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ANALYSIS OF SOUTH AFRICA'S NON-FUEL MINERAL EXPLORATION EXPENDITURE TO ASSESS INVESTMENT CLIMATE IN THE MINING INDUSTRY IN THE POST-APARTHEID ERA.

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A research report submitted to the faculty of Engineering and Built environment, University of Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Mining Engineering.

Johannesburg, 2021

DECLARATION

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ABSTRACT

The research analysed the impact of the Minerals and Mining Policy of 1998 as a document that laid the philosophy and the foundation of the role of the mining industry in the South African economy in the new democratic dispensation. This document sought to transform the industry to include the participation of the previously disadvantaged people due to apartheid policies and the goal was to be achieved with minimal disruption to investment and sustainability in the industry. The Mineral and Petroleum Resources Development Act 28 of 2004 (MPRDA) underpins the legislative framework to realise the aspirations expressed in the mineral policy.

Two decades have passed since the publication of the Minerals and Mining Policy in 1998 and the mining industry has gone through fundamental changes both locally and internationally. Both the Minerals Policy and the ensuing legislations were analysed to gauge how responsive they have been to the changing environment in terms of sustainability of the South African mining industry. This was examined through the integration of exploration expenditure, discovery of new deposits or mines, and production output of gold, platinum, copper and diamond in the past two decades. The purpose of this research was to identify shortcomings of the current mining sector regulatory environment that has led to a shrinkage in investment, especially greenfields exploration, in the in South African mining industry.

The research results illustrate that despite South Africa's massive mineral endowment, exploration investment expenditure and production output in the mining industry has continued declining in the past two decades. It is postulated that the shift in post-apartheid mineral regulation and legislation was intended mainly to dismantle apartheid injustices and policies with less effort devoted to growing and sustaining an industry that is in decline. As a consequence, South Africa has failed to deploy the right policy instruments to stimulate mineral development and attracting investment to improve the lives of the people on the back of the massively rich mineral endowment.

ACKNOWLEDGEMENTS

Through this journey I have come to learn about the fascinating role mining has played, and continue to play in the both the South African and global economy. It has been a very wonderful experience to learn about the intertwining nature of emergence of mineral exploitation and rise of economic prosperity.

I wish to express my deepest gratitude to the following people and organisation for their contribution in the course of conducting this research project:

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CONTENTS

1 INTRODUCTION 1

1.1 Chapter overview 1

1.2 Background 1

1.2.1 Development of the South African mining industry 1

1.2.2 Contribution of the mining industry in the post-1994 economy in South Africa 3

1.3 Problem statement 4

1.4 Using exploration expenditure to gauge mining investment climate 5

1.5 Research objectives 6

1.6 Research design 7

1.7 Research methodology 10

1.8 Limitations 11

1.9 Summary of chapter and structure of the report 11

2 LITERATURE REVIEW 13

2.1 Chapter overview 13

2.2 Evolution of mineral regulatory systems 13

2.2.1 Potential impact of mineral production to national economy 13

2.2.2 Factors underpinning mineral regulatory systems in developing countries 15

2.3 Impact of mineral regulatory systems on resource development 17

2.3.1 Life cycle of a mineral deposit 17

2.4 Historical mineral development and growth of the South African mining industry 20

2.4.1 The British hegemony and gold: 1910-1948 21

2.4.2 Rise of Afrikaner hegemony: 1948-1961 22

2.4.3 Collaboration of state and industry: 1961-1976 22

2.4.4 State survival and total onslaught: 1976-1994 23

2.4.5 Redistribution of wealth and privilege: 1994-2012 23

2.4.6 Challenge to the tripartite alliance: 2012-present 23

2.5 Chapter summary 23

3 MINERAL REGULATION AND LEGISLATION IN POST APARTHEID SOUTH AFRICA 24

3.1 Introduction 24

3.2 Development of the post-apartheid mining regulation environment in South Africa 24

3.3 South African mining regulatory environment 26

3.3.1 Acquisition of mineral rights 27

3.4 Mineral rights ownership 28

3.4.1 Socio-economic requirements for granting of mineral rights 29

3.4.2 Problems with the administration of mining permits 32

3.5 Mining tax system in the post-apartheid era 34

3.6 Regulatory factors contributing to shrinkage of mining investment in South Africa 36

3.6.1 Ambiguous provisions in the MPRDA and Mining Charter 36

3.6.2 Discretionary powers of the Minister in the MPRDA 37

3.6.3 Ineffective administration of mining and prospecting rights 37

3.6.4 Lack of transparency in the administration of mineral rights 38

3.6.5 Corruption and maladministration in the DMR 38

3.7 Chapter summary 39

4 MINERAL EXPLORATION IN SOUTH AFRICA 40

4.1 Introduction 40

4.2 The nature of mineral exploration 40

4.3 Drivers of mineral exploration 42

4.3.1 Market environment 42

4.3.2 Exploration environment/Government policy 43

4.4 South Africa's mineral exploration prior to 1994 45

4.5 Factors that influenced mineral exploration in South Africa prior to 1994 46

4.5.1 Political environment 46

4.5.2 Economic environment 46

4.6 South Africa mineral exploration prior in the post-apartheid era 48

4.6.1 Mineral exploration expenditure 49

4.7 Mining projects investment in South Africa in the post-apartheid South Africa 51

4.8 Chapter summary 53

5 SOUTH AFRICAN GOLD MINING INDUSTRY 55

5.1 Introduction 55

5.2 Demand and Supply dynamics of gold 55

5.3 Development of the South African gold mining industry 58

5.4 Gold production in the post-apartheid era 61

5.5 Operational challenges facing the South African gold mining industry 64

5.6 Impact of post-apartheid legislation in the development of the gold mining industry in South Africa. 65

5.7 Chapter summary 67

6 SOUTH AFRICAN PLATINUM MINING INDUSTRY 69

6.1 Introduction 69

6.2 Platinum demand drivers 69

6.3 Platinum supply 72

6.4 Development of the South African platinum mining industry 75

6.5 Platinum production in the post-apartheid era 78

6.6 Operational challenges facing the South African platinum mining industry 79

6.7 Impact of post-apartheid legislation in the development of the platinum mining industry in South Africa. 82

6.8 Chapter summary 83

7 SOUTH AFRICAN DIAMOND MINING INDUSTRY 86

7.1 Introduction 86

7.2 Demand and Supply of diamonds 86

7.2.1 Supply of conflict diamonds 89

7.3 Development of the South African diamond mining industry 90

7.4 Diamond production in the post-apartheid era 92

7.5 Impact of post-apartheid legislation in the development of the diamond mining industry in South Africa. 93

7.6 Chapter summary 94

8 SOUTH AFRICAN COPPER MINING INDUSTRY 96

8.1 Introduction 96

8.2 Copper demand and supply drivers 96

8.2.1 Copper recycling 98

8.3 Development of the South African copper mining industry. 99

8.4 Copper production in the post-apartheid era 99

8.5 Impact of post-apartheid legislation in the development of the diamond mining industry in South Africa. 101

8.6 Chapter summary 102

9 DISCUSSIONS 103

9.1 Mineral projects development in the past two decades 103

9.2 Decline in production of some mineral commodities in South Africa 103

9.2.1 Gold production decline 106

9.2.2 Platinum production decline..... 106

9.2.3 Diamond production..... 107

9.2.4 Copper production decline 108

9.3 Decline in exploration investment in the post-apartheid South Africa 110

9.3.1 Labour productivity.....**Error! Bookmark not defined.**

9.4 Chapter summary 114

10 CONCLUSIONS & RECOMMENDATIONS 115

10.1 Introduction..... 115

10.2 Findings..... 116

10.2.1 Hypothesis 1: There has been a decline in exploration expenditure, especially greenfields projects expenditure, in South Africa since 1998..... 119

10.2.2 Hypothesis 2: The decline in greenfields and brownfields projects expenditure has resulted in the decline of the discovery of new ore deposits and decline of extension of current reserves since 1998 in South Africa. 119

10.2.3 Hypothesis 3: The decline in the discovery of new ore deposits and extension of current deposits has influenced the South African production of key commodities: gold, platinum, copper and diamond. 120

10.2.4 Hypothesis 4: Regulatory framework impediments have contributed in the decline of exploration expenditure of gold, platinum, copper and diamond since 1998 in South Africa..... 121

10.3 Recommendations 122

11 REFERENCES 126

12 APPENDIX 140

12.1 South African gold mining capital expenditure..... 140

12.2 South African platinum mining capital expenditure 148

12.3 Diamond mining capital expenditure projects, 1993-2018 162

12.4 Copper mining capital expenditure projects, 1993-2018 166

12.5 South African mineral exploration projects: 1995-2005..... 169

12.6 Major mining investment projects in South Africa: 2000-2018..... 205

LIST OF FIGURES

Figure 1.1 Location of mineral deposits in relation to rail infrastructure and power stations 2

Figure 1.2: South Africa mining GDP growth rates.....5

Figure 1.3: The contribution of gold, PGMs, copper and diamond into the total mineral exports of South Africa. 8

Figure 1.4 Structure of the report.....12

Figure 2.1 Life cycle of a mineral deposit.....19

Figure 2.2 Schematic representation of the historical development of the South African mining industry regulatory environment 21

Figure 3.1 South African mining legislation in the post-apartheid era. 26

Figure 3.2 South African mineral rent generated between 1970 and 2017 35

Figure 4.1 Global nonfuel exploration expenditure and significant ore-body discoveries.....41

Figure 4.2 Nonfuel global exploration expenditure by commodity; 1975 -2016 43

Figure 4.3 Nonfuel global exploration expenditure by region; 1975 -2016 44

Figure 4.4 South African exploration expenditure in South Africa, 1960-1983.....45

Figure 4.5 South African exploration budget in South Africa, 2000-2017 47

Figure 4.6 Global and South African exploration investment budgets: 2000-2017.....49

Figure 4.7 South Africa's share in African exploration budgets.....50

Figure 4.8 South African exploration project stages: 1995-2018).....51

Figure 4.9 Major mining investment projects in South Africa: 2000-2018.....53

Figure 5.1 Global gold demand.....55

Figure 5.2 World gold supply.....57

Figure 5.3 Major countries where gold mining occurs. 57

Figure 5.4 The seven discreet gold fields of the Witwatersrand basin 58

Figure 5.5 South African gold production and yield from the Witwatersrand basin: 1887-2016 60

Figure 5.6 South African mine gold production from the Witwatersrand basin and average annual price: 1887-2016 60

Figure 5.7 Numbers of years left before depletion of gold reserves in South Africa at the current production rate 63

Figure 5.8 Eskom tariff annual increases for the mining sector 64

Figure 5.9 Sibanye Gold working cost composition 65

Figure 5.10 Gold mining capital expenditure in South Africa: 1993-2018 66

Figure 6.1 Platinum demand drivers 69

Figure 6.2 Global platinum demand by regions 70

Figure 6.3 Global supply of platinum 73

Figure 6.4 Global supply of palladium 74

Figure 6.5 PGMs mines in the Bushveld Complex 76

Figure 6.6 The change in significance of the platinum mining sub-sector in the South African mining industry 77

Figure 6.7 The impact of new mine into the platinum production in South Africa. 79

Figure 6.8 Number of years left before depletion of platinum reserves in South Africa at the current production rate 81

Figure 6.9 Platinum mining capital expenditure in South Africa, 1993-2018 82

Figure 7.1 The diamond market value chain 86

Figure 7.2 Global diamond production by volume **88**

Figure 7.3 Global diamond production value **89**

Figure 7.4 South African diamond mines location **90**

Figure 7.5 South African diamond annual production by weight and major producing mines **91**

Figure 7.6 The impact of legislation on the activities of alluvial diamond mining in South Africa **94**

Figure 8.1 Major copper consumers **96**

Figure 8.2 Global and South African copper mine production **97**

Figure 8.3 Copper and the circular economy **98**

Figure 8.4 Historical sites of copper mining in South Africa **99**

Figure 8.5Average South African mining and copper employment **100**

Figure 8.6 Contribution of total and copper mining to total GDP; 2001-2016 ..... **101**

Figure 9.1 Value of announced capital investment in the mining industry in South Africa . **104**

Figure 9.2 Comparative return on assets of different minerals in South Africa, 2009 and 2013 ..... **105**

Figure 9.3 Best practices versus prevailing regulation mineral potential indexes in South Africa, 2001-2015 ..... **111**

Figure 9.4 Announced mineral exploration projects per commodity in South Africa, 2017 **113**

Figure 9.5 South African labour cost and productivity ..... Error! Bookmark not defined.

LIST OF TABLES

Table 1.1 Contribution of mining and quarrying to gross domestic product, fixed capital formation and total national exports of goods, 2001 – 2016 4

Table 1.2: Key research questions to be addressed this study 9

Table 3.1 New-order mining ownership rights in terms of the MPRDA 27

Table 3.2 Mining charter elements: 2004, 2010, 2017 and 2018. 30

Table 3.3 Mining Charter Scorecard compliance 32

Table 5.1 Major gold mines currently producing in South Africa 62

Table 7.1 Major political and economic events since the start of diamond mining in South Africa 92

1 INTRODUCTION

1.1 Chapter overview

The purpose of this chapter is to give background and motivation of pursuing research in the post-apartheid mining legislation and regulation environment in South Africa and the impact it has had on investment in the sector. South Africa is endowed with mineral resources, however, in the past two decades the country has failed to translate this mineral abundance into economic prosperity. Post-apartheid mineral regulation uncertainty is generally cited as the significant contributor to South Africa's falling production and discovery of new mineral deposits as international investment is directed to other mining jurisdictions in the world. This research study uses the levels exploration expenditure and exploration activities to gauge the impact of post-apartheid mining legislation on the exploration and mining output of gold, platinum, copper and diamond industry in South Africa.

1.2 Background

1.2.1 Development of the South African mining industry

The formal commercial exploitation of mineral resources in South Africa started with copper mining in Namaqualand in the Northern Cape Province in 1852 (Ngcofe and Cole, 2014; Davenport, 2013). The subsequent discovery of diamonds in Kimberley in 1867 and of gold on the Witwatersrand in 1886 catapulted the mining industry into a dominant force in the national economy (Ngcofe and Cole, 2014). Thus, for over a century and a half, the mining industry has been the pillar of the South African economy: both mining of diamonds and gold, coupled with the ensuing discovery of coal, brought about the importance of the mining sector in South Africa (Robinson and von Below, 1990). South Africa was mostly agrarian before the discovery of the diamond and gold. It is the emergence of mining towns that drew some of the rural people from their homelands in search of work in the newly established urban areas and thus mining has been deployed as an effective tool to shape boundaries as well as social and financial structure (van der Merwe, 2011). As the commercial extraction of minerals intensified, there was a need for

abundant and cheap labour to extract both diamonds and gold optimally. Due to these shortages of labour, mine owners and colonial administrators sought to recruit labour across southern and central Africa. However, the process of recruitment of labour often happened in the most violent manner through dispossession of pastoral land and imposition of taxes on traditional leaders (First, 1982). Up until the 1970s Malawi and Mozambique were the major suppliers of migrant workers into the mining industry in South Africa.

Beyond significantly contributing to the country's gross domestic product (GDP), the mineral rent generated from mining activities has provided the much-needed capital for industrial development and provided a network of physical infrastructure such as roads and the rail system (Walker, 2001). Even the establishment of such big cities as Johannesburg, Kimberley, and Richard's Bay was on the back of mineral extraction and processing for the export market (Figure 1.1).

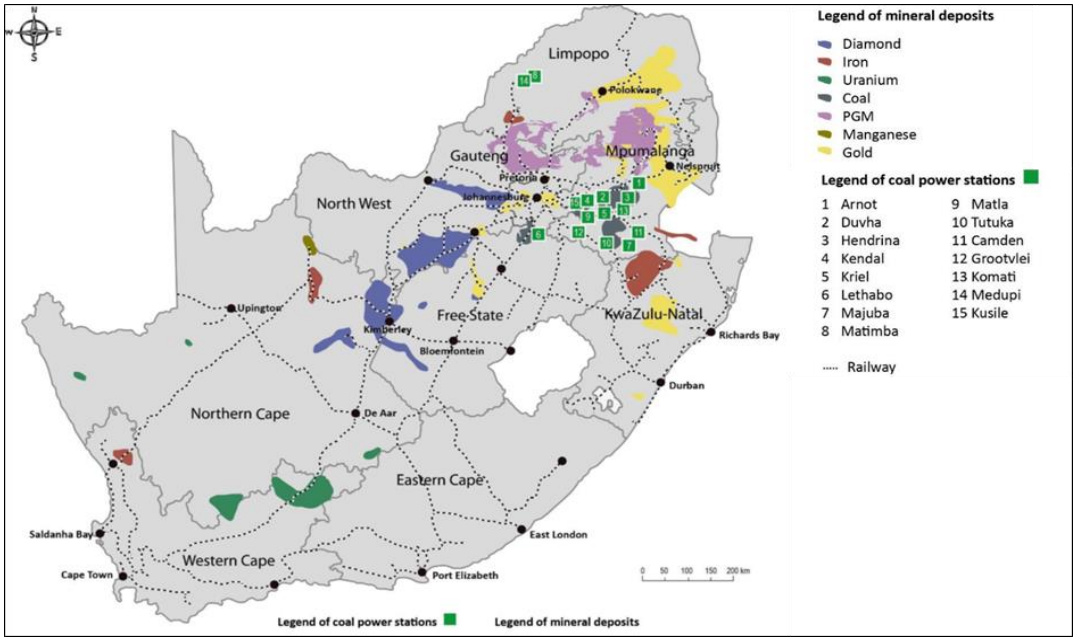


Figure 1.1 Location of mineral deposits in relation to rail infrastructure and power stations

(Source: Chamber of Mines of South Africa, 2015)

1.2.2 Contribution of the mining industry in the post-1994 economy in South Africa

The mining industry in South Africa, once billed as the mainstay of the economy, is now but a shadow of its former glory. In the middle of the 20th century, gold and diamonds dominated the country's export merchandise and mining contributed a quarter of the country's GDP (Davenport, 2013). The South African mining industry has evolved over the past century and a half. For many decades gold was the mainstay commodity and the dominant foreign exchange earner in terms of export mineral products. However, the gold mining sector is now a mere shadow of past glory, with peak production of over 1000 tonnes of gold reached in 1970.

