchy, there is no doubt that outbreaks of disease and war negatively affected mining operations; and, in some instances, led to the cessation of operations. This situation was compounded by the arrival of European settlers and traders (e.g. the Portuguese), who destroyed these ancient mining activities.

It was, furthermore, shown in Chapter 2 that the early days of modern mining were besieged by a widespread shortage of labour. Both the diamond diggings of Kimberly, and the large gold mines in the Witwatersrand basin, experienced a chronic shortage of labour - a shortage exacerbated by appalling conditions on the mines and the inhuman treatment of Blacks. The early days of modern mining were also closely linked to politics, with business continuously lobbying government to introduce laws and practices that would benefit them. Unfortunately, many of the resultant laws and practices were subsequently used to entrench racial discrimination in South Africa during the National Party government era.

In short, Chapter 2 provides an overview of labour challenges faced by the mining industry from pre-modern to early modern times and reveals the role played by politics, government and business in addressing these challenges – leading to the conclusion that labour has always played a vital role in the development of South Africa's mining industry.

12.2 Status of South Africa's Mining Industry

In Chapter 3, it was shown that the nigh 100 years of modern mining in South Africa has resulted in the creation of a world-class mining industry that is supported by a strong institutional frame work comprising a number of role players. The key players are government (represented by the DME), business (principally represented by the Chamber of Mines) and labour (chiefly represented by the NUM). The emergence of BEE companies resulted in the creation of SAMDA, an association that represents small and junior South African mining companies.

The industry is supported by three key research institutions, namely: the CGS, CSIR and Mintek. Government has recently restructured the DME to, inter alia, address issues relating to downscaling. With regard to research institutions, the main concern relates to an increasing focus on commercial activities at the expense of scientific research – perhaps this was the reason for the insufficient attention paid by these organisations to downscaling matters in the past. The institutions have, therefore, failed to act timeously and so play a significant role in respect of research relating to downscaling. In fact, had the three institutions mentioned above, and the Human Science Research Council (HSRC), commenced research during the Expansion Period (Period 2), the current crisis in the industry could have been controlled considerably. Nonetheless, the recent involvement of these institutions in respect of downscaling is commendable.

With regard to its contribution to the economy, in 2006, the mining industry (led by the success of the gold mining sector for many years), accounted for: 32,2 per cent of total exports; 7,9 per cent of total GDP; 6,1 per cent of total GDFI; and 0,3 per cent of total state revenue from taxes (Mwape et al, 2007). Whilst the country benefited enormously from mining in the past, there are indications that the industry has recently entered a downscaling phase and that the relative importance of mining to the economy is declining - as demonstrated by the following:

- Mining's contribution to GDP dropped from over 20 per cent in 1980 to 7,9 per cent in 2006;

- Mining's contribution to total exports dropped from 62 per cent in 1980 to 32,2 per cent in 2006;
- Mining's contribution to fixed direct investment dropped from 11 per cent in 1980 to 6,1 per cent in 2005;
- Employment levels dropped from 792 745 in 1980 to 458 600 in 2006 (gold mining being the most affected industry); and
- Employment dropped from 9 per cent of economically active people in 1980 to 2,7 per cent of economically active people in 2005.

Downscaling in the industry has affected not just South Africa, but has also resulted in thousands of employees from neighbouring African countries losing their jobs - impacting negatively on the economy of the larger southern Africa region. However, it was shown in Figure 3.10 that: the number of employees from South Africa and Lesotho declined considerably; whilst those from Mozambique increased, as mining companies were of the opinion that Mozambicans were more reliable and trustworthy employees, and less likely to become involved in strikes.

In summary, the over 100 years of mining in South Africa created a world-class mining industry, supported by several government and business institutions. In recent years, the relative contribution of the mining industry (especially the gold mining industry) to the economy has been declining. The industry has also been downscaling and shedding jobs at an alarming rate – with the most affected sub-sector being the gold mining industry.

12.3 The Gold Mining Industry and Downscaling

It was demonstrated conclusively in Chapter 4 that the gold mining industry is in decline and that it has been downscaling for a number of years, as is evident from the following:

- Gold reserves are expected to be depleted by 2030;
- Gold production has declined from 600 tons in 1980 to 272 tons in 2005; and

- Employment has dropped from 476 398 in 1980 to 159 000 in 2006.