The South African mining sector, despite being regarded as a sunset industry, continues to play a critical role in the national economy (Mabuza, 2016). The industry not only contributes as a foreign exchange earner, contributing 21% to the total exports in 2018 and provides the much-needed employment, it critically provides a fundamental economic base from which economic linkages are developed with other sectors of the economy. The mining industry requires manufactured goods and consumables whereas it supplies raw mineral products for the manufacturing sector in other parts of the economy (Walker, 2001).

The mining industry is not only the bedrock on which the South African economy was built, up until today, it also influences socio-economic dynamics within the country. In 2018 it contributed about 7, 2 % of the GDP; employed about 450 000 people directly, down from 950 000 at its peak in the early 1970s; remains a major contributor as a foreign exchange earner contributing 27% of total foreign exchanges earnings at R333 227 million; and was responsible for 10% of total investment at R91 098 million in the country as illustrated in Table 1.2.

Table 1.1 Contribution of mining and quarrying to gross domestic product, fixed capital formation and total national exports of goods, 2001 – 2016

Year	CONTRIBUTION VALUE ADDED			CONTRIBUTION TO FIXED CAPITAL			CONTRIBUTION TO NATIONAL TOTAL		
	National Gross Domestic Product	From Mining		Total Fixed Capital Formation	GFCF From Mining		Total Exports	From Mining	
	R' million	R' million	%	R' million	R' million	%	R' million	R' million	%
2001	1 020 007	77 214	7.6	151 008	15 871	10.5	328 428	90 833	27.7
2002	1 171 086	92 730	7.9	172 151	19 802	11.5	408 271	109 363	26.8
2003	1 272 537	85 770	6.7	196 999	21 706	11.0	376 158	86 910	23.1
2004	1 415 273	91 198	6.4	226 180	17 917	7.9	394 923	89 673	22.7
2005	1 571 082	105 992	6.7	263 754	16 743	6.3	459 719	102 487	22.3
2006	1 767 422	132 301	7.5	324 083	27 715	8.6	571 540	138 879	24.3
2007	2 109 501	157 672	7.5	435 548	40 628	9.3	706 061	223 901	22.8
2008	2 369 063	197 643	8.3	556 997	59 084	10.6	892 172	300 763	24.7
2009	2 507 676	200 824	8.0	539 440	64 574	12.0	734 015	239 881	23.9
2010	2 748 009	230 350	8.4	529 431	63 555	12.0	820 448	300 891	27.4
2011	3 023 659	261 575	8.7	578 014	68 420	11.8	959 153	370 833	29.4
2012	3 253 852	267 344	8.2	625 643	72 106	11.5	1 015 672	363 756	26.5
2013	3 539 791	288 085	8.1	721 234	79 350	11.0	115 532	385 033	24.2
2014	3 807 677	286 163	7.5	784 418	87 030	11.1	1 270 440	386 350	21.2
2015	4 049 758	284 012	7.0	827 325	89 517	10.8	1 327 951	386 709	20.1
2016	4 336 992	304 362	7.0	849 291	93 352	11.0	1 402 838	423 881	21.0

(Source: Chamber of Mines of South Africa, 2018; Mineral's Council of South Africa, 2019)

1.3 Problem statement

Although the existence of large mineral resources of a variety of elements has been proved in South Africa, the country's reputation as an investment destination with sound mineral policy and regulatory frameworks has been steadily deteriorating over the years. Low commodity prices since 2012 coupled with operational challenges such as depleting reserves and escalating costs, the industry is now faced with robust competition for foreign direct investment. Investors are seeking alternative mineral projects in other mining jurisdictions with perceived stable regulatory environment. For instance South Africa's shares of African mineral exploration expenditures has continued declining with countries such as Democratic Republic of Congo (DRC) AND Tanzania benefitting in the past two decades. Due to non-performance of mining companies, investors are shifting to other sectors of the economy where they expect to derive better returns.

This research seeks to analyse exploration expenditure in the South African mineral industry in the post-apartheid era as a mechanism to gauge the investment climate or investment level in greenfields projects to search for new ore deposits. This

research focuses on the response of exploration funding for gold, copper, platinum and diamonds since the shift in mineral policy and regulatory framework in South Africa between 1998 and 2018.

1.4 Using exploration expenditure to gauge mining investment climate

The first decade of the 21st century was characterised by an unprecedented demand of mineral commodities due to some Asian developing countries industrialising (Chen, 2010). The South African mining industry has experienced minimal growth, only 0, 11% GDP growth from 2001 to 2018, even in the high commodity price environment of the past two decades as indicated in Figure 1.2. The recovery of mineral commodity prices from 2016 to 2018 has not had a positive impact on the mining GDP. The lack of growth of investment in the mining industry has led to closure and mothballing of uneconomic operations resulting in jobs being lost.

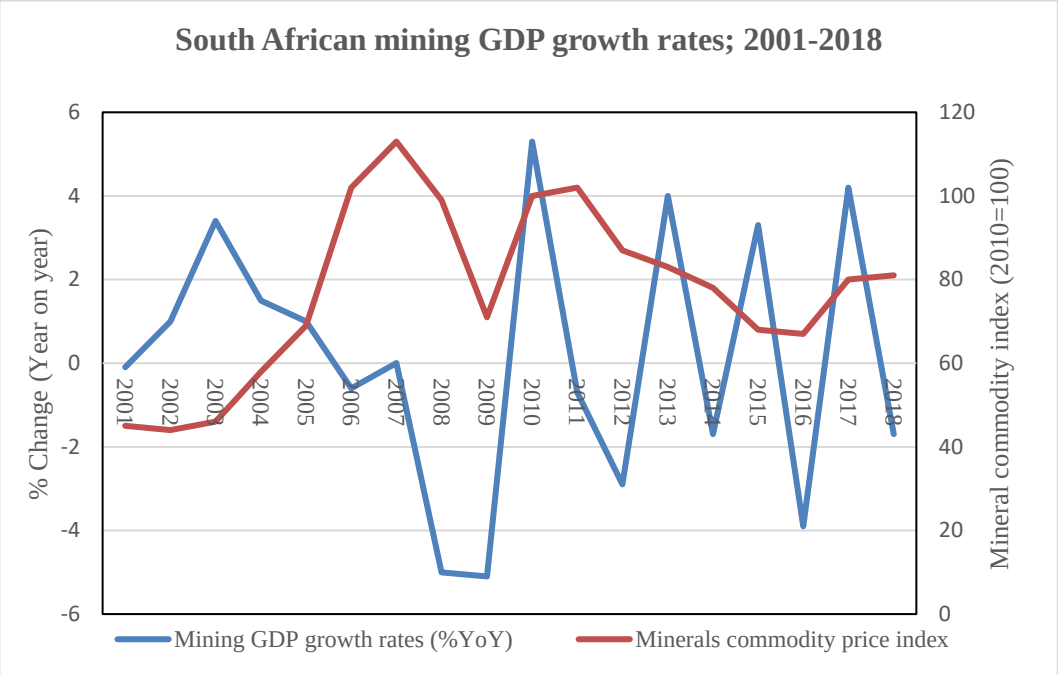


Figure 1.2: South Africa mining GDP growth rates

(Source: Chamber of Mines of South Africa, 201; Mineral's Council of South Africa, 2019)

Lockwood (2016) argued that the greater share of the fixed investment in mining is directed towards servicing infrastructure and brownfield exploration in and around current mining operations. South Africa is a country that depends on private investment to explore and develop its mineral resources. It is therefore prudent for the country to develop a set of robust indicators to gauge its true current investment attractiveness especially since there has been a shift in regulatory framework after the promulgation of the Mineral and Petroleum Resources Development Act.

Although organisations, such as the Fraser Institute, undertake annual surveys of investment attractiveness for exploration in major mining jurisdictions in the world, these surveys are often based on opinions and perceptions of those involved in the industry rather than actual market behaviour (Jara *at el*., 2008). Jara *at el*., 2008, postulated that exploration expenditures presumably respond more quickly to changes in investment climate and reflect actual market participant behaviour as opposed to reported perceptions. Most importantly, Jara *at el*., 2008 found that it is grass roots expenditure on specific commodities, such as gold and base metals, as opposed to the total exploration expenditure, that immediately responds to shift in investment environment.

Although fixed investment in mining has performed relatively better, especially compared to other sectors of economy in the past decade, South African has a smaller proportion, in terms of scale and value, of greenfields projects (Department of Mineral Resources, 2015a; Lockwood, 2016). The decline in greenfields exploration expenditure, and the subsequent decline in the discovery of new mineral deposits in the past 20 years, is a cause for concern in that new mineral deposits discovery is required to continue the exploitation of minerals for the benefit of the economy.

1.5 Research objectives

The aim is to decipher the impact of the shift in mineral regulatory framework, or the uncertainty brought about by this shift, in the post-1994 democratic dispensation in South Africa on mineral investment climate. Furthermore, this research will analyse the impact of exploration expenditure during this period in finding new

greenfields projects and new brownfield extensions and therefore should shed light into the future mining industry output based on estimated available resources and reserves. The mining industry is a critical component of the South African economy and therefore government should amplify its efforts to encourage investment in the industry to ensure sustenance and growth of the industry. By highlighting the level of exploration efforts in discovering new mineral deposits or extending known deposits that are currently being exploited this report, ultimately, aims to encourage and amplify the debate around adoption of mechanisms to attract investment into the industry.

1.6 Research design

The mining industry is a critical component of the South African economy through its contribution as a vital foreign exchange earner and directly employing over 450 000 people. Most importantly, the country's economic growth and development plan is premised on the extraction and processing of minerals. In the past two decades, the country has experienced a significant decline in the production of gold and copper, with improvements registered in the production of platinum and diamonds. This period was characterised by the high demand of minerals driven by the infrastructure-led economic growth of China and other Asian emerging economies (Chen, 2010).

South Africa overhauled its mineral policy and regulation with a view to align it to the democratic ethos that it now embraced post the watershed elections in 1994. One of the critical components of this overhaul was the need to include previously disadvantaged persons to participate and derive value from the exploitation and processing of minerals as the mineral resources belong to all the citizenry. This shift in mineral policy was characterised by the shift in ownership, management and development of the mineral resources within the country for the benefit of the entire nation.

The 'White Paper on Minerals and Mining Policy for South Africa' acknowledged that mining is an international business and therefore, the country has to compete against developed and developing countries to attract both foreign and local

investment. Regulatory changes that were envisaged in this document was to transform the industry while simultaneously creating a conducive environment for increased minerals investment, without disturbing investor confidence.

This research seeks to examine whether changes in the legislative and regulatory environment, carried out in the past two decades, have indeed led to an increased minerals investment as envisaged in the minerals policy of 1998. This research will examine the production output, exploration investment level and the discovery of new deposits of gold, platinum, diamond and copper projects in South Africa in the past two decades. The four mineral commodities are of historical significance in terms of the development of the mining industry in the country and in terms of contribution to export merchandise as illustrated in the figure below, Figure 1.3

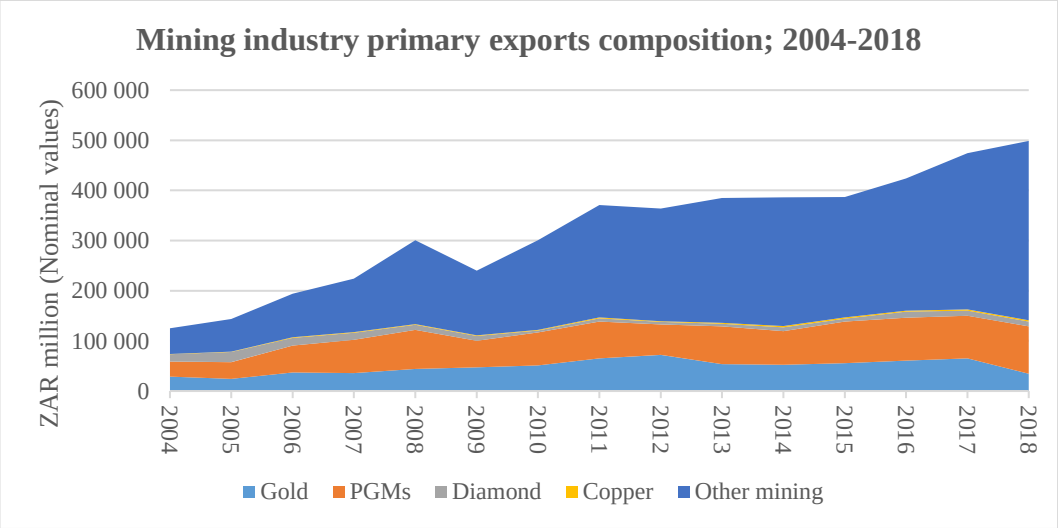


Figure 1.3: The contribution of gold, PGMs, copper and diamond into the total mineral exports of South Africa.

(Adapted: Mineral's Council of South Africa, 2019)

The formal commercial exploitation of mineral resource in South Africa started with copper mining in Namaqualand in the Northern Cape Province in 1852 and therefore this commodity is of historical significance in terms of the understanding of the development of the local mining industry. The discovery of diamonds in Kimberley in 1867 led to an influx of international investment into the emerging

mining industry of South Africa (Mackenzie, 2019). The South African diamond mining industry is the fourth largest diamond producer in the world and remains a significant foreign exchange earner. The discovery of gold on the Witwatersrand in 1886 catapulted the mining industry into a dominant force in the South African economy. Gold mining has, for many years, thus contributed immensely in terms of the number of people employed and mining primary exports - even though this is in decline. Platinum mining has surpassed gold mining as the largest mining employer in 2005 and contributes more in mining primary exports.

This research assessed whether the post-apartheid mineral regulatory framework has prioritised redistribution of the mineral wealth to the historically disadvantaged peoples. It appears that the current mineral regulatory framework has failed to create and sustain a stable environment for mineral development and attracting investment so that more people can participate within the sector meaningfully and find jobs. This research will address the questions shown in Table 1.2 to articulate the research question.

Table 1.2: Key research questions to be addressed this study

<table>
<tr><td><u>Hypothesis 1</u>: There has been a decline in exploration expenditure, especially greenfields projects expenditure, in South Africa since 1998</td><td rowspan="3"><u>Hypothesis 4</u>: Regulatory framework impediments have contributed in the decline of exploration expenditure of gold, platinum, copper and diamond since 1998 in South Africa</td></tr>
<tr><td><u>Hypothesis 2</u>: The decline in greenfields and brownfields projects expenditure has resulted in the decline of the discovery of new ore deposits and decline of extension of current reserves since 1998 in South Africa.</td></tr>
<tr><td><u>Hypothesis 3</u>: The decline in the discovery of new ore deposits and extension of current deposits has impacted on the South African production of key commodities: gold, platinum, copper and diamond.</td></tr>
</table>

1.7 Research methodology

This research uses both qualitative and quantitative data collection methods to resolve the research problem with empirical data and analysis. Both data sets were collected simultaneously, analysed and compared to determine if there is any convergence, differences or some combination (Creswell, 2009). As Thies (2002) succinctly puts it: "An interest in qualitative methods suggests an examination of the presence or absence of certain qualities or attributes in some phenomenon of interest, as opposed to quantitative methods which generally measure the degree to which an attribute is present."

Quantitative research was conducted to test hypothesis 1, 2 and 3 (see Table 1.2). Hypothesis 1 was tested by compiling and analysing the total exploration budgets from 2000 to 2017 to assess the investment level within the mining industry. Due to lack of exploration expenditures for specific commodities within the public domain, exploration activities for various commodities were compiled from public available data on exploration sites of both greenfields and brownfields projects in South Africa since 1998 and was analysed to gauge exploration vibrancy during the period under consideration.

Hypothesis 3 was tested by analysing the production output of gold, platinum, copper and diamond from 1998 to 2018. The impact of major orebodies coming into production were analysed in terms of how they contributed to overall production for each commodity in South Africa. Hypothesis 4 was tested by correlating regulatory changes against changes in exploration expenditures and/or activities and pinpointed the impact of regulatory changes for each mineral commodity being analysed.

Finally, both qualitative and quantitative data were rigorously interrogated and assimilated into the research study churning out outcomes in terms of how the current framework needs to be tweaked to bring about an environment where the South African mining industry can thrive again through sustained investment in greenfields projects investment to replace depleting reserves.

1.8 Limitations

The aim of this research was to critically assess the impact of the policy instruments deployed in the post-apartheid mineral regulatory framework to stimulate mineral development and attracting investment in the South African mining industry. This study examined the relationship between exploration activities, discoveries of minerals deposits and production of gold, platinum, copper and diamond in the post-apartheid South Africa.

Assessing the investment level in the mining industry since the shift in mineral regulation in the new political dispensation in South Africa proved to be difficult due to the lack of publicly available exploration data on individual mineral commodities in the public domain. This study relied on publicly available aggregate exploration expenditure budgets as a way to determine the level of investment in the past two decades.

A combination of administrative incapacity, lack of transparency and publicly available database on mining and prospecting rights at the Department of Mineral and Resources (DMR), where mining companies or the general public could easily track efficiency of the processing of these rights in the past two decades, made it impossible to gauge exploration investment level based on number of processed licenses in the period under study.

1.9 Summary of chapter and structure of the report

Chapter 1 provided the justification for the research work and sets out the background to the research problem and the methodology adopted to solve the problem. The report is structured as indicated in Figure 1.4.

Chapter 2 explored the global historical development of the mineral investment law and policy choices from the mercantilism era to the current environment. Chapter 3 analysed the South African post-apartheid mining and mineral policy, together with the supporting pieces of legislation, with a view to determining aspects that

may have caused an uncertain regulatory environment and led to a shrinkage in exploration investment.

Chapter 4 analysed exploration expenditure in South Africa and globally. This chapter thus looks into possible causes as to what hampered South Africa's ability to attract and compete for greenfields exploration investment compared to other major mining jurisdictions of the world since 1998 when the new mineral regulatory framework was adopted. Chapters 5, 6, 7 and 8 dealt with the production output of the mining industry in South Africa in the past two decades and highlight the impact of lack of greenfields investment in the declining production output of gold, platinum, copper and diamond. Results of the research study are discussed in chapter 9. Conclusions and recommendations are made in Chapter 10.

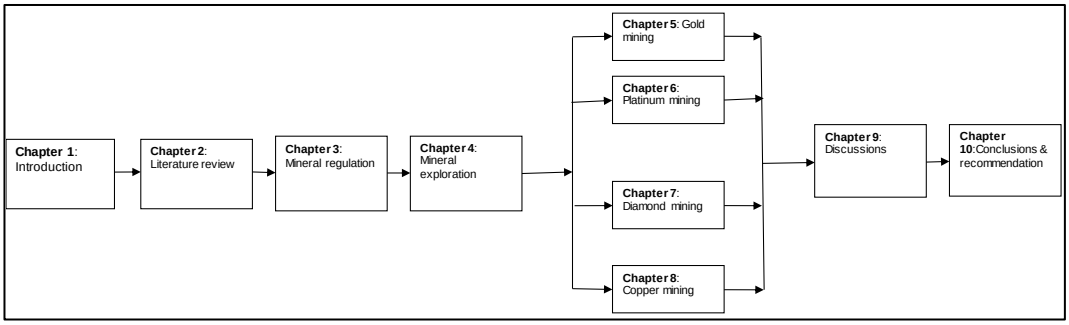


Figure 1.4 Structure of the report

2 LITERATURE REVIEW

2.1 Chapter overview

The aim is to explore the economic and political context in which the regulatory systems have developed from the mercantilism era to the current environment. Section 2.2 and 2.3 of this chapter explore the global historical development of the mineral investment law and policy choices from the mercantilism era to the current environment. Section 2.4 unpacks the evolutionary nature of mineral exploration in the South African mining industry and identifies main factors that shaped the critical pipeline of new deposits. This analysis of the historic nature of the laws affecting mineral exploration activities is critical in laying down the framework for understanding the current prospecting productivity in terms of the shift in mineral policy and regulatory environment in the past two decades.

2.2 Evolution of mineral regulatory systems

Traditionally, dominant prevailing economic theories have shaped policy choices in terms of the role of a government within a free market economy. For instance, during the mercantilism era, conventional economic thinking was dominated by neoclassic economic theory. In this school of economic thought, prosperity is achieved through the allocation of scarce resources through competitive markets and government intervention is limited to enabling a legal framework for competitive markets to prosper. After the great depression of the 1930s, government played a greater role in the economy, for the greater good of the nation to manage unemployment, inflation and external account deficit (Otto and Cordes, 2002). The contribution of mineral production and exports in the national economy is also informed by prevailing economic growth and development theories (Otto and Cordes, 2002).

2.2.1 Potential impact of mineral production to national economy

Since early human development, minerals and metals have provided raw material inputs in the making of hunting tools equipment and providing shelter. In today's

world economy, minerals continue to provide the primary input in energy, building materials and high technology industries, and are responsible for having improved the quality of life in most of developed economies and are associated with the generation of wealth (Freeman and Highsmith, 2014). Revenues generated from the exploitation of the mineral resources can be utilised to drive economic development through sustained economic growth coupled with raised incomes "and bring increased investment in human and physical capital, which will ensure a nation's long-term economic and social success" (Maxwell, 2013).

Income generated from the sales of mineral products alone is not sufficient to fully bring about development in the host country. The mining industry should foster the development of other industries centred on providing the needs of extracting and processing mineral resources through cluster development and thus expanding the economic impact of the industry in terms of providing employment and, most importantly, providing a platform from which future national economic developmental aspirations can be based on (Walker and Minnit, 2006). The rise in global population over the past two centuries has resulted in the increase in mineral consumption as witnessed by the surge in prosperity amongst major economic powerhouses (Freeman and Highsmith, 2014). However, not all nations have succeeded in generating maximum benefits, economically and socially, from the exploitation of the natural resource endowment. The difference between countries that have succeeded in turning the natural resource endowment into prosperity, such as the United States of America (USA), Australia, Norway, etc., and those that have remained in poverty, such as Zambia, Congo, Zimbabwe, etc., is the sectoral regulatory environment under which exploitation was managed (Maxwell, 2013). The recipe for achieving a sustainable mineral export led economic growth for developing countries lies in the ability of the country to diversify the economy through the creation of backward and forward linkages to the mining industry and not only through income generation from mining taxes. Most importantly, the role of the mineral production in the national economy varies depending on the stages of economic development of the host country. For instance, the structure of the economy in developing countries is significantly different to that of developed countries and therefore makes it difficult to encourage pure free market economy.

Governments have to play an active role in the economy to pursue developmental aspirations.

2.2.2 Factors underpinning mineral regulatory systems in developing countries

Otto and Cordes (2002) postulated that the evolution of mineral investment laws in developing countries can be compartmentalised into three eras, namely: The Colonial Era, The Post-Colonial Era, and The Modern Era. Each era captures a prevailing world view based on accepted economic theories and developmental paradigms.

2.2.2.1 The colonial era

Multinational companies ventured into colonial states to access untapped mineral deposits and investors reaped benefits from the price boom created by the increased demand of minerals, especially coal, as the Industrial Revolution intensified. As economic development increased in the aftermath of World War II, it resulted in an increased appetite for minerals and fuels. However, the benefits from exploiting these mineral resources did not filter through to the people in colonised countries due to the colonial political systems. The primary drive for these investors was to acquire mineral raw materials for the colonial power with very little attention paid to the development of the host countries. Therefore, it was difficult for the colonised territories to derive any meaningful benefit from their mineral endowment. Mineral investment agreements in this era constituted sweetheart deals between mining companies and the colonial administrators intended to serve home country interest characterised by low royalties and tax rate income generated from mining projects (Otto and Cordes, 2002). This era ended with the demise of colonialism with many territories obtaining liberation in the 1960s in countries such and Ghana and Zambia in the African continent. However, countries such a Chile experienced the same fate in South America.

2.2.2.2 The post-colonial era

Most resource-rich countries gained independence in the 1960s, such as Ghana and Zambia, many of them embarked on the journey to change their mineral codes to reflect the political ideological inclination of the new governments (Otto, 1996). The revision of mining codes in this era was often emotive with less understanding of the local economic and political situation to advance coherent mineral policy due to colonial injustices. Therefore, filled with anger sprinkled with socialist rhetoric; prime example of this is the complete annihilation of the mining industry in Zambia and Ghana. Host government demanded ownership of mineral projects, at times through nationalisation of mines, and greater control in the decision-making process. This period, starting in 1960 and ending in 1985, was characterised by mining investors refraining from investing in these developing nations and focused on investing in developed countries which were perceived to have stable mineral regulatory frameworks, such as Canada, Australia and the USA (Maxwell, 2013; Otto, 1996).

2.2.2.3 Modern era

Mineral development being capital intensive, governments in developing countries, since the mid-1980s, have had to consider softening their mining codes to attract investment in the sector to then use it as a springboard for economic development (Maxwell, 2013). The most prominent feature of this era is the diminishing role, through ownership or operational decision making, of host countries' governments in mining projects in preference for private investments. Government assumes the role of a regulator in setting up the guidelines and legislative framework for the mining industry to thrive. However, with volatility of commodity prices resulting in cyclicality of revenues, many governments in developing countries have resorted to continuous adjustments to their mining laws as a mechanism to derive more value from mining activities even in times of low commodity prices (Maxwell, 2013). Due to the fact that many parts of the world are now open for mining investment from international companies, this has introduced competition amongst governments for scarce capital for investment.

2.3 Impact of mineral regulatory systems on resource development

Historically, the increase in mineral production and exports has been associated with the economic growth and development through increased foreign exchange earnings in mineral-rich countries (Otto and Cordes, 2002). Mining companies invest in mining projects to achieve adequate return on investment. Governments, on the other hand, wants to generate maximum income from mining projects and achieve their developmental aspirations. It is important to note that it is in the interest of both host governments and mining investors to develop successful mining projects. National regulatory legislations and policies were crafted by host countries to generate high economic rents from resource exploitation, which was previously dominated by a small number of large companies with foreign investment, and foster the development of other industries (Otto and Cordes, 2002).

Since the demise of colonialism in most developing mineral-rich jurisdictions, especially in Africa, successive governments have failed to transform the natural resource endowment for economic prosperity and improving the standard of living of their people. For those pursuing resource-based industrialisation strategies "the formulation and implementation of particular strategy is strongly influenced by: raw materials, capital, and cheap labour" (Walker, 2001). On the other hand, Robinson and von Below (1990) argued the fact "that a country's domestic production of raw materials does not confer a major competitive advantage in the production of advanced beneficiated products" and put emphasis on the skills of the people as source of competitive advantage.

2.3.1 Life cycle of a mineral deposit

Mining companies are in the business of searching for mineral deposits, at a greater financial risk, and once found, developed and mined, at times, at a profit. In that sense an ore-body is a critical component for any mining operation, of which once depleted, the mining operations cease. Mineral deposits occur in certain geological settings, mining operations can only take place where economically and technically viable ore-bodies are located (Peters, 1987). Mineral exploration is, therefore, critical in that the discovery of new economically viable mineral deposits or

extension of current or known orebodies continuously injects reserves that are depleted through production.

Beyond an ore-body being of a sufficient size and grade, the economic viability of mining such a deposit is impacted by a variety of factors called modifying factors such as mining, metallurgical and legal factors. Peters (1987) proposed a life cycle of mineral deposit model, illustrated in Figure 2.1, which is adopted for this research study to rationalise the current decline in some mineral production in South Africa from a dominant position in the past century.

According the model proposed by Peters (1987), the beginning of the mineral deposit cycle starts with the discovery of mineralisation and followed by artisanal high grade workings. This stage is characterised by limited geological knowledge and may take many more years before the whole orebody delineation is fully understood. The improved geological knowledge of the orebody, which represents the next stage of the cycle, is brought about through a successful exploration program. A successful exploration program is followed by development of the orebody providing the requisite infrastructure to optimally exploit the available ore reserves.

Continuous brownfield exploration program during the production phase may lead to addition of extra reserves into the life of mine which dramatically improves production output as compared to the initial estimates. Once peak production is achieved, mining operations are often restructured to match the declining reserves to maintain profitability. The production profile continues to decline until the mining operation is no longer economically viable in which case the property will either be shut down or sold off to another operator who might see some value with the reduction in overhead costs.

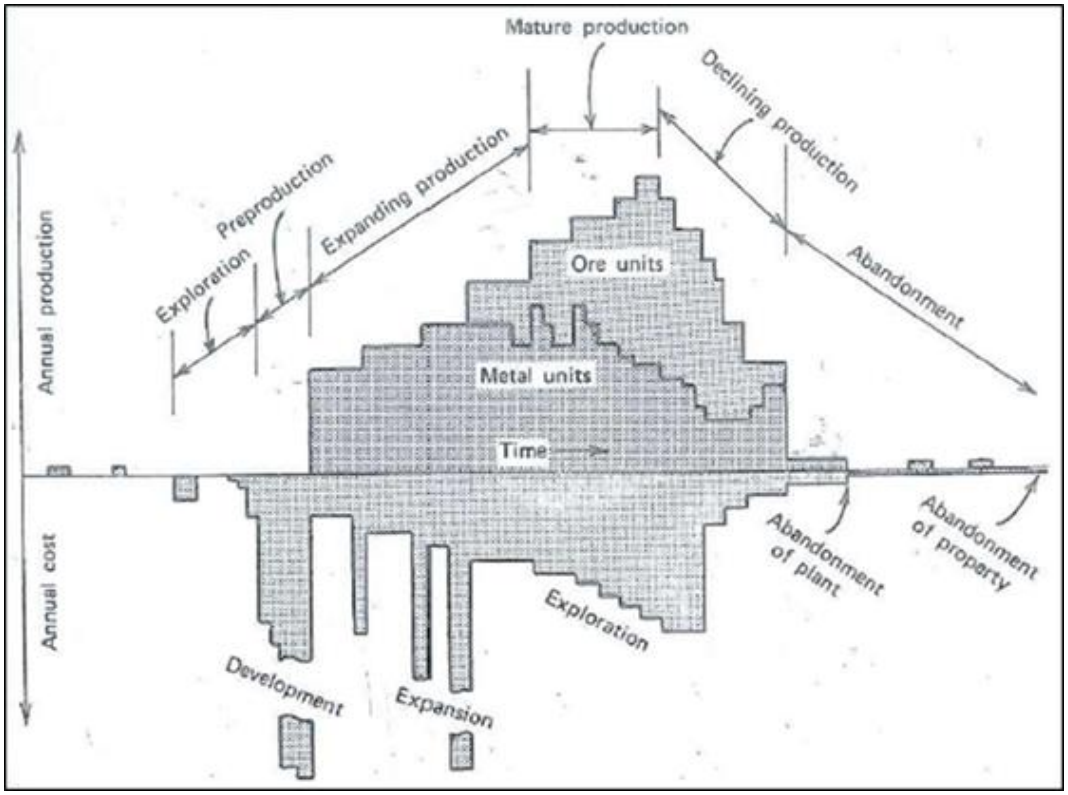


Figure 2.1 Life cycle of a mineral deposit

(Source: Peters, 1987).

Once a mine is in production, prevailing operating environment could impact the viability of an operation. Factors such as the demand and prices of commodities being mined and associated costs of mining impacts the profitability of an operation. Risks associated with mining projects are dynamic. Peters (1987) observed that some ore-bodies have been mined for over 100 years despite lowering grades and increased depth, albeit with interceding breaks, as new efficient mining methods are introduced or as there is an improvement in the mineral price being mined.

The end of mining operations can often lead environmental, economic and social disturbances in the areas where they are located. South Africa is currently battling to manage environmental damages associated with the old gold mines around the Johannesburg area that stopped operating in the 1970s. An intergrated mine closure plan is required to reduce the environmental, ecological, social and economic

damage ounce mines cease to operate. The MPDRA stipulates that mining companies should set aside a financial guarantee for the purpose of rehabilitation once mining operations end.

2.4 Historical mineral development and growth of the South African mining industry

As stated earlier in section 1.4, many mineral-rich countries rely on private investors from all over the world to fund and develop mineral resources for the benefit of their national economies. Prior to the discovery of copper in 1852, with the subsequent discoveries of both diamond and gold in the late 1800s, South Africa was merely a colonial outpost. The discovery of these critical commodities placed the country at the centre of global economic activities with capital fast flowing into the country for the search and further development of mineral deposits (Davenport, 2013).

Prior to the ushering in of the democratic dispensation in 1994, mineral policy was a product of the colonial past and apartheid South Africa (Dale, 1997). Van der Merwe (2011) argued that all the political meddling of the past in the mining industry had the main intention of controlling the industry with a view to long-term sustainability. However, given that mining, especially gold mining, was a major foreign exchange earner for the country, the sector was protected by the government and this led to minimal oversight. Mining companies were left to their own devices in their quest for maximum profit, undesirable strategies were put in place. Firstly, by countering any attempts by the government to regulate the industry; secondly, building in complex mechanisms that avoided liabilities; and lastly, externalising any costs to government where possible such as rehabilitation of mined out areas (Adler et al., 2007). Turton (2016) argued that in terms of the historical development of the mining industry regulatory environment in South Africa, it can be subdivided into six policy paradigms as outcome specific shock events as indicated in Figure 2.2.

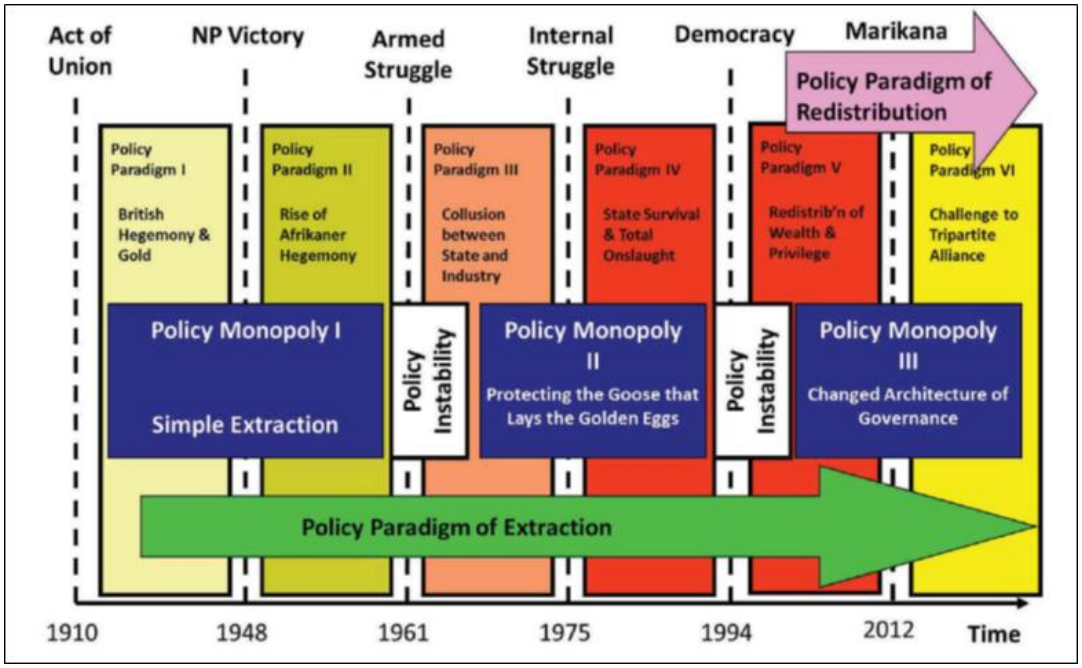


Figure 2.2 Schematic representation of the historical development of the South African mining industry regulatory environment

(Sources: Turton, 2016)

2.4.1 The British hegemony and gold: 1910-1948

During this colonial era, in South Africa specifically, natural resources such as gold were extracted, under heinous underground working conditions often resulting in fatalities or serious injuries to the black migrant workforce, to ensure accumulation of wealth in the United Kingdom with the host country remaining impoverished. This painful period in history has resulted in a mistrust between mining companies and the ANC-led government, organised labour resulting in a tense labour and uncertain regulatory environments. Some of the legislation that came to define this era:

- The Mines and Works Act 12 of 1911 called for the first exclusion of blacks from certain job categories, such as preventing obtaining blasting certificates, in preference of their white counterparts. Also, despite the sustained profits of mining operations, black mine workers received miniscule salary increments;

- The Native Land Act 27 of 1913 prohibited blacks from land ownership in the country except for within an area that constituted 7.3% of the country. As a result of the exclusion, blacks were unable to acquire mineral rights; and
- The Industrial Conciliatory Act 11 of 1924 opened the doors for workers to form trade unions to bargain with employers. However, black workers were not allowed to affiliate with these trade unions or to form their own.