Downscaling in the gold mining industry has had a negative effect, not only on the economy, but also in creating a massive environmental liability for the country. In fact, it is glaringly apparent that the country was caught unprepared for the environmental degradations resulting from downscaling. The challenge for stakeholders is to find solutions for the environmental legacies that pose a threat to the health of many communities. These legacies include: dust pollution, polluted ground water, as well as health problems relating to occupational diseases. In brief, South Africa's gold mining industry is downscaling at an alarming rate, which is noticeably associated with negative economic, social and environmental problems.

12.4 Events and Factors that Led to Downscaling

In Chapter 5, it was shown that the gold mining industry has gone through three periods between 1960 and 2004, i.e.: the Stable Period (Period 1: 1960-1975); an Expansion Period (Period 2: 1976-1987); and a Downscaling Period (Period 3: 1987- 2004). There is sufficient evidence (as demonstrated in Figure 5.1, for example) to conclude that the current downscaling was triggered by a combination of socio-political and economic factors. The socio-political factors related to uncertainties resulting from strong unionisation on the mines and the commencement of negotiations for a new political dispensation for South Africa. The economic circumstances were largely driven by several critical business factors during Period 3 (Table 5.8). These factors included:

- Depressed dollar and real rand gold prices – The trends of the two factors, more or less, mimic employment trends (Figures 5.3 and 5.6).
- Declining ore milled and ore treated – The trends of the two factors, more or less, mimic employment trends (Figures 5.7 and 5.9).
- Declining gold production – Gold production has been declining since 1972 (Figure 5.11).

- Declining gold grades – Gold grades have been declining since 1972 (Figure 5.13). This decline is one of the most important problems facing the gold mining industry of South Africa.
- Declining real rand revenue – Real rand revenue trends, more or less, mimic employment trends (Figure 5.17).
- Containment of real rand working costs - Although not to the same extent as the real rand revenue, ore milled, ore treated, dollar gold prices and real rand gold prices, real rand working costs, more or less, mimic employment trends (Figure 5.21). The industry battled to contain costs through, amongst others, reduction of the number of employees.
- Declining real rand working profits – The overall trend of working profits also reveals a close association with employment (Figure 5.24).

There are a number of factors that play a role in influencing employment at any particular moment. In Chapter 6, it was shown that multivariate statistical regression techniques can be used to identify the significant factors that affect employment, and therefore downscaling, in any particular period. In this regard, statistically significant factors were used to develop the following regression models:

Overall period:

$$\hat{Y} = 379995 + 417.35 x_4 - 446.89x_7 - 5.59x_{11} + 6.37x_{12} + 0.50x_{13} - 217838x_{15} + 2754.71x_{16} - 2734.06x_{17} \quad (3)$$

Predicted employment is represented by employment ($\hat{Y}$) and significant business factors are: nominal rand working revenue per ton milled (X_4); nominal rand working costs per ton milled (X_7); ore milled (X_{11}); ore treated (X_{12}); gold production (X_{13}); productivity in terms of gold produced per employee (X_{15}); productivity in terms of ore milled per employee (X_{16}); and productivity in terms of ore treated per employee (X_{17}).

Overall Period:

Period 1:

$$\hat{Y} = 442995 + 8.35x_{12} - 3432.96x_{17} \quad (4)$$

Predicted employment is represented by $\hat{Y}$ and significant business factors are: ore treated (X_{12}) and productivity in terms of ore treated (X_{17}).

Period 2:

$$\hat{Y} = 498471 + 0.37x_{13} - 199223x_{15} \quad (5)$$

Predicted employment is represented by $\hat{Y}$ and significant business factors are: gold production (X_{13}); and productivity in respect of gold produced per employee (X_{15}).

Period 3:

$$\hat{Y} = -253372 + 643.34x_5 + 7.24x_{11} \quad (6)$$

Predicted employment is represented by $\hat{Y}$ and significant business factors are: real rand revenue per ton ore milled (X_5); and ore milled (X_{11}).

All four regression models ((3), (4), (5) and (6)) show relatively high coefficient of determinations ($R\text{-square}=0.99$), suggesting that the respective significant factors reasonably explain changes or variation in employment. For example, the model for Period 3 (6) would account for 99 per variability in employment. The reliability of the regression models is further demonstrated by the plots of actual employment against predicted employment (Figures 6.1, 6.2, 6.3, 6.4 and 6.5). The predictive techniques could prove a valuable tool for policy makers and mine operators in managing downscaling in South Africa's mining industry. However, it must be noted that the models provide an indicative figure (number of employees) that should be complemented with practical knowledge on the impact of several economic factors, such as the effect of a varying gold price on the viability of mining.