2.4.2 Rise of Afrikaner hegemony: 1948-1961

Although apartheid was formally adopted as government policy in 1945, like any other aspect of the South African life the mining industry, especially, since the emergence of the industry in the late 1800s entrenched practices and laws that perpetuated the exploitation and subjugation of black people:

- The Group Areas Act 41 of 1950 limited the movement of black people and thereby impacting where they could live and seek employment and thus mining companies could access cheap black labour; and
- The Bantu Education Act 47 of 1953 limited the level and type of education received by black pupils and therefore restricted the categories of jobs available to blacks in the economy and thereby preventing blacks from contributing to the mainstream economy.

2.4.3 Collaboration of state and industry: 1961-1976

South Africa faced international isolation and boycotts due to her apartheid policy. To continue benefiting from the tax revenues generated from mining operations, government crafted a regulatory regime that encouraged mineral resource development and investment:

- Mining rights act, 20 of 1967; and
- Expropriation of Mineral Rights Act, 96 of 1969

2.4.4 State survival and total onslaught: 1976-1994

An attempt by the apartheid government to maintain grip on the mining industry, in the sweeping political changing environment, through the enactment of Minerals Act 50 of 1991 and Mineral and Energy Laws Rationalisation.

2.4.5 Redistribution of wealth and privilege: 1994-2012

This period is represented by the transition from apartheid rule to a democratic dispensation where the ANC won majority rule in 1994. The ANC-led embarked on a mission to transform every sphere of government, including the mining industry, to align it with its political ideals by crafting new pieces of legislation to encourage the participation of black people into the mainstream economy and repealing those deemed to enable the subjugation of black people.

2.4.6 Challenge to the tripartite alliance: 2012-present

Since the start of the decline in metal prices in 2002 many operations were either mothballed or completely shut down due to declining profitability. The closures resulted in job losses on a large scale. With less people able to find work in the mining industries, trade union movements had to bear the less of income due to dwindling membership. The fight for membership amongst the trade union movements prompted a wild cat industrial action in the platinum belt which led to the shooting at Marikana. This unfortunate tragedy was followed by a four month industrial action – the longest in the history of South Africa mining industry. The hostility in the labour environment is still very much alive.

2.5 Chapter summary

Although percentage contribution of the South African mining industry has been in decline in the past three decades, the industry is still a critical component of the economy. Although the industry has been, and is still is, shaped by both local and international economic and political developments, mining regulation has always determined the direction the industry pursued.

3 MINERAL REGULATION AND LEGISLATION IN POST APARTHEID SOUTH AFRICA

3.1 Introduction

This chapter analyses the South African post-apartheid mining and mineral policy, together with the supporting pieces of legislation, with an aim to determine aspects that may have caused an uncertainty in the regulatory environment which led to a shrinkage in exploration investment in the sector.

3.2 Development of the post-apartheid mining regulation environment in South Africa

The formulation of the new mineral and mining policy, in earnest, materialised after the election of the new government in 1994, which resulted in the formulation of the government of national unity (Dale, 1997). The main participants were: the Government of National Unity; representing labour was the National Union of Mine Workers (NUM); and representing the mining industry was the Chamber of Mines of South Africa (Mtegha et al., 2006). Several workshops were held amongst stakeholders culminating in the key issues affecting both the mining industry and the South African society at large, being identified and policy positions adopted. The diversity of the stakeholder participants illustrates the deviation from the traditional mineral policy development practice. The main objective was not only to attract the investment into the industry to generate income for government but to also pursue broader social and economic development aspirations. Greater emphasis was also placed on the need to utilise the mining industry as a springboard for reconstruction and development of the economy and the assimilation of previously disadvantaged people into the mainstream economy (Mtegha *et al*., 2006).

The National Constitution of 1996, a supreme law in South Africa, is a product of extensive political debate before the 1994 elections and provided fundamental pillars on which the mining legislation and supporting instruments rest. These policy positions were expounded in the draft green paper which was published on

the 3rd of February 1998 for public comments – a key requirement in the South African constitution (Rocha, 2016). Cabinet approved the White Paper on a Minerals and Mining Policy for South Africa on the 23rd September 1998 and thereby paving a way for the development of the Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA).

The development of the MPRDA took place between 1999 and 2002 (Rocha, 2016). The draft bill was subsequently approved by parliament on 26 June 2002 and the MPRDA became law on the 1st of May 2004 replacing the Mineral Act 50 of 1991 (Rocha, 2016). This Act sought to redress some of the wrongs of the apartheid and colonial era in South Africa that was deeply entrenched in the mining industry. As can be observed from the stated objectives in the preamble of the MPRDA of 2002, a major emphasis was paid to transformation of the industry (MPRDA, 2002):

- Recognising that minerals and petroleum are non-renewable natural resources;
- Acknowledging that South Africa's mineral and petroleum resources belong to the nation and that the State is the Custodian thereof;
- Affirming the State's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources and promote economic and social development;
- Recognising the need to promote local and rural development and the social upliftment of communities affected by mining;
- Reaffirming the State's commitment to reform to bring about equitable access to South Africa's mineral and petroleum resources;
- Being committed to eradicating all forms of discriminatory practices in the mineral and petroleum industries;
- Considering the State's obligation under the Constitution to take legislative and other measures to redress the results of past racial discrimination;
- Reaffirming the State's commitment to guaranteeing security of tenure in respect of prospecting and mining operations; and

- Emphasising the need to create an internationally competitive and efficient administrative and regulatory regime.

3.3 South African mining regulatory environment

South African mining regulatory environment is underpinned by the MPRDA and deals mainly with the acquisition of mineral licenses to conduct reconnaissance, prospecting and mining for mineral resources as illustrated in Figure 3.1. Despite the good intention of creating an internationally competitive and investor friendly environment, there are some of the provisions in the MPRDA that have had a profound impact in the mining industry in South Africa. These provisions are with regards to mineral rights ownership, mechanics of acquiring mineral rights with associated environmental authorisation and water-use license, and the new mining tax system.

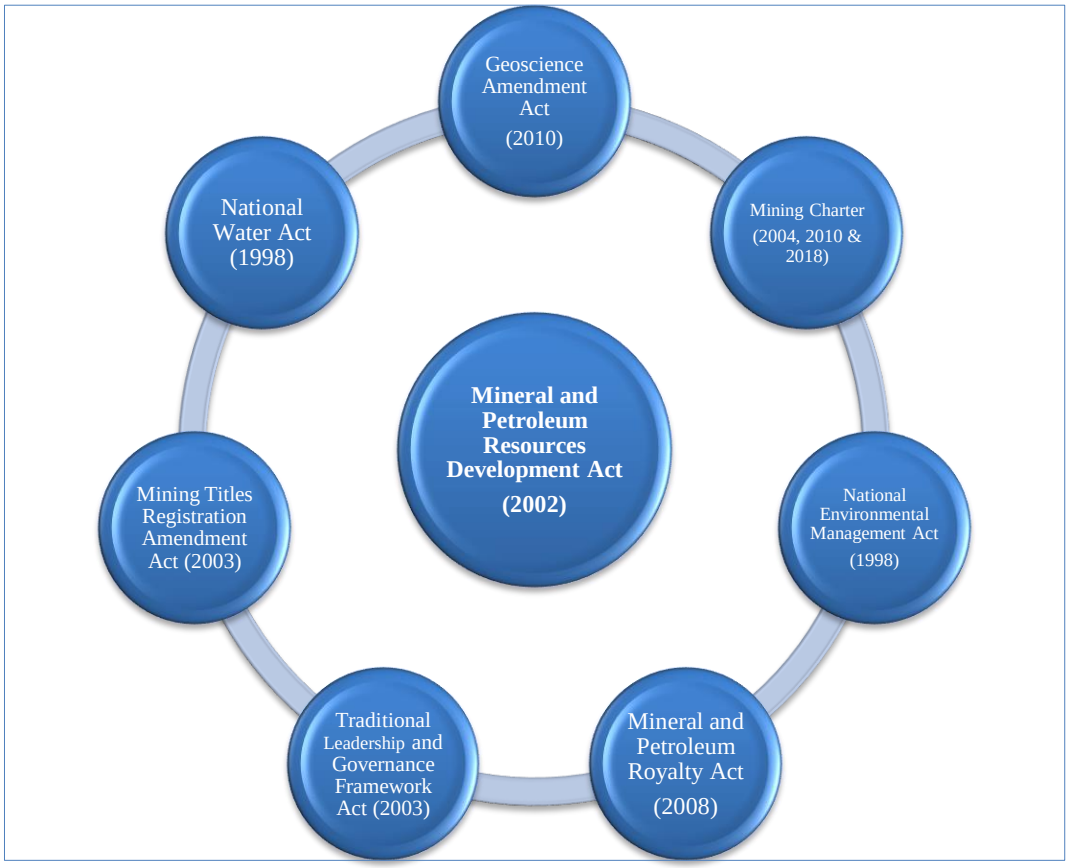


Figure 3.1 South African mining legislation in the post-apartheid era.

3.3.1 Acquisition of mineral rights

The most important aim of legislating the MPRDA was to redistribute the mineral wealth of the nation to include people who were previously disadvantaged due to apartheid rules. In order to achieve this goal government took over custodian of all the mineral resources of the country by stipulating that all "old-order rights' to be returned to the State (Sorensen, 2011). Under this new legislative framework, the 'old-order' mineral rights were replaced by 'new-order' rights which had to be applied for, for both existing and new mineral projects (Sorensen, 2011). The enactment of the MPRDA had a profound impact on the type of mineral rights available and the manner in which they are acquired to conduct reconnaissance, prospecting and mining rights as illustrated in Table 3.1.

Table 3.1 New-order mining ownership rights in terms of the MPRDA

Right	**Duration**	**Description**
Reconnaissance permission	Two-year non-renewable.	Search for minerals by geological, geophysical and photo-geological surveys.
Prospecting /exploration right	Five year, once renewable for three years.	Holder granted exclusive right in regard to an application for a mining right.
Retention permit	Three-year, once renewable for two years.	Holder cannot mine due to market conditions. Exclusive right to apply for and granted mining right.
Mining right	Thirty-year, renewable for an indefinite number of 30-year periods.	Holder granted authority to mine for specific minerals for by specific means within a given time frame.

The authorisation of mineral rights is administered by the Department of Mineral Resources (DMR), under the executive leadership of the Minister, with head offices

situated in Pretoria and each of the nine provinces of South Africa have regional offices headed by a Regional Manager (Stevens, 2017). The application of both the prospecting and mining rights is lodged through the Regional Manager of the DMR in the region where the planned operation is to take place (MPRDA, 2002). Within fourteen days of accepting an application lodge, the Regional Manager is directed by the Act to make known that an application for a prospecting right, mining right or mining permit has been accepted in respect of the land in question. The Act also stipulates that the Regional Manager to inform interested and affected persons to submit their comments regarding the application within 30 days from the date of the notice. Beyond consulting with interested and affected persons in the area where prospecting is to take place, the applicant must apply for environmental authorisation and display to have access to financial resources and has the technical ability to conduct the proposed prospecting operation optimally in accordance with the prospecting work programme (MPRDA, 2002). The applicant must undertake that the exploration activities will not result in intolerable damage to the environment. The Minister must, within 30 days of receipt of the application from the Regional Manager, grant a prospecting right if all legislative requirements are met.

3.4 Mineral rights ownership

One of the significant provisions in the MPRDA is the deviation from the private and ownership of mineral rights towards a setup where government is the only custodian of mineral rights on behalf of the nation. The cancellation of the 'old-order' mineral rights and stipulated that holders of current and future mineral rights ought to apply for the 'new-order' mineral rights of which can be granted at the discretion of the Minister of Mineral Resources subject to the applicant meeting certain socio-economic criteria (Sorensen, 2010).

Once a mineral right is granted under the new mining regime, the MPRDA creates a "use or lose it" principle whereby if a mineral right lays unused it is forfeited. Under the previous legislative arrangement, holders of mineral rights were guaranteed security of tenure under law and transferability of these rights were not

prohibited or subjected to any conditions. Furthermore, under the previous legislative framework, mineral rights could be separated from land ownership, vested with the individual. However, prior to mining taking place, a right holder had to apply for a mining right from the State. Associated with the right to mine, a lease payment or royalty was incurred. Due to this private mineral ownership, mineral exploration was encouraged in that security of tenure was guaranteed. This private ownership of mineral rights, however, had its own downside. For instance, some land owners demanded large amount of options payment from exploration companies interested in their land and this led to an increased cost of exploration in the country (Beukes, 1986). Beukes (1986) further argued that another disadvantage of this system, from a nationalistic point of view, was the fact that when large mining companies owned mineral rights over large tracts of land, such land would remain under explored for some minerals.

3.4.1 Socio-economic requirements for granting of mineral rights

The granting or cancellation of mineral rights is subjected to holders of mineral rights meeting the socio-economic criteria as prescribed by the Mining Charter Scorecard as a mechanism to ensure mineral rights could be distributed equitably. As articulated in Section 100 of the MPRDA of 2002, the aim of the broad-based socio-economic empowerment charter is to set a framework, targets and time-table for "opportunities for historically disadvantaged persons to enter the mining and minerals industry or benefit from the exploitation of the nation's mineral resources" (Mining Charter, 2004). The progress made in achieving the objectives of the Mining Charter is tracked through the Mining Charter Scorecard. To this end, the 2004 Mining Charter's objectives were stated as follows:

- Promote equitable access to the nation's mineral resources to all the people of South Africa;
- Substantially and meaningfully expand opportunities for historically disadvantaged South Africans (HDSA) including women, to enter the mining and minerals industry and to benefit from the exploitation of the nation's mineral resources;

- Utilise the existing skills base for the empowerment of HDSA's;
- Expand the skills base of HDSA's in order to serve the community;
- Promote employment and advance the social and economic welfare of mining communities and the major labour sending areas; and
- Promote beneficiation of South Africa's mineral commodities.

The development of the Mining Charter of 2004 was an inclusive engagement process involving all interested stakeholders and thereby produced an end product that was largely endorsed by all in terms of the main objectives it set out to achieve. The Mining Charter of 2004 targets were considered vague and ambiguous, except for the ownership requirement of 26% HDSA shareholding with no clear targets for other elements, and therefore tracking progress or compliance by both mining companies and government became difficult (Leon, 2010). The revision of the Mining Charter in 2010 provided an opportunity for government to clearly define objectives and targets of the elements to be complied with (see Table 3.2). In 2017, the Chamber of Mines of South Africa launched two cases against the minister: firstly, petitioned the High Court to set aside the Mining Charter that he had unanimously imposed on the industry had hiked the HSDA ownership target from 26% to 30%, along with other unreasonable clauses; and lastly, secured an interdict against Minister Zwane's unilateral moratorium on the granting of mining rights. The Chamber of Mines pushed back against the Minister's unilateral imposition of the Mining Charter of 2017, while negotiations were still continuing, and issuing a moratorium on the granting of mining rights.

Table 3.2 Mining charter elements: 2004, 2010, 2017 and 2018.

2004 Mining Charter Elements	**2010 Mining Charter Elements**	**2017 Mining Charter Elements**	**2018 Mining Charter Elements**
1. Human Resources development plan;	1. Human Resources development plan;	1. Ownership;	1. Ownership;
2. Employment Equity;	2. Employment Equity;	2. Procurement, Supply and Enterprise Development;	2.Inclusive Procurement, Supplier and Enterprise Development;
3. Migrant Labour;	3. Mine Community and Rural Development;	3. Employment Equity;	3.Human Resource Development;
4. Mine Community and Rural Development;	4. Housing and Living Conditions;	4. Human Resource Development;	4. Employment Equity;

5. Housing and Living Conditions;	5. Procurement and Enterprise Development;	5. Mine Community Development;	5. Mine Community Development;
6. Procurement;	6. Ownership;	6. Sustainable Development and Growth of the Mining and Minerals Industry;	6. Housing and Living Conditions.
7. Ownership and Joint Ventures;	7. Beneficiation;	7. Housing and Living Conditions;	
8. Beneficiation;	8. Reporting;	8. Application of the Charter to Licences Granted Under the Precious Metals Act, 2005 and The Diamond Act, 1988;	
9. Financing Mechanisms;	9. Sustainable Development and Growth of the Mining Industry.	9. Reporting (Monitoring and Compliance);	
10. Consultation, Monitoring, Evaluation & Reporting.		10. Applicability of Targets;	
		11. Transitional Arrangements;	
		12. Non-compliance;	
		13. Review of the Charter;	
		14. Repeal of Previous Mining Charters;	
		15. Interpretation of the Mining Charter;	
		16. Scorecard: Mining Charter Review.	

Although the Mining Charter of 2010 was developed with the view to clarify transformation targets that the mining companies had to comply with, audits representing about 90% of mining companies in South Africa, illustrated the deep-seated disagreement in terms of the application of definitions and measuring targets of the Mining Charter's transformation objectives between industry and government. Table 3.3 shows that disagreements between government and industry in terms of the compliance level of the Mining Charter was not restricted to one but all the elements of the Charter. One of the areas of the most disagreement in terms of the compliance level of the Charter is with regards to the HSDA ownership element. The disagreements between the DMR - and more specifically against the then Minister Mosembenzi Zwane - and the Chamber of Mines escalated into a public spat.

Table 3.3 Mining Charter Scorecard compliance

	Mining Charter Scorecard		DMR: (i) Comparison to target; (ii) % of submission that has met target		CoM: (i) Comparison to target; (ii) % of submission that has met target
Element	Description	Target	Un-weighted	Weighted	Weighted
Ownership	HDSA ownership %	26%	(i) 30.6%	(i) 32.5%	(i) 38%
	% of companies achieving 26%	100%	(ii) 79%	(ii) 90%	(ii) 100%
	% of companies with BEE, community & ESOP	(not agreed)	6.30%	20%	41%
Housing and Living Condition	% reduction of occupancy rate towards 2014 target	100%			(ii) 73%
	% of hostel info family units	100%	(ii) 55%		(ii) 63.4%
Procurement and Enterprise Development	Capital goods	100%	(ii) 39.6%	(ii) 82.1%	(i) 72%
	Services	70%	(ii) 33.2%	(ii) 64.9%	(i) 63%
	Consumable goods	50%	(ii) 60%	(ii) 85.2%	(i) 72%
	Annual spend on prodcurement and MNCs	0.5%	(ii) 3.3%	(ii) 14.9%	(ii) 20%
Employment Equity	Top management (Board)	40%	(i) 54.1%		(i) 50.4%
	Senior management (Exco)	40%	(i) 50.7%		(i) 41.9%
	Middle management	40%	(i) 52.7%		(i) 50.9%
	Junior management	40%	(i) 62.8%		(i) 54%
	Core skills	40%	(i) 75.2%		(i) 75.5%
Human Resource Development	HRD expenditure as % of total annual payroll % of companies achieving target	5%	(ii) 38.1%	(ii) 56.9%	(i) 5.5%; (ii) 100%
Mine Community Development	Implement approved community projects % of companies meetign targets	Up to date implementation	(ii) 36%		(i) 70.6%
Sustainable development and growth	Implementation of approved EMPs	100%	(ii) 44.5%	(ii) 48.6%	(i) 90.6%
	Implementation of the tripartite action plan on health and safety	100%	(ii) 2.8%	(ii) 1.6%	(i) 86.2%
	Percentage of samples in SA facilities	100%	(ii) 65.5%	(ii) 84.2%	(i) 84.6%

(Source: Mandinginye, 2016)

3.4.2 Problems with the administration of mining permits

According to the Department of Minerals and Energy (DME) (2009), between the enactment of the MPRDA 2004 on the 31st of March 2009, 25 648 applications for all mineral rights had been received by the DMR of which only 16 190 had been accepted, 3 653 rejected and 5 805 issued. However, another report released by the DMR (2010) stated that since the MPRDA becoming law in 2004, a total amount of 25 867 applications for prospecting and exploration rights were received by the regulator. This was indicative of a vibrant exploration investment environment in South Africa, with PGMs, diamonds, gold, uranium and coal being the dominant

targets. In 2014 the DMR put the total number of all mineral rights to have been received from applicants since the inception of the MPRDA to be 26 000 with 3 507 of these applications for prospecting rights (DMR, 2014). However, according to the current minister of mineral resources, Mr. Gwede Mantashe, the DMR has a backlog on new mineral right applications stretching as far back as 2012; while applications for renewal of prospecting right applications go as far back as 2010 (Independent Online, 2018).

During the 2010/2011 financial year, the DMR started the process of developing an integrated electronic system called 'The South African Mineral Resources Administration System (SAMRAD)' with the view to migrate from the ineffective National Mining Promotion System (NMPS) data system which resulted in cases of double granting permits in some instances. The new system is also able to electronically accept applications for mining permits, prospecting rights and mining rights through the website. To ensure the credibility of the data being migrated from the NMPS data to the new electronic system, comprehensive data currently sitting on the NMPS system had to be properly audited. The minister of the DMR at the time, Ms. Susan Shabangu, imposed a moratorium on the lodging of new prospecting rights on the 1st September 2010 to clean up NMPS data regarding the status of all rights that were awarded since the enactment of the MPRDA and ensure the accuracy and reliability of information before migrating to SAMRAD. The moratorium was lifted in February 2011 in all provinces, excluding Mpumalanga, when the new electronic system went live.

Another troubling aspect of the MPRDA in its current form is the powers vested in the minister as stipulated in Section 49. On the 19th of July 2017 Minister Mosembenzi Zwane published a notice in the Government Gazette advising of his intention to indefinitely suspend all new applications for prospecting rights, mining rights and section 11 transfers where rights are transferred between owners. This move by the Minister appears to be informed by Section 49 of the MPRDA which stipulates that the Minister, after inviting representations from relevant stakeholders, may; prohibit or restrict the granting of any reconnaissance permission, prospecting right, mining right or mining permit in respect of land

identified by the minister for such period and on such terms and conditions as the minister may determine; and restrict the granting of any reconnaissance permission, reconnaissance permit, prospecting right, mining right or mining permit in respect of a specific mineral or minerals or class of minerals identified by the minister for such period and on such terms and conditions as the minister may determine (MPRDA, 2002). This notice was withdrawn after the Chamber of Mines had filed an urgent court application to oppose this notice.

3.5 Mining tax system in the post-apartheid era

Prior to the enactment of the Mineral and Petroleum Resources Royalty Act (MPRRA) 28 of 2008 on 24 November 2008, mining companies were subjected to a standard corporate income tax of 29% except for gold mining companies and could claim 100% of their capital expenditures against tax. The spending that companies were allowed to claim against tax included "spending on: prospecting; mining equipment and shaft sinking; and development, general administration and management prior to commencement of production" (Curtis, 2009). Additionally, mining companies were required to pay a Secondary Tax on Companies (STC) of 10 per cent of the net amount of dividends declared (Curtis, 2009). Capital expenditure deduction were initially introduced in 1956 with the intention to stimulate investment in new ultra-deep gold mines in the Witwatersrand Basin (van Blerck, 1988).

The level of mineral rent that government derives is determined by production output and prices for mineral products and the relative ease and cost of mining in South Africa (Cawood, 2011). Figure 3.2 illustrates that during the 1970s and 1980s commodity prices were high, production of gold was at its peak in 1970 and contributed more half of the foreign exchange, and yet mineral rents generated remain low. According to analysis by Cawood (2011) since the Mineral and Petroleum Royalty Act 29 of 2008 (MPRRA) was legislated, mineral rent increased by 8% and during higher commodity price environments this increase is expected to reach 50%. Another aspect important to know illustrated in Figure 3.2 is the fact

that the South African GDP growth rates reflect, to a larger extent, the level of rent generated from the mining industry.

The introduction of the MPRRA by the South African government was aimed at the royalty regime taxing of mineral rents based on income or profits before tax because this reflects the financial position and ability of companies to meet tax obligations in both low and high commodity environments. Another important aspect of the MPRRA is to encourage refinement of metals being mined within South Africa to increase in the value derived along the value chain.

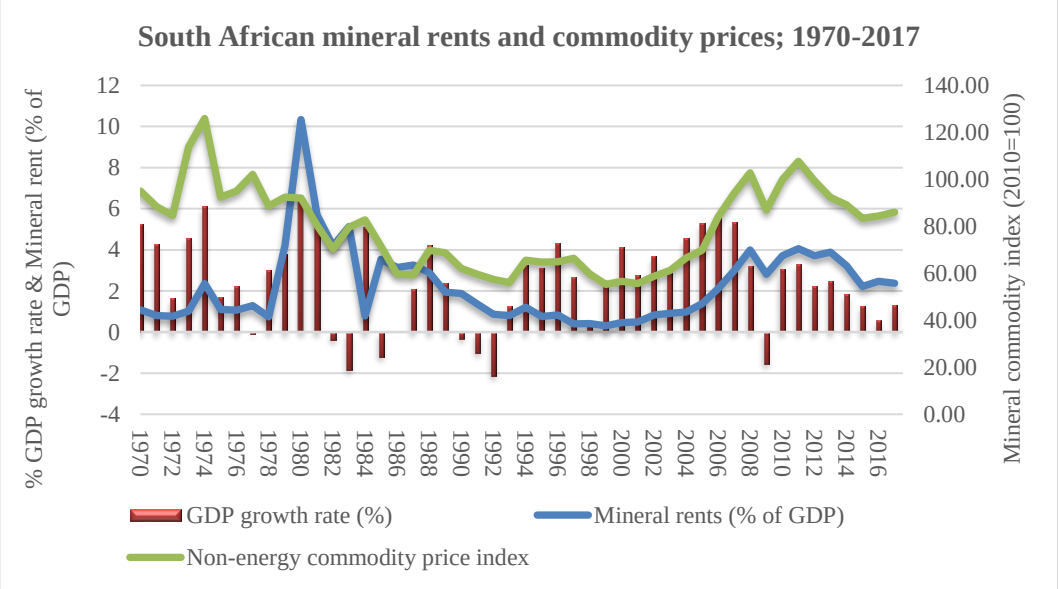


Figure 3.2 South African mineral rent generated between 1970 and 2017

(Source: World Bank, 2019)

Although the tax regime influences the revenue generated from extracting mineral resources by government, it also influences the decisions by mining companies on exploration investment in that the profits generated from the ensuing mining operations will also be determined by the tax rate. Cawood (2016) concluded that the enactment of the MPRRA, increased pay limits for marginal gold mines that did not have readily-developed high grade reserves in stock, and resulted in premature closures.

3.6 Regulatory factors contributing to shrinkage of mining investment in South Africa

Mining requires large capital and often takes 10-15 years of investment before an income could be generated from the sale of mined minerals. Despite the good intention of creating an internationally competitive and investor friendly environment, below are some of the aspects in the MPRDA that have had a profound impact in terms of attracting investment into the mining industry in South Africa:

3.6.1 Ambiguous provisions in the MPRDA and Mining Charter

The MPRDA is generally known to be fraught with drafting errors and ambiguous provisions (Stevens, 2013; Corruption Watch, 2017). Section 102 of the MPRDA stipulates that a mining right or prospecting right "may not be amended or varied (including by extension of the area covered by it or by the addition of minerals or a share or shares or seams, mineralised bodies, or strata, which are not at the time the subject thereof) without the written consent of the Minister." In the famous Lonmin case, the ambiguous definition of associated minerals in the MPRDA led to the different applicants lodging mining rights application for minerals occurring in the same ore and lease area. Lonmin had successfully converted its older rights for the mining of PGMs for its Marikana operation before the stipulated deadline of 2009. However, Lonmin had not applied for its mining right to include associated minerals such as nickel, copper and chrome that are recovered as by-products in its PGM operations. While Lonmin was busy lodging the application, another mining company applied and was granted mining right for the associated minerals in the Lonmin lease area.

The 26% Black Economic Empowerment (BEE) ownership requirement under the Mining Charter of 2009 was one of the contentious issues within the South Africa mineral regulatory environment. Mining companies, represented by the Chamber of Mines, sought the courts to clarify the true implication of this provision. The DMR was of the view that once a BEE partner sells off their stake, mining companies had to find another BEE partner to maintain compliance. Mining

companies, however, were of the view that they should be able to maintain their BEE status even if a BEE partner sell off their stake. In April 2018 the full bench of the North Gauteng High Court ruled in favour of mining companies in that once empowered always empowered.

3.6.2 Discretionary powers of the Minister in the MPRDA

The discretionary powers of the Minister under the section 49 of MPRDA has the potential to threaten the security of tenure for mining companies. Minister Shabangu in 2010 put a moratorium on the issuing of mining license so that the Department could clean up the database in preparation for the implementation of the SAMRAD system. In 2007, Minister Zwane also invoked section 49 in 2017 to put a moratorium on the issuing of mining licenses after the mining industry had rejected the Mining Charter that he had unanimously imposed on the industry. Such powers often create uncertain which is not appropriate for long-term investment.

3.6.3 Ineffective administration of mining and prospecting rights

The DMR is entrusted with the responsibility of issuing of mining and prospecting rights subject to certain conditions. The MPRDA stipulates that, should all legislative requirements be met, the Minister must within 30 days of receipt of the application from the Regional Manager grant a prospecting right. However, Regional offices in the different provinces appear to interpret the MPRDA differently because they appear to be applying different time frames when it comes to processing of mining and prospecting right application (Corruption Watch, 2017). It was admitted by the current DMR Minister, Mr. Gwede Mantashe that the Department has a backlog on new mining and prospecting rights applications stretching as far back as 2010. This simply means that there are entities that have been waiting for almost 10 years to invest in the mining industry in South Africa but are being frustrated by the bureaucracy and inefficiency of the DMR. Corruption Watch (2017) concluded that some of the delays are a result of incapacity and unlawful conduct by officials of the DMR.

3.6.4 Lack of transparency in the administration of mineral rights

The adoption of the SAMRAD system was to eliminate the issue of double granting permits as it was the case in the previous system and ensure that mining companies could submit their applications electronically. In reality, however, this system is usually unavailable and applications are still being lodged manually (Corruption Watch, 2017). Another shortfall of the SAMRAD system is that it does not provide for applicants to track the progress concerning the processing of their license application.

3.6.5 Corruption and maladministration in the DMR

It was widely reported in the media that Minister Mosebenzi Zwane flew to Switzerland to meet Glencore CEO Ivan Glasenberg, to persuade him on behalf of the Guptas - an immigrant family from India that was highly connected to the sitting president of South Africa, Mr. Jacob Zuma - to sell Optimum Coal Mine to Oakbay. At the Zondo inquiry into state capture, former Director-General of the DMR, Thibedi Ramontja, stated that all issues relating to Optimum Coal Mine became centralised in the office of former Minister Mosebenzi Zwane when he arrived at the Department in late 2015 (Corruption Watch, 2019). According to Minister Ngoako Ramathlodi's testimony at the state capture commission, whom Minister Mosebenzi Zwane replaced at the DMR, he suspected that the President moved him away from the DMR after he had refused a request to change the ownership of Optimum Coal Mine and grant mining rights to the Guptas's company Oakbay. In 2015 Oakbay made an offer of R2 billion to buy Optimum Coal Mine and its Richard Bay coal terminal from Glencore which was rejected. According to the state capture commission's testimony of Mr. Clinton Ephron, former Glencore CEO, after the revised offer or R1 billion was rejected by Glencore, Optimum Coal Mine was issued with various sections 54 notices to immediately shut down the mine's operations for minor transgression such as leaking oil underground (Independent Online, 2019). Mr. Clinton Ephron further stated that this action from the DMR was perceived by Glencore as suggesting that Optimum Coal Mine can

only survive under different owners. Glencore eventually succumbed to the political pressure from the DMR and Eskom and agreed to sell the Optimum asset to Oakbay.

3.7 Chapter summary

The inefficiency within the DMR has resulted in the backlog that span over 10 years and this implies that there are investors that have been waiting to invest in the country for that long. This inefficiency, coupled with the corruption by officials in the DMR and ministers such as was the case with Minister Zwane putting political pressure on Glencore to sell their Optimum asset to the Gupta family, delays with the acquisition of exploration and mineral rights through the DMR has a negative impact on the investment desirability in the industry. The threat of arbitrarily revoking mining licenses whenever disagreement arise between mining companies and government solidifies the hostile stakeholder engagement. This shift in regulatory environment that was brought about by the introduction of the MPRDA has introduced a dynamic atmosphere that is deemed to discourage investment into the industry. The MPRDA Amendement Bill of 2012 was meant to address the shortcomings that have been identified since the enactment of the MPRDA in May 2004. However, this Amendement Bill was sent back to Parliament in 2015 by President Zuma citing insufficient public consultation a requirement in the South African constitution.

4 MINERAL EXPLORATION IN SOUTH AFRICA

4.1 Introduction

This chapter aims to decode what has hampered South Africa's ability to attract and compete for greenfields exploration investment as compared to other major mining jurisdiction of the world since 1998 when the new mineral regulatory framework was adopted.

4.2 The nature of mineral exploration

Mineral exploration is the searching for mineral deposits which have been put in place by geological processes over the course of geological time (Eggert, 1993). Although exploration is generally associated with the discovery of new mineral deposits, exploration features extensively in the mine development process where discoveries are proved up, de-risked and progressed to a bankable stage (Eggert, 1993). Greenfields exploration is an activity focused on discovering new mineral deposits with potential economic value in areas away from current mining activities whereas brownfields exploration refers to exploration activities in areas adjacent to known mineral deposits. Greenfields exploration is thus considered a higher risk than brownfields exploration because in the latter case the mineral endowment of the areas has already been confirmed (Australian Institute of Geoscientists, 2010). Brownfields exploration can be further divided into late stage and mine site exploration. Late stage exploration occurs when a discovered mineral deposit is evaluated with a view to convert resources to reserves. Mine site exploration occurs when a mineral deposit is being mined to further delineate the deposit and extend life of mine by identifying nearby targets accessible with the current infrastructure.