In summary, the historic analysis reveals that South Africa's gold mining industry has undergone three distinct periods between 1960 and 2004; an examination of trends and events in the industry leads to the conclusion that the Downscaling Period (Period 3, 1987-2004) was triggered by a combination of socio-political events and unfavourable economic factors. Whilst qualitative analyses can provide fairly good information about the relationships between individual business factors and employment, statistical regression models provide (to a large extent) reasonably reliable tools in terms of predicting employment levels in the gold mining industry of South Africa.

12.5 National Initiatives to Manage Downscaling

National initiatives put in place to address downscaling can be subdivided into three phases, i.e.: Phase 1 (Reactive phase), Phase 2 (Policy development phase), and Phase 3 (Implementation phase) (Figure 7.1). Unique to these national initiatives is their tripartite nature – participants in all the initiatives involved government, labour and business. Tripartism promoted a spirit of inclusiveness amongst participants and created an avenue for dialogue to take place on critical issues facing the mining industry.

Both the Gold Crisis Summit and the Mining Summit (held during Phase 1 and Phase 2 respectively) were, to some extent, successful in the sense that positive proposals were agreed upon by government, labour and business. The GCC (a committee created to implement the Gold Crisis Summit outcomes) did achieve some of its important objectives, especially in respect of minimising job losses and the conceptualisation of a mining Social Plan. The GCC made it difficult and cumbersome for employers to retrench employees “willy-nilly”. Nonetheless, job losses and downscaling continued unabated, as employers continued to find new ways of reducing the number of employees. With regard to the SPC (committee created to implement the Mining Summit outcomes), the committee also played a vital role in the development of the mining Social Plan.

However, the lack of resources and commitment from some stakeholders inhibited the implementation of some of the GCC and SPC recommendations. Furthermore, most projects could only be implemented by the private sector, which was not always fully supportive of some proposals. For instance, some mining companies have not embraced the idea of increasing the beneficiation of minerals, especially in respect of jewellery fabrication, arguing that their core business and expertise are in mining and not in manufacturing. They also point out that the matter of beneficiation should be left to the markets and entrepreneurs interested in the sector. The legislative process (Phase 3) seems to be addressing some of the impediments preventing the implementation of the GCC and SPC recommendations.

In summary, the process of addressing downscaling in the gold mining industry has passed through three phases, involving three distinct national initiatives. Some of the recommendations emanating from the initiatives are currently being implemented through the legislative process. However, there are still many challenges that the country is facing in respect of downscaling and implementation of the many recommendations that emanated from the activities of the GCC and the SPC.

12.6 Management of Downscaling at Driefontein

An analysis of the management of downscaling at Driefontein provides insight as to how South Africa's mines were affected by downscaling and also into how downscaling was managed. In Chapter 8 it was possible to show that large mines, such as Driefontein, did not escape downscaling and the crisis that engulfed the gold mining industry. However, it is also important to realise that downscaling affected different mines at different times. For instance, it is a fact that nationwide downscaling and the gold crisis commenced in 1987, whereas real downscaling at Driefontein only commenced in 1997/1998.

Downscaling at Driefontein was influenced, by and large, by the same business factors that influenced nationwide downscaling. These factors included: declining

gold production, gold grades, working revenue, and working profits. However, it was shown that Driefontein managed its downscaling by, for example, significantly improving productivity in terms of ore milled and introducing initiatives in the area of human resources, which proved effective and successful. These initiatives included the following:

- Reduction of head office personnel;
- Replacement of contractors by Gold Fields' employees;
- Placing employees on extended leave;
- Releasing employees through natural attrition and medical repatriation; and
- Releasing employees through voluntary separation and early retirement.

In summary, downscaling in the gold mining industry affected different mines at different time periods. It can, furthermore, be concluded that downscaling, both at Driefontein and nationwide, was influenced largely by the same factors inimical to profitable business operations, such as declining gold grades. It is also apparent that, despite the many challenges and their lack of experience, management at Driefontein and Gold Fields successfully managed downscaling at the mine. Some of the important lessons learned from the management of downscaling at Driefontein are discussed below:

- *Planning for future downscaling*

As with most South African mines, management at Driefontein was not prepared for downscaling. As a result, many reactive measures had to be put in place to address problems associated with downscaling. The lesson to other mining companies and governments is that proper downscaling strategies need to be put in place throughout the life of a mine.