In many of the mature mining jurisdictions of the world, including South Africa, easy to find near-surface mineral deposits are either being currently mined or were mined in the past (Espi, 2009; Council of Geoscience, 2016). It takes one thousand grassroots prospects to make a discovery and it takes one hundred discoveries to make a mine (Australian Institute of Geoscientists, 2010). Figure 4.1 illustrates the historical global exploration expenditures and the corresponding significant

discoveries of mineral deposits. Furthermore current increased exploration investment rates have not resulted in significantly higher number of economically viable mineral deposits.

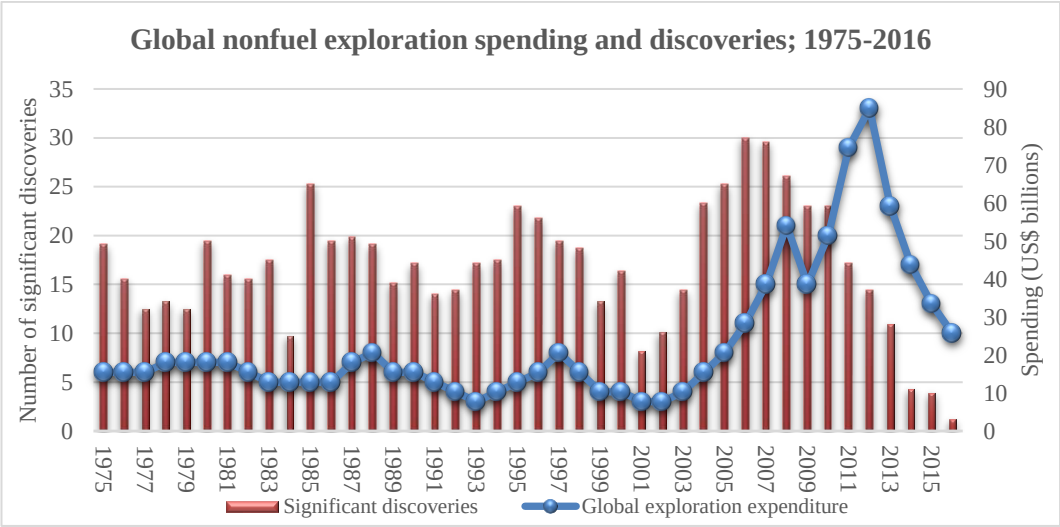


Figure 4.1 Global nonfuel exploration expenditure and significant ore-body discoveries

(Adapted from Reuters, 2019)

From early stage exploration to a well-defined mineral deposit can take years of work and substantial amount of exploration investment with a limited probability of success. However, the discovery of an economically viable mineral deposit can result in enormous financial benefit to companies investing in mineral exploration. It is therefore clear that mineral exploration investment funds are committed with a long term expectation that significant economic benefits might accrue. However, exploration investment is but one of the ways in which a mining company may deploy to reinvigorate reserves in their portfolio. Robinson and Mackenzie (1987) recognised that a mining company may acquire new mineral deposits either through successful exploration efforts or through acquisition of high potential exploration projects or joint ventures with other companies depending on the company's vision. Thus from a corporate perspective exploration projects have to compete for funding against other options that can be utilised to replace depleting reserves such as developing an underdeveloped deposit (Eggert, 1993). However, inasmuch as some

mining companies may prefer replacing resourcing and reserves through acquisition, there will always be a need to discover new mineral deposits through greenfields exploration to replace known deposits that are currently being mined. The financial returns of mineral exploration investment, through the successful discovery of economically viable ore deposits, are highly skewed in that few companies get to generate significant profits from extracting these discovered deposits whereas most of the companies are never successful.

4.3 Drivers of mineral exploration

Economically viable mineral deposits are so strategically important to a mining enterprise because they sustain a continuous ore reserve replacement in the portfolio beyond current operations and therefore offers organic growth (Mackenzie, 1973). The survival of mining and exploration companies as business enterprises is hinged on the continuous discovery of economically viable mineral deposits in order to replace depleted reserves currently being mined each year and to continue generating cash flow from mining operations or disposing off some of their projects (Robinson and Mackenzie, 1987). Mining companies that elect to pursue the replacement of their resources and reserves through exploration, especially greenfields exploration, are confronted with a whole host of economic, social, and political challenges, namely; uncertain government regulations, increasing cost of exploration and hostile local communities (Robinson and Mackenzie, 1987; Espi, 2009; Mackenzie, 1973). Mining companies that are in the business of finding and developing mineral resources are confronted with these barriers in some parts of the world that can be summarised based on the following:

4.3.1 Market environment

It is an old adage that, when the mining industry enters a slump, exploration budgets and activities, particularly those designated for greenfields activities, are the first to be curtailed (Davenport, 2016). This is precisely because the major drivers of exploration expenditure is mineral prices; exploration efforts tend to increase in a high mineral commodity price environment and, likewise, decrease in low commodity price environment (Karl and Wilbur, 2017). In the long-term,

exploration investment is guided by the long-term market trends for specific mineral commodities in relation to their resource potential. In the past two decades iron ore and base metals have continued to attract significant composition of global exploration investment supported by growing demand as developing nations focus on commodity-intensive infrastructure development projects (see Figure 4.2). Due to gold prices having soared in the past two decades, as it continued to rise as a preferred asset class for investors, exploration investment for this commodity has constituted thirty percent of the total global expenditure.

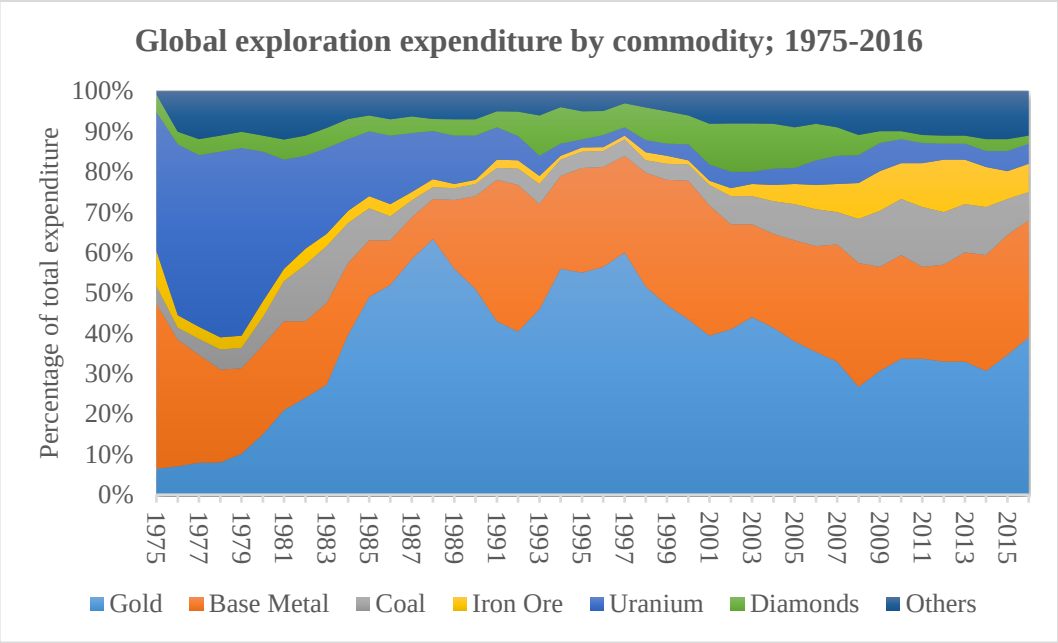


Figure 4.2 Nonfuel global exploration expenditure by commodity; 1975 -2016

(Adapted from Reuters, 2019)

4.3.2 Exploration environment/Government policy

This comprises the perception of resource endowment in a particular region or country and the exploration techniques and skills available for the successful discovery of new mineral deposits. There are three fundamental exploration environment parameters for exploration planning; these are: the cost associated with discovering a mineral deposit, the environment probability of discovering an economic mineral deposit, and the return from an economic discovery (Mackenzie,

1973). The role of government on the regulation factors impacting the extractive industry such as taxation, interpretation and enforcement of regulations, environmental regulations, infrastructure, political stability, labour issues, geological database, native land claims, uncertainty regarding the administration of regulation and security impact the investment attractiveness of a country. As can be observed in Figure 4.3 China has increased its percentage of global exploration expenditure from two percent in 1997 to twenty six percent in 2016. During the same period Africa has experienced a decline from fifteen to eleven percent in global exploration investment. Mature and stable mining jurisdictions such as Canada, Australia and Chile have experienced a significant decline in the composition of global exploration investment in the same period, this could be attributed to the difficulty to discover deposits, and competition for capital broadens especially from previously less explored developing countries.

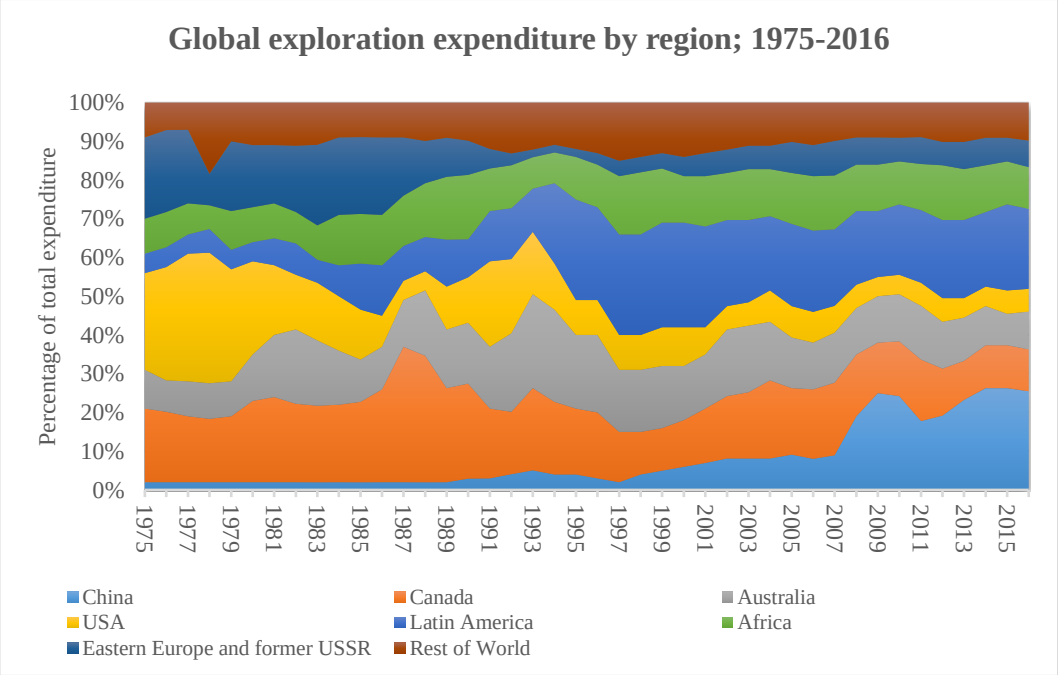


Figure 4.3 Nonfuel global exploration expenditure by region; 1975 -2016

(Adapted from Reuters, 2019)

Countries with economies that are dominated by the extractive industry, such as South Africa, should have a regulatory environment that nurtures greenfields

exploration because it is the successful discovery of new mineral deposits which is followed by major investment in development of mines, which may lead to job creation and infrastructure development. Furthermore, the pipeline of new mineral deposits are critical in the future competitiveness of the mineral industry in each country (Lockwood, 2016). However, countries that depend on private investors to explore and develop their mineral resources must compete with each other to attract available investment and expertise (Jara et al., 2008).

4.4 South Africa's mineral exploration prior to 1994

The post 1969 renewed focus on South Africa as a preferred exploration destination led to an increase in budget and intensity of mineral exploration and indicated in (Beukes, 1986). Exploration efforts in South Africa during this period was mainly focused on the continued search for gold, coal, diamond, base metals and to a lesser extent offshore hydrocarbons (Beukes, 1986). Figure 4.4 illustrates the exploration expenditure, in nominal Rand terms, for precious metals, energy and base metals from 1960 to 1983. From 1960 to 1969, the total exploration expenditure remained stagnant and not exceeding twenty million Rands yearly, with the majority of expenditure directed towards the search for precious metal deposits.

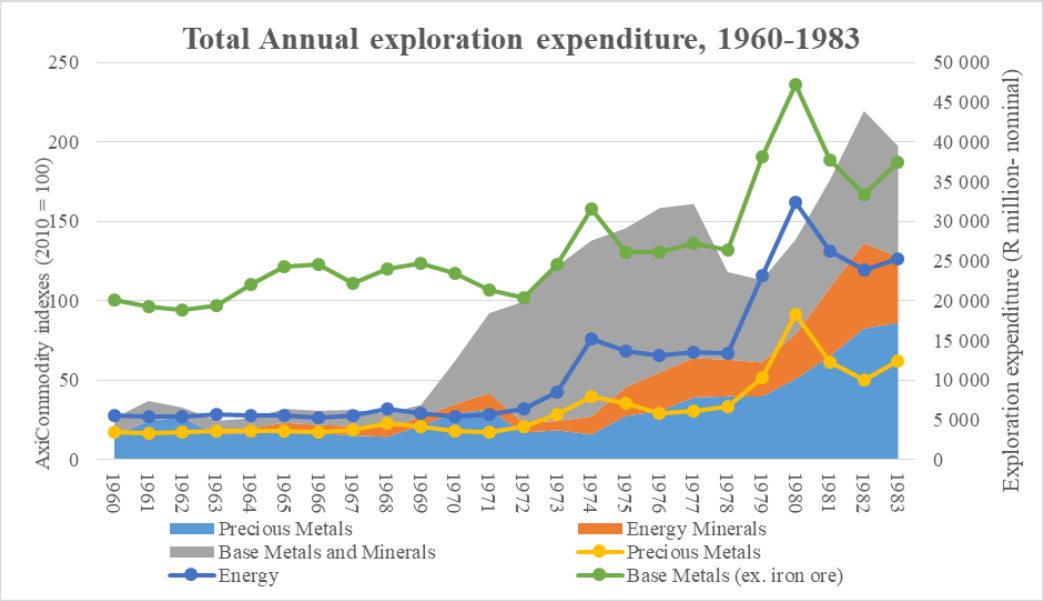


Figure 4.4 South African exploration expenditure in South Africa, 1960-1983

(Adapted: Beukes, 1986; World Bank Commodity Price Data, 2018)

From the 1970s onwards, exploration expenditure increased substantially, from just under twenty million Rands to over hundred and fifty million Rands, responding to an increase in commodity prices. Another characteristic observed in this period is that there was a significant increase in the exploration expenditure on base metals and energy minerals, which included coal and uranium. The rise in base metal exploration in this period is related to the higher price of the metals and the better was discovered that virtually all the base metals deposits occur in Mobile Metamorphic Belts such as the Kaapvaal Craton and hence the focus on the Namaqualand Belt

4.5 Factors that influenced mineral exploration in South Africa prior to 1994

4.5.1 Political environment

Prior to 1950, mineral exploration strategies in South Africa were largely informed by the desires of foreign multinationals' executives, mostly British nationals who owned and ran most of the mining firms in that period; however, this influence declined in the 1950s (Beukes, 1986). Beukes (1986) pointed out that as this British influence waned it was replaced by American and South African mining corporations. The South African mining companies actively explored for minerals in the rest of the African continent up until such a point when the majority of countries attained their political independence thereby becoming a hostile environment to pursue exploration investment due to policies of discrimination against black people (Beukes, 1986). Due to this hostile investment environment in other parts of the African continent to South African mining companies, exploration investment was re-directed to South Africa.

4.5.2 Economic environment

The intensity of use of certain minerals in the world economy affects the demand for such minerals. Due to the volatility of the global economic growth, the demand for mineral commodities variability leads to price cycles, which is permanent

feature in the mining industry. The commodity price boom, which started in the early 2000s, and ending in 2011 was the most powerful cyclical upswing seen in recent times and drove the majority of commodity prices to record highs.

The demand brought about by the commodity prices cycles encouraging mining companies' expenditure on exploration and investment as they respond to demand. Figure 4.5 illustrates how the eruption of the largest commodity boom in history resulted in multiple increases in commodity prices. South African exploration budgets reflects the rising commodity prices from 2002 to the end of the boom in 2011.

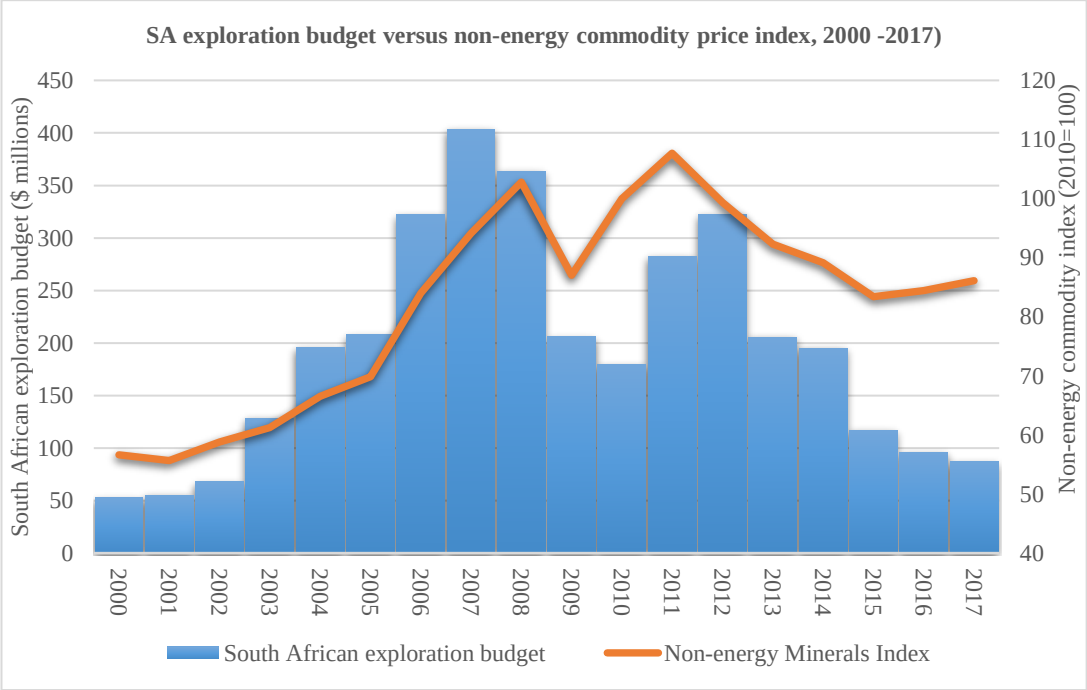


Figure 4.5 South African exploration budget in South Africa, 2000-2017

This increase in exploration expenditure during this period occurred despite the concerns around nationalization of mines; recurring labour disputes and escalating energy costs and shifting regulatory environment. From 2011 onwards, when the commodity boom ended, the exploration expenditure in South Africa appears to be

in sharp decline. This decline in exploration expenditure is in motion despite South Africa being well endowed in minerals.