- *Ore milled vs gold produced and gold grades*

One of the most important lessons learned in respect of ore milled is that the tendency of pursuing economies of scale - by increasing ore milled to

compensate for declining gold grades and gold production - is an unsustainable strategy that should not be followed by other mines.

- *Consultations between employees and management*

Whilst the issue of retrenchments is unpleasant and often associated with animosity, the consultative process between management and employees, as well as with the GCC resulted in some jobs being saved. This is an indication that proper consultations, though not perfect, can produce desired outcomes.

- *Policy of not retrenching employees*

For many years, Gold Fields practiced the policy of not retrenching employees, even when economic circumstance indicated that there was a need to reduce the number of employees. This policy was definitely not sustainable and only served to postpone the inevitable. Economic circumstances and pressure from shareholders resulted in the company changing its policy of not retrenching employees (Prof R. P. Viljoen, former consulting geologist at Gold Fields, personal communication). The lesson learned on this matter is that whilst it is always important to save and protect jobs, unsustainable measures are not the answer – sustainable measures should be explored and implemented.

- *Short-term measures vs Sustainable measures*

Most of the measures implemented at Driefontein to save jobs and costs were reactive and short-term in nature. For example, the measures relating to extended leave, releasing employees through attrition and early retirement are not sustainable measures for the country, nor for the mine. It is, therefore, important that mining companies and governments incorporate long-term initiatives to address downscaling. For example, sustainable measures need to be put in place to support redundant employees and also attract investment into the mining industry. In this

regard, South Africa (and other countries) can learn from Canada, the United Kingdom and Poland, as discussed in Chapter 9.

12.7 International Experiences

It was demonstrated, in Chapter 9, that downscaling is not confined to South Africa, but is also a major problem in other mining countries. Canada, the United Kingdom and Poland provide many good examples of measures that can be introduced to manage downscaling. Canada provides good examples of proactive and long-term measures for promoting the mining industry and indirectly addressing downscaling. For example, exploration tax incentives are important for the long-term sustainability of the industry. On the other hand, the United Kingdom and Poland present excellent examples of initiatives aimed at providing support to redundant employees and affected communities. South Africa can benefit a great deal from the experiences of the abovementioned countries in terms of developing its own strategy to manage downscaling.

12.8 Strategy to Manage Downscaling in South Africa's Gold Mining Industry

A comprehensive strategy for managing downscaling was proposed in Chapter 11. The proposed strategy aims at streamlining processes and incorporates best practices from other countries. In this regard, the strategy comprises a three-pronged approach, i.e.: national management process, mine management process, and local community management process. Each of the management processes requires the implementation of appropriate measures, initiatives and processes to address downscaling during the different phases of mining development. The core of the strategy is based on an integrated management approach, which requires the establishment of the necessary institutional structures and the setting up of appropriate measures in respect of the three phases of managing downscaling, i.e.: monitoring phase, notification phase, and retrenchment phase (Figures 11.1a and 11.1b).

12.9 The Future and Summary of Key Recommendations

Some of the key factors that could affect the future of South Africa's gold mining industry were discussed in Chapter 10. These factors can be grouped into economic, socio-political, institutional support and environmental factors. Whilst there are many uncertainties in respect of most of the factors, there is one thing that is certain about the gold mining industry: the industry has a limited life and the current downscaling will continue well into the future, which will result in misery for many mineworkers and affected communities in the southern African region. The solution lies in the implementation of comprehensive recommendations and strategy, as proposed in Chapter 11. A summary of key recommendations is presented below.

12.9.1 Key recommendations in respect of economic factors

Economic factors

a) Promotion of gold utilization to increase and sustain demand

Increased demand for gold will benefit South African mines and it is, therefore, important that stakeholders participate in programs aimed at addressing this matter.

Recommendation

- Government and business must jointly increase their support of current R&D programs on the usages of gold.
- Gold mining companies must be encouraged to join the World Gold Council and thereby provide support to the organization's programs that are aimed at promoting global gold usage. Other mining companies, operating outside South Africa, must be lobbied to join and provide support for the World Gold Council.

b) Managing costs and improving productivity in the industry

The sustainability of the industry will largely depend on the success of the industry in managing the expected increase in costs, as well as with implementing effective productivity improvement programs.

Recommendations

- The industry should, on a regular basis, hold forums to discuss and develop strategies for reducing costs, improving profitability and improving productivity. The proposed National Downscaling Agency should be tasked to facilitate such forums.

c) Lack of ore reserves and declining grades

The lack of new ore reserves and declining gold grades does not augur well, nor lead us to expect a brighter future for employment in the gold mining industry. The Canadian-style approach of promoting the industry through, amongst others, exploration incentives and sustained research programs should be adopted.

Recommendations

- Appropriate and sustained funding must be made available for targeted gold mining research programs in respect of: geosciences surveys and research, mining technologies (especially for deep mining), and mineral processing technologies.
- Sufficient resources need to be injected into R&D on mechanisation of the industry to enhance capabilities of exploring deeper gold resources. However, a balance must be struck between job preservation and mechanisation as the country has a high unemployment rate.
- Investigation and introduction of exploration incentive schemes to attract investment.

d) Diversification and beneficiation

Gold Mining is not a sustainable economic activity and it is, therefore, imperative for stakeholders to diversify the economies of towns and communities that depend on gold mining. Diversification of the economies could include promoting agricultural activities and manufacturing of mining related input goods. In this regard, the Enterprise Zone concept used in the United Kingdom should be

investigated in respect of transforming adversely affected mining towns into Enterprise Zones. Adding value to minerals does not necessarily mean beneficiation, as is often stated. It is a fundamental element of sustainable development and entails ensuring that depletion of remaining resources is offset by an equivalent increase in man-made capital; this is often referred to as societal capital or material stock (Young et al, 2001). Education of people can be regarded as societal capital, whilst material stock would include the traditional products of beneficiation. According to Otto and Cordes, (2000) an appropriate portion of the proceeds should be invested into activities that will continue to create economic well-being after mining ceases to exist.

Recommendations

- A concerted effort should be made to promote diversification and adding value in respect of current gold mining activities. Diversification programs should also include promotion of tourism and agriculture.
- Government should explore the possibility of providing incentives for companies that are directly involved in diversification and beneficiation programs.
- Transforming of adversely affected towns into Enterprise Zones should be investigated. Calertonville/Merafong and Welkom/Matjhabeng could serve as ideal pilot projects.
- The beneficiation of gold should be promoted and encouraged; institutions such as CSIR and Mintek should be encouraged and given incentives for involvement in gold beneficiation research projects.
- With regard to societal capital, a significant amount of gold mining rent should be channeled into education and the development of diversified skills in communities that are directly affected by gold mining.
- The future of the mining industry of South Africa lies, inter alia, in the successful introduction of advanced mechanisation but not enough research has gone into the mechanisation of South Africa's gold mining industry.

12.9.2 Key recommendations in respect of socio-political and governance factors

Re-training of employees and counseling of redundant employees

Unless serious and effective interventions are put in place, the future of most mine employees is without doubt gloomy and it is essential to implement proactive initiatives. Some of the important initiatives should involve re-training employees to equip them with portable skills, whilst they are still employed on the mines. However, Smith (1994), in his study on the needs of retrenched workers, has pointed out that short-term re-training of retrenchees provides limited positive effects; therefore more costly long-term training programs are required in order to make a significant impact.

Redundant employees are often devastated by the news of losing their jobs. In most cases, no emotional support is provided to these employees, who are often left to integrate themselves into their communities. In addition, some employees lack financial skills and often end up destitute after a few months, despite being paid a severance package.

Recommendations

- Government should consider providing incentives to employers for portable skills training programs.
- A National Downscaling Skills fund should be established.
- In instances where retrenchments are to take place, employers should be requested to provide emotional and financial counseling to redundant employees – this should be part of the now legislated Social and Labour Plan.
- Programs that integrate employees into local and labour sending communities should be explored.
- Establishment of an appropriate insurance fund, which could pay out reasonable funds to retrenched employees, must be investigated.

Availability of labour

Unlike in the early days of modern mining, the gold mining industry does not face the threat of a shortage of labour. The industry relies on relatively low-skilled labour, which is in abundance in the southern African region. However, despite the abundance of low-skilled labour, the industry is currently facing two main threats, namely: HIV/AIDS pandemic, and a shortage of artisans and skilled employees.

Recommendations

- The industry needs to continuously train and educate employees in terms of required technical skills and basic literacy education to ensure future availability of employees with functional skills.
- In terms of HIV/AIDS education, awareness and treatment programs need to be intensified. Joint government and industry programs must be initiated in all mines and mining communities.
- Review of current MQA skills development programs must be undertaken with a view to proposing effective programs that will address the shortage of artisans.
- In terms of professional skills, government must increase and sustain its support to tertiary institutions and ensure that effective strategies are put in place to retain and attract staff at the institutions.