Another aspect of the South African mining industry that previously influenced exploration philosophy and expenditure in the country is the structure of the mining houses as a result of the isolation of the country's economy during apartheid. The enforcement of international economic sanctions against South Africa prevented both inward and outward investments thereby facilitating cohesiveness within the industry which facilitated significant co-operation in areas of mutual interest (Antin, 2013; Beukes, 1986).

The South African mining industry that previously influenced exploration philosophy and expenditure in the country is the structure of the mining houses as a result of the isolation of the country's economy during apartheid. The enforcement of international economic sanctions against South Africa prevented both inward and outward investments thereby facilitating cohesiveness within the industry which facilitated significant co-operation in areas of mutual interest (Antin, 2013; Beukes, 1986).

Through the "Group System" individual mines, although completely independent, nerveless had administrative and financial ties with mining house finances (Beukes, 1986). Beukes, (1986) noted that these "mining finance houses had the required financial muscle and the technical expertise to undertake mineral exploration and to finance the development and management of new mining ventures "

The establishment of the Chamber of Mines also benefited the mineral exploration efforts in South Africa as it provided funding, on behalf of mining companies that were members of research units in institutions of higher learning (Beukes, 1986). These research units were critical in the development of understanding of the South African economic geology thus enhancing exploration success rate (Beukes, 1986)

4.6 South Africa mineral exploration prior in the post-apartheid era

4.6.1 Mineral exploration expenditure

Figure 4.5 illustrates that global exploration has increased from four billion Dollars in 2000 to twenty billion Dollars in 2008 which is a seven hundred and twenty five percent hike. This increase in mineral investment is attributed to the unprecedented demand of mineral commodities which led to record prices of the majority of these mineral prices. During this period, South African mineral exploration investment rose from fifty-three million Dollars and peaked at four hundred and four million Dollars in 2007 which is a six hundred and sixty-four percent hike.

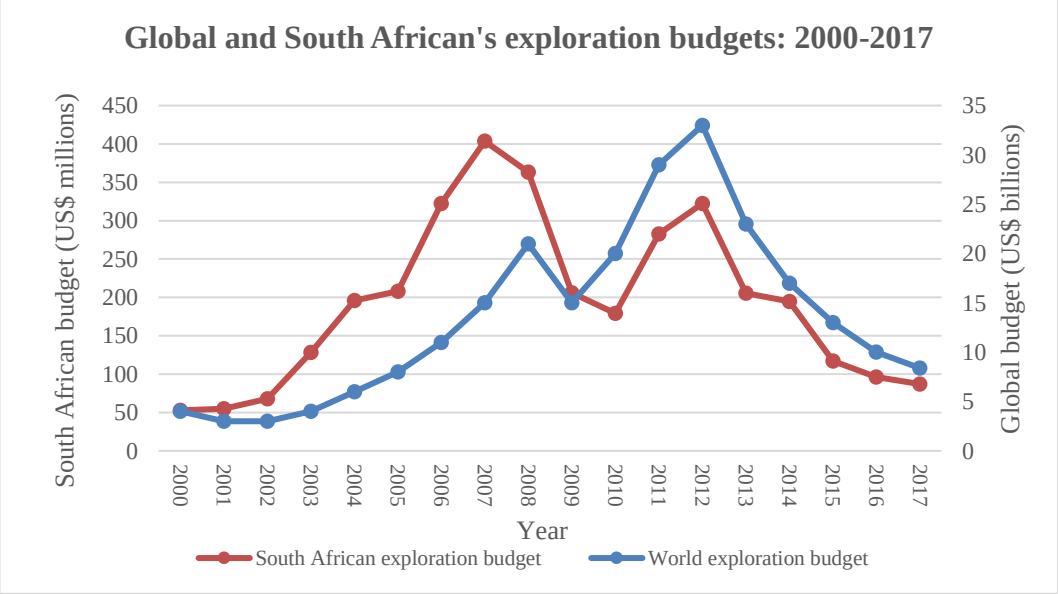


Figure 4.6 Global and South African exploration investment budgets: 2000-2017

(Source: Minerals Council South Africa, 2018; Reuters, 2019)

In 2009, global mineral exploration declined from 21 billion Dollars to 15 billion Dollars primarily because of the global financial and economic crisis, which led to a decrease demand of mineral commodities. However, global exploration investment level recovered well from the 2009 low to an all-time peak of 33 billion Dollars in 2012 as mineral commodity demand recovered. In South Africa's case, exploration investment declined from a peak of four hundred and four million dollars in 2007 to hundred and seventy nine million dollars in 2010. Although

exploration investment somewhat recovered from 2011 to a high of three hundred and twenty-three million dollars in 2012, this was way below the all-time peak of 2007 before the global and financial crisis of 2008. From a peak of 2012, global exploration investment has dropped by seventy five percent in 2017. In the same period, South Africa has declined by seventy three percent although coming from a lower base compared to global investment levels. This period coincided with a depressed demand of commodity minerals in the global economy.

Whereas South African exploration expenditure has declined in the past two decades, other countries in Africa, such Democratic of Congo (DRC), Burkina Faso and Tanzania, which were not considered competitors, have continued to gain investment significantly. Other African countries have implemented competitive regulatory regimes and are reaping the rewards in terms of attracting exploration investment. Figure 4.6 illustrates the declining South African share of African exploration expenditure compared to Zimbabwe in the past 17 years starting in 2000. South Africa's share of African exploration expenditure peaked at just thirty-seven percent in 2003 and has been declining since then in 2017 was recorded at eight percent.

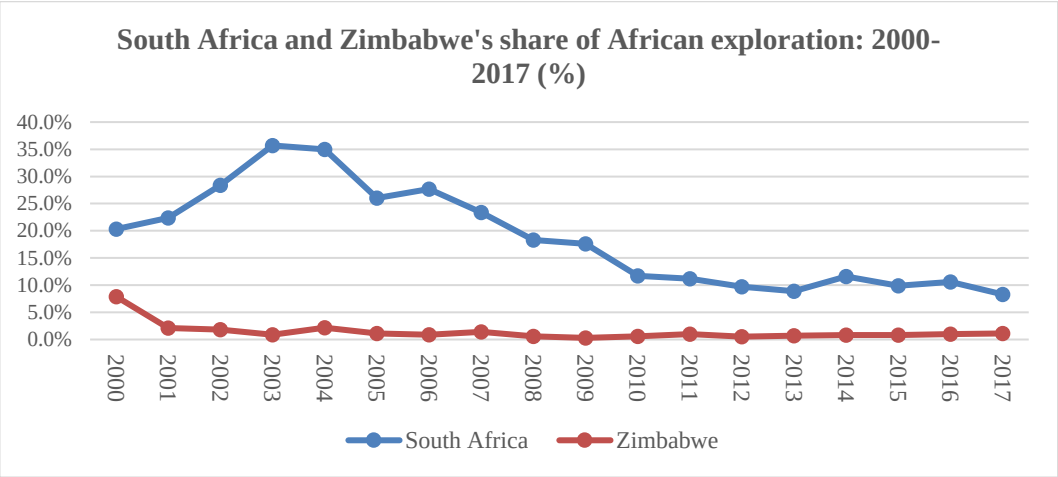


Figure 4.7 South Africa's share in African exploration budgets

(Source: Mineral's Council of South Africa, 2018)

As can be observed in section 4.3.1 global exploration investment has been dominated by the search for gold and base metal deposits. By observing appendix 12.5 in page 196, during the commodity boom of 2002-2008, the exploration investment growth in South Africa was dominated by greenfields exploration for platinum group metals, closely followed by diamonds and then gold. From 1995 to 2005, exploration sites were dominated by greenfields exploration projects (see Figure 4.7). Although there author could not find reliable available information in the public domain on active exploration sites from 2006 to 2018, there is no evidence of any greenfields exploration activities in this period. However, sites where exploration was conducted with a view to extend currently operating mines were found.

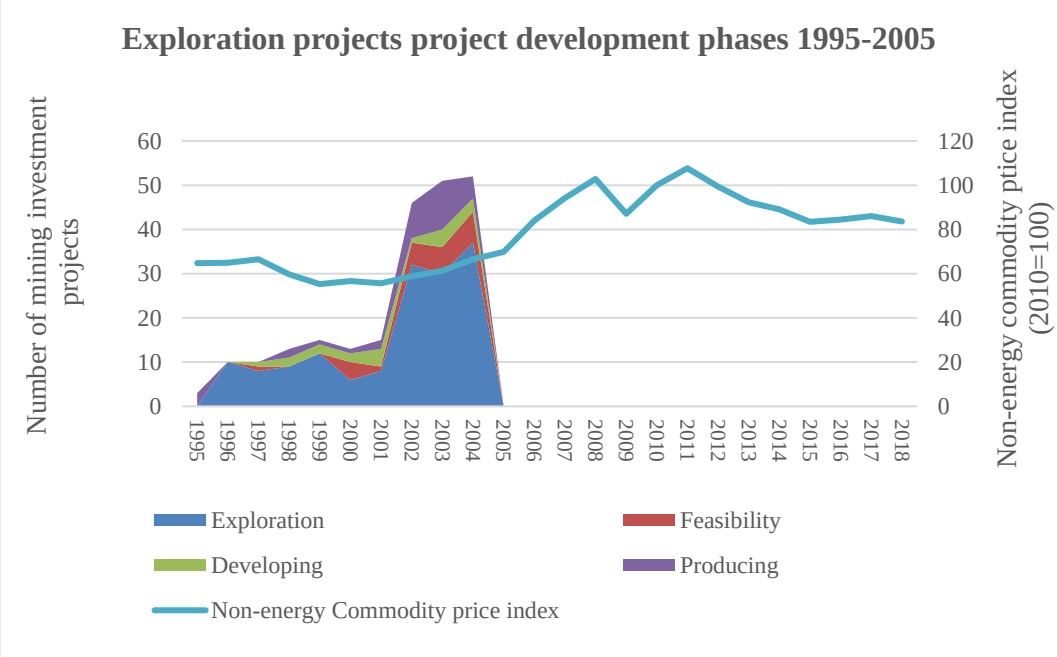


Figure 4.8 South African exploration project stages: 1995-2018)

(Adapted: USGS, 2005 and World Bank, 2019)

4.7 Mining projects investment in South Africa in the post-apartheid South Africa

Global economic demand for minerals promotes the stimulus for investment in both the exploration of new mineral deposits and the expansion of current operations to

meet the growing demand. However, the consideration of investment in mining projects is informed by the cost of exploring and developing the deposit against the potential revenue to be generated throughout the lifecycle of the operation. Only projects with proven economic viability potential are pursued for development. However, the evaluation of a mineral project starts with the decision on what commodity and location where exploration investment is to be pursued. The exploration investment mainly deals with the searching of new mineral deposits, focuses on the delineation of zones of mineralisation and associated metal content. Once a mineral deposit is discovered the investment decisions for mining projects involves the consideration and evaluation of the technical, fiscal and legislative aspects of the country in which the mineral deposit is located. Flowing from the exploration phase is the conceptual assessment stages where decisions on the allocation of capital and project length are made prior and construction and commencement of production

Figure 4.8, in conjunction with appendix 12.6, illustrates the investment level of mining projects in South Africa from 2000 to 2018 based on announced projects recorded by the Engineering and Mining Journal. This data indicates the feasibility studies conducted in this period determining the number of proved mineral resources ore-bodies from exploration projects that were developed with the expectation to be mined profitably under the prevailing market conditions The author is utilising this information to gauge investment level in the mining industry during this period, however this data does pose some bias in that mining companies often hype the start of a new project with a view to attract investment. However, there is very little fanfare when such projects are put on hold or scraped off the project pipeline altogether (Engineering and Mining Journal, 2001).



Figure 4.9 Major mining investment projects in South Africa: 2000-2018

(Adapted: Engineering and Mining Journal, 2000-2018)

In the year 2000 and 2001 the majority of mining projects were mainly brownfields where existing operations were being expanded. However, there was also a significant number of greenfields projects in the conceptual and feasibility phases in the same period. From 2001 to 2004 South Africa experienced a decline in greenfields projects although this period was characterised by growing global demand of mineral commodities. Greenfields projects continued to decline and currently sit at twenty projects in 2018 from forty in 2001.

4.8 Chapter summary

Mineral exploration expenditure is a function of prospectivity, investment climate and mineral prices. South Africa is known to have more 50% of the world gold resources; more than half of the world's reserves of manganese, chromium and

platinum group metals; it has 40 per cent or more of the world's vanadium, gold and vermiculite reserves (Malherbe, 2000). For more a century and a half South Africa dominated the global rankings of a variety of minerals on the back of this rich mineral endowment.

The past two decades in South Africa has witness the introduction of the MPRDA and other pieces of legislation gear to align the mining industry with the democratic ethos of the new dispensation. The implementation of the MPRDA has brought about uncertainty is deemed to discourage investment into the mining industry.

Although the country is well endowed with minerals, and mineral prices reached peak levels in the past two decades with the exploration expenditure reflecting a mineral commodity boom environment and therefore masking the low investor confidence in the country. South Africa has continued sliding down the investment attractiveness rankings. The decline in exploration expenditure is in line with the perception of the investment climate in the South Africa. The declining exploration expenditures means that there will be few new mining project development in the future and that will impact the sustainability of the South African mining industry. The next chapters deal with the production output of the mining industry in South Africa in the past two decades and highlight the impact of lack of greenfields investment in the declining production output of gold, platinum, copper and diamond.

5 SOUTH AFRICAN GOLD MINING INDUSTRY

5.1 Introduction

This chapter analyses the impact of the post-apartheid mineral regulation, and other challenges, on the competitiveness of the gold mining and exploration in South Africa in the past two decades.

5.2 Demand and Supply dynamics of gold

Gold is a unique precious metal in that it is traded for both its incorporeal and physical characteristics. Its richly yellow-golden colour is associated beauty and mystique whereas it's high melting point (1064 ˚C), resistance to corrosion, highly malleability and good electrical conductivity make for a variety industrial applications (DMR, 2009b). As illustrated in Figure 5.1 both industrial and jewellery demands increased from early 2000s, largely driven by the increase in disposable income in China and India, until the slowdown of the global economy in the aftermath of the Global Financial crisis of 2008-2009 which led to a reduction in consumption demand and a corresponding decline in the price of gold.

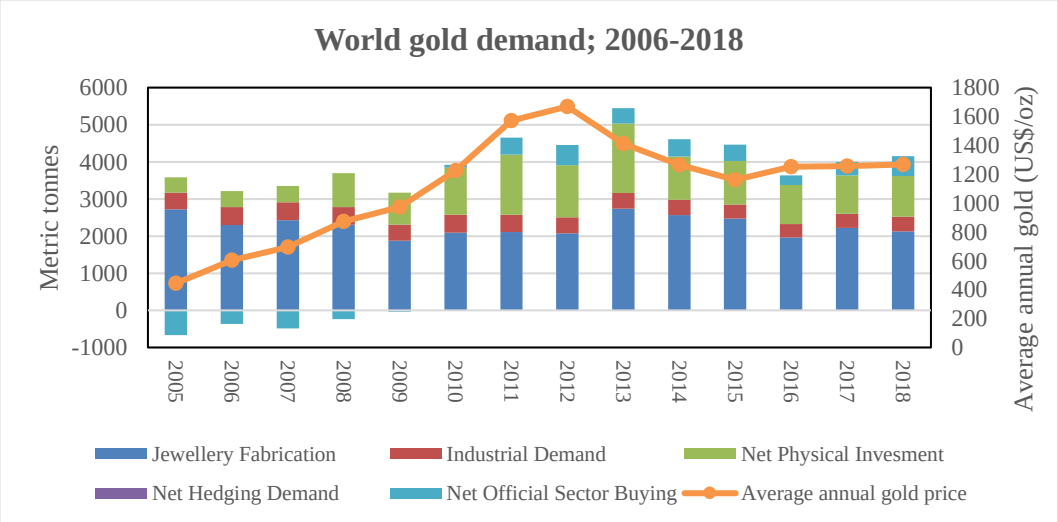


Figure 5.1 Global gold demand

(Source: GFMS, 2019)

The nature of the consumer demand of gold, jewellery and industrial demand, is driven by the global economic growth. This consumption demand picked up again in 2013 and the global economy gained traction.

Gold is not only traded for its physical properties but also serves as a trusted repository of wealth, a storehouse of value, held by investors and governments alike, and therefore unlike most commodities it is not bound by the traditional laws of market supply and demand (Amey, 1996). The investment demand of gold is driven by periods of global market downturns with investors preferring gold as a safe haven (World Gold Council, 2019) (see Figure 5.1). The increase in the investment demand of gold is also attributed to the development of new ways to access the market such as the physical gold-backed exchange-traded funds (ETFs) and a renewed focus on the effective risk management post the 2008-2009 global financial crisis (World Gold Council, 2019). After 21 years of net sales, central banks became net buyers of gold in 2010 led by China, Russia, India and other central banks in emerging-market countries (UNCTAD, 2015).