Political and policy environment

Whilst the country is politically stable and there are no foreseeable possible political instabilities, the current leadership changes in the ruling party need to be managed properly by relevant bodies, in order to ensure that investor confidence is maintained at all times. The current implementation of unprecedented policy reforms also needs to be managed properly and effective communication needs to be put in place to assure investors and other stakeholders.

Recommendations

- Government must hold regular discussions with mining companies and financial institutions to address concerns and perceptions on policy and political issues.
- A national program that educates people about the importance of attracting foreign investment into the country needs to be introduced. Radio and television can play an important role in such a program.
- Government must ensure that an enabling legislative regime, specific to the gold mining industry, is put in place so as to attract potential investors in both gold exploration and existing gold mining operations. The Canadian flow-through tax incentive scheme should be introduced to attract investment into the exploration sector.

12.9.3 Key recommendations in respect of institutional support factors

Current stakeholder organisations (e.g. NUM, Chamber of Mines and SAMDA) serve a useful purpose. It is thus important to encourage their continued existence and to ensure that they take a proactive approach in addressing future downscaling in the mining industry.

Government structures include government departments and government regulatory and research institutions. Whilst the institutions do serve a need, a focused and dedicated approach is needed to address current and future downscaling in the country. In terms of the proposed strategy to manage downscaling (Chapter 11), three key institutional structures need to be established at national, mine and local community levels. At national level, it is recommended that a downscaling focused institution (National Downscaling Agency) be established to address current and future downscaling issues. The establishment of the institution will require a special legal framework. The legal framework must also incorporate the establishment of institutional structures, at mine and community level.

Recommendations

- Labour unions and business organisations should be encouraged to proactively address downscaling issues.
- Legislation should be introduced to establish downscaling institutional structures and the recommended processes for managing downscaling. In this regard, the National Downscaling Agency, Future Forums and Local Adjustment Committees must be established. The three institutional structures should be tasked to develop and update regression models for predicting employment and therefore possible future downscaling.
- The government research institutions (CGS, CSIR and Mintek) should be encouraged to become involved in research programs that will address the negative impact of downscaling and to proactively explore ways of creating or preserving jobs in the mining industry. In this regard, research programs could, inter alia, focus on the following:
 - Addressing current and future physical environmental degradation associated with downscaling.
 - Creating and preserving jobs through exploring increased mechanisation on the mines and through identifying additional resources and reserves.

12.9.4 Key recommendations in respect of environmental factors

Legacies of the past (environment)

There is no doubt that the environmental degradation that started some 100 years ago will remain a challenge for the country for many years to come. Environmental problems, including polluted ground water and dust pollution, are likely to increase with the expected increase in downscaling.

Recommendations

- The country should put in place a comprehensive strategy to deal with environmental legacies and the looming problem of polluted groundwater.

Possible future occupational health litigation

Former and present mineworkers are becoming increasingly aware of their rights in respect of occupational diseases; the likelihood is that employees might feel aggrieved at contracting diseases related to their working environment and could institute legal proceedings against mining companies. The industry should prepare itself for the possibility of an increase in future litigations, especially from retrenched former employees, who often become destitute after a few years.

Recommendations

- The appropriateness and adequacy of current compensation for people who contracted occupational diseases, such as silicosis, should be assessed.
- Companies should explore the possibility of investing sufficient funds to cater for possible future litigation in respect of occupational diseases.

12.9.5 Legislative requirements

The proposed strategy to manage downscaling, as well as the accompanying institutional structures and programs, will need to be legislated in order to ensure effective implementation. The key elements of the strategy that would need to be legislated are presented in Table 12.1 below.

Table 12.1 Summary of key elements of the strategy to manage downscaling in South Africa's gold mining industry and the proposed legislations.

Institutional Structure	Downscaling Funds	Downscaling Programs	Req
○ National Downscaling Agency (National level) ○ Future Forums (Mine level) ○ Local Adjustment Committee (community level)	○ National Downscaling Enterprise Fund ○ National Downscaling Skills Fund	○ National Research Programs ○ National Mining Investment Attraction Programs ○ National Programs to Promote Usage of Gold ○ Life Skills Training Programs	○ L to ○ f - In - D - N - R

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