The unprecedented commodity boom of the early 2000s brought about an unprecedented demand for gold and the corresponding increase in gold prices as illustrated in Figure 5.2. However, prior to the 1970s and under Bretton Woods Agreement, gold price was fixed at US$35 per ounce. After the termination of the fixed peg of dollar to gold, gold prices entered a period of increases in the 1970s. In 2003 the gold price averaged US$363 per an ounce, and then peaked at US$1669 per ounce in 2012. From 2012 to 2015 the gold price experienced a 30% decline; however, since then the gold price has somewhat recovered and averaged US$1268 per ounce in 2018.

The increase in gold price has led to a corresponding increase in both the primary production from mines and secondary production from recycling (see Figure 5.2). The commercial exploration and mining operations to supply gold exist around the world at varying types and scale.

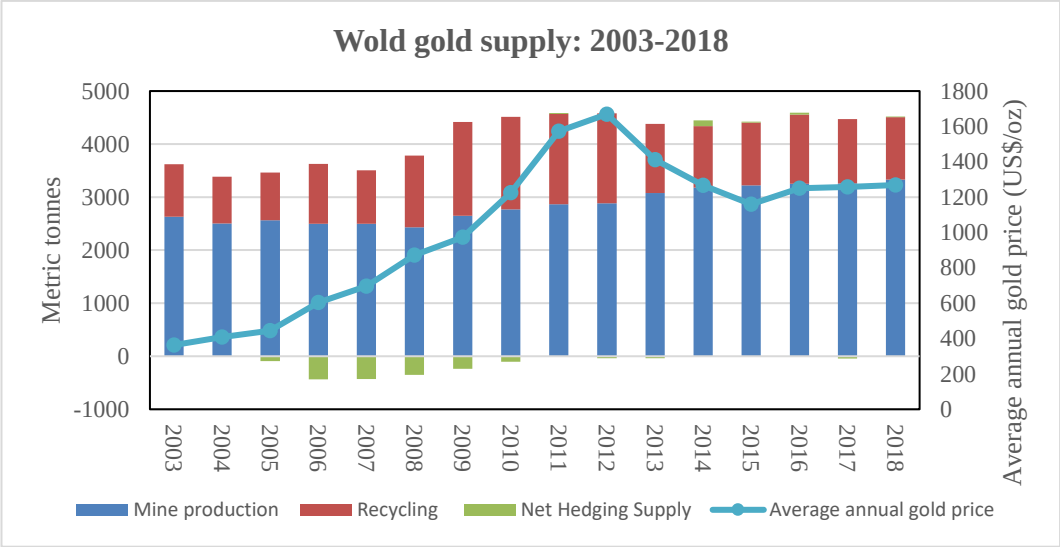


Figure 5.2 World gold supply.

(Source: GFMS, 2019)

In 2008 gold was mined in over 60 countries and increased to about 90 countries in 2015 with six nations having been historically dominant producers as indicated in Figure 5.3 (DMR, 2009b: UNCTAD, 2016). From 1898 to 2006 South Africa was a dominant producer of gold until it was overtaken by China.

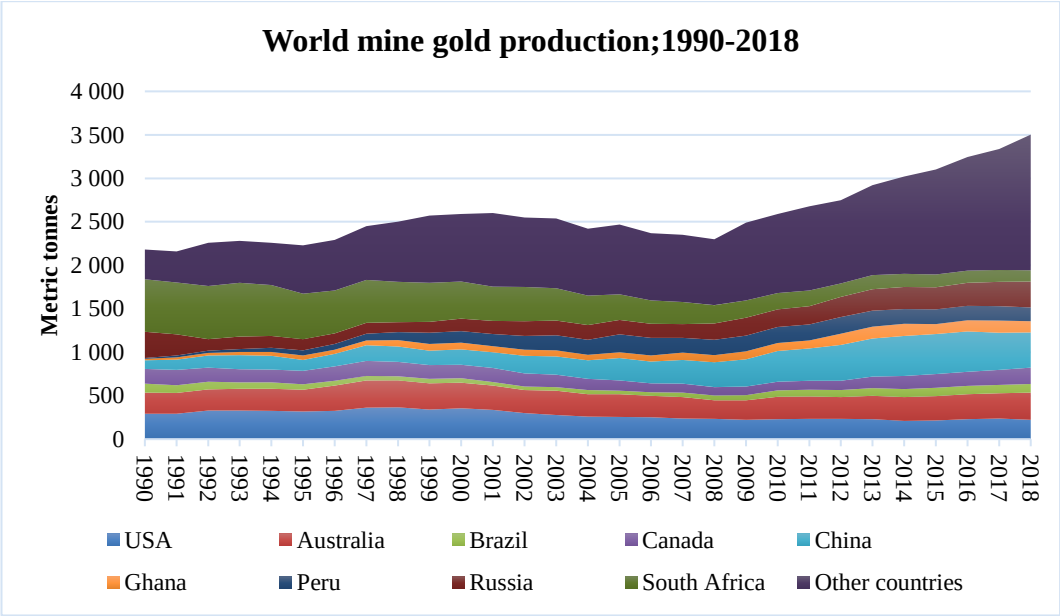


Figure 5.3 Major countries where gold mining occurs.

In 2018 the number one global producer was China followed by Australia, Russia, USA, Canada, and Peru and with South Africa coming at seventh position. Figure 5.3 illustrates that in the past three decades global mine production of gold has been characterised by the decline of the share of South Africa production and the emergence of new players such as China and Peru.

5.3 Development of the South African gold mining industry

Prior to the discovery of gold in the Witwatersrand Basin in 1886, there was some gold mining in South Africa from the Archean Greenstones Belts; however, more than 98% of the primary gold produced in South Africa comes from the mines in the Witwatersrand Basin (Viljoen, 2009). The Witwatersrand basin comprises of seven major discreet gold fields, namely: Central Rand, East Rand, West Rand, Carletonville, Klerksdorp, Welkom and Evander (Figure 5.4)

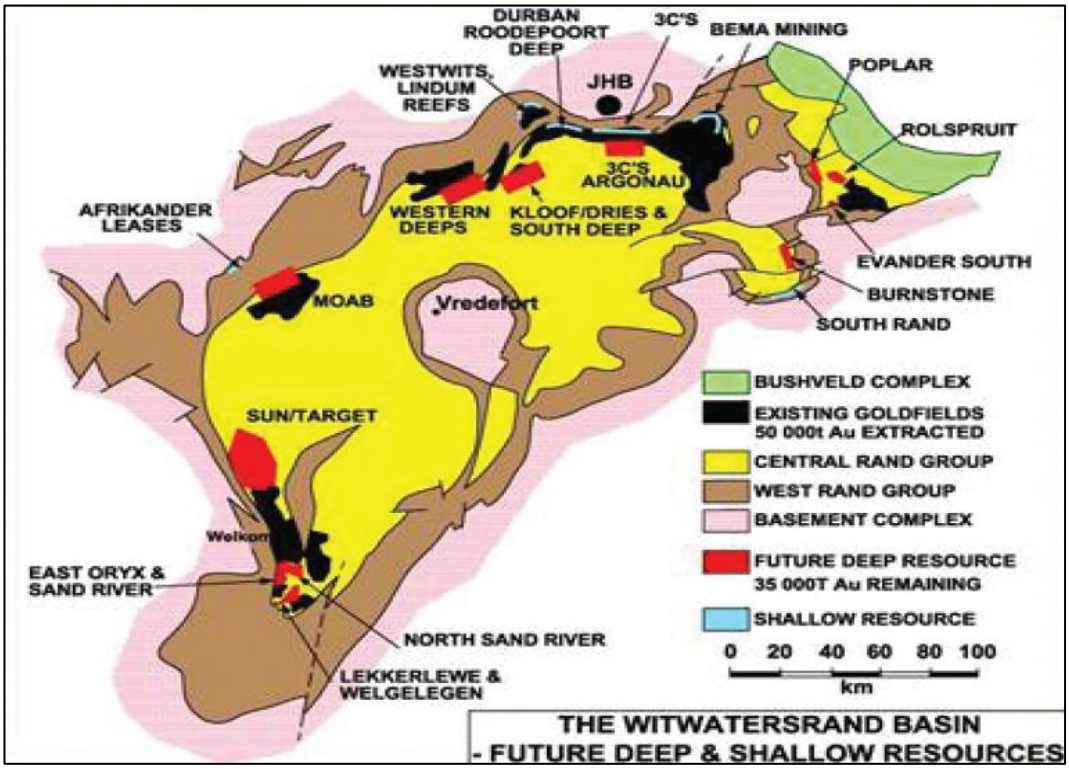


Figure 5.4 The seven discreet gold fields of the Witwatersrand basin

(Source: Viljoen, 2009)

The unique characteristics of these gold deposits are the lateral continuity of the reef horizons, high grade ores and large tonnage (Phillips, 2013: Phillips and Powell, 2015). The discovery of the Witwatersrand gold deposits coincided with many large economies of the day embracing the gold standard which ensured that there is large demand of gold to accommodate increasing international trade activities. With high demand of gold required to ensure the smooth functioning of the gold-backed currencies, the Witwatersrand mines had guaranteed customers for the gold and therefore production soured.

Immediately after gold was discovered in 1886 on the Central Rand, mining activities immediately mushroomed around the areas adjacent to the outcrop and underground mining only commenced after down-dip and strike length extension of reef horizons and associated grades were confirmed by an extensive diamond drilling program (Viljoen, 2009). Subsequent to the discovery of the Central Rand, the East and West Rands were discovered in the late 1880s and contributed to the expansion of gold mining operations and increase in South African gold production to 199 tonnes in 1898. This souring gold production, however, was stalled by the Boer War from 1900 to 1902. As can be observed in Figure 5.5 production from these early discoveries stabilised in the 1920s and the concern for the long-term sustainability of the mines crept in.

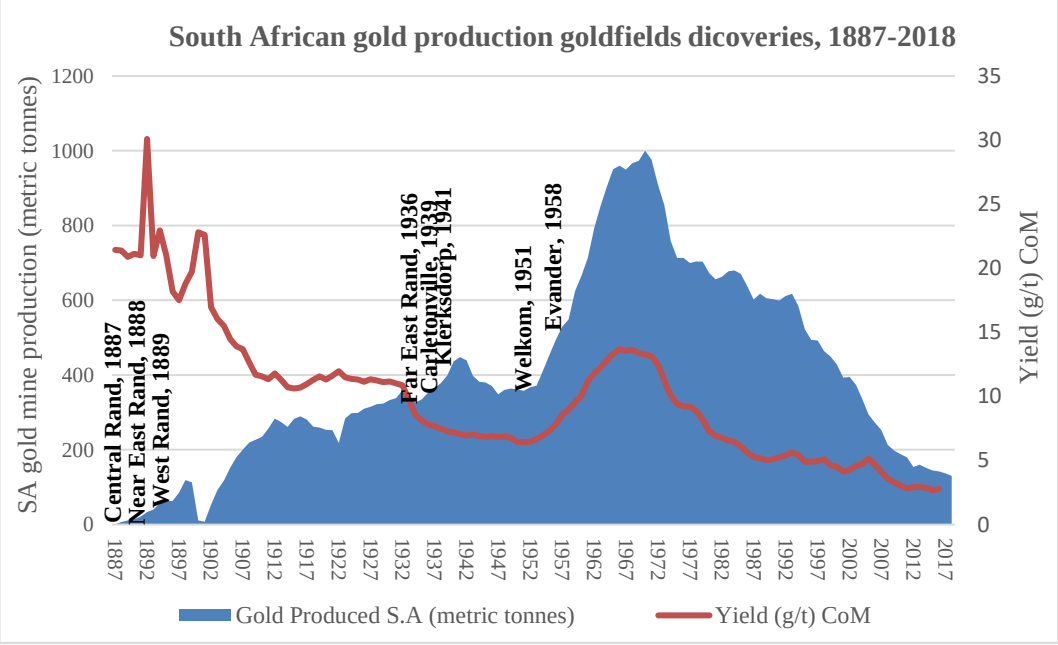


Figure 5.5 South African gold production and yield from the Witwatersrand basin: 1887-2016

(Source: Handley, 2004; Chamber of Mines of South Africa, 2018)

As gold production was stabilising from Witwatersrand mines, the gold standard was suspended in 1932 resulting in an increase in the price of gold: gold price averaged US$22, 68 per troy ounce in 1932 to US$34, 86 per troy ounce in 1935 (see Figure 5.6). This increase in gold price resulted in increased profitability of the mining operations. Most importantly, however, the increase in gold price brought back some of the low grade gold resources into profitability – the average grade of the Witwatersrand ores averaged 11.09 g/t in 1932 and it declined to 8.79 g/t in 1934 and thereby increasing the life of mines for some of the operations (see Figure 5.5). Davenport (2013) postulated that it was this massive increase in profitability and expansion of production to existing mines that contributed to the initiation of an extensive exploration program, using stratigraphy, geophysics and diamond drilling, which resulted in the discovery of the three new gold fields, namely, Carletonville, Klerksdorp and Welkom gold fields in 1936, 1939 and 1941 respectively .

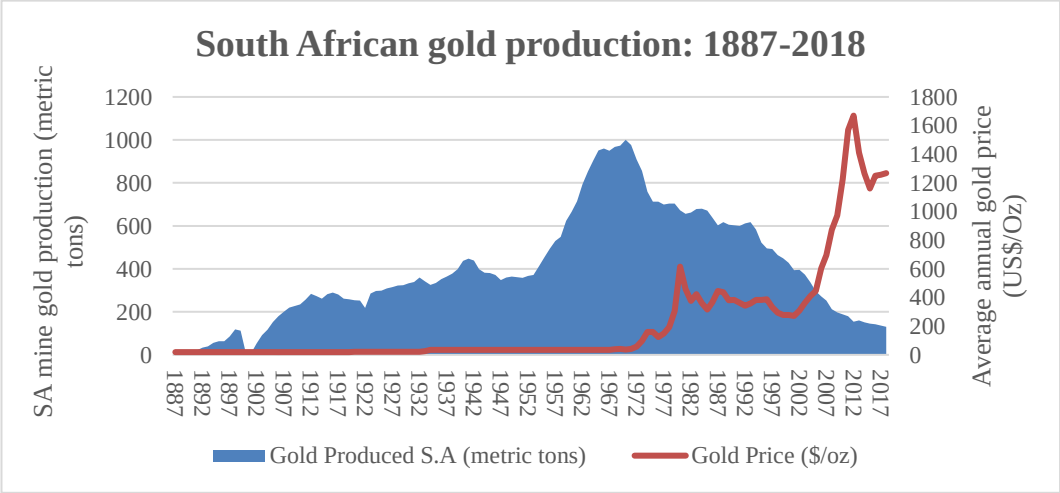


Figure 5.6 South African mine gold production from the Witwatersrand basin and average annual price: 1887-2016

(Source: Handley, 2004; Chamber of Mines of South Africa, 2016)

5.4 Gold production in the post-apartheid era

Phillips (2013) attributed the astronomical growth of gold production in South Africa, coupled with an increase in average grade increase of 6,96 -12,51 g/t from 1954 to1970 squarely on the commissioning of mines developed from the earlier discovered Carletonville, Klerksdorp, and Welkom gold fields. Peak production was reached in 1970 and since then gold production has been in decline. Firstly, a sharp decline from 1000 metric tonnes in 1970 to 917 metric tonnes in just 5 years; a stable decline from 713 metric tonnes in to 620 metric tonnes over eighteen years period starting ending in 1993; another relatively sharp decline of 365 metric tonnes from 1993 to 253 metric tonnes in 2007 (see Figure 5.6). Since 2007, however, the decline gold production appears to be somewhat stable.

Various reasons have been put forward in an attempt to explain the decline in gold production from a peak of over 1000 tonnes of gold in 1970 to a meagre 142 tonnes in 2016. Viljoen (2009) postulated that the decline of gold production in South Africa is due to escalating costs and difficulties associated with deep-level mining, compounded by increasing labour costs and low gold price. Phillips (2013), however, disagreed with the notion that the decline in gold production could be attributed mainly to the increased depth of mining operations and declining gold price. Phillips (2013) correctly pointed out that the mining depth has not changed much in the past 40 years. For instance, Western Deep Level was mining at 3, 7 km in 1977 and this depth reached 4,1km in 2009. In terms of gold price impact on gold production, Phillips (2013), argued that even the gold price increase of 1974 and 1979 could not stall the declining trend.

The main factor driving the gold production decline is identified as the failure to discover new gold deposits since Evander in 1958 (Viljoen, 2009; Phillips, 2013). Table 5.1 illustrates that current gold production is coming from mines commissioned as far back as 140 years.

Table 5.1 Major gold mines currently producing in South Africa

Deposit	Major mines	Founded	Lifespan
Central Rand Goldfield	Durban Roodepoort Deep Operations.	1895	123
	ERGO (Surface operations)	1978	40
West Rand Goldfield	South Deep/Western Areas	1961	57
	Randfontein Operation/Cooke Section	1970	47
	Doornkop	1983	34
East Rand Goldfield	Consolidated Modderfontein	1887	131
	East Rand Proprietary Mines	1893	125
Far West Rand Goldfield	Western Deep Levels (Mponeng)	1981	37
	Western Deep Levels\Savuka	1958	60
	Western Deep Levels\Tau Tona	1962	56
	Driefontein	1948	70
	Kloof Gold Mine	1964	54
	Kloof Gold Mine\Ventersport	1934	84
	Kloof Gold Mine\Libanon	1936	82
	Elandskraal Operations (Kusasalethu)	1978	40
Klerkdorp Goldfield	Vaal Reefs\Great Noligwa	1972	46
	Vaal Reefs\Kopanang	1984	34
	Vaal Reefs\Tau Lekoa	1991	27
Welkom Goldfield	Beatrix	1981	37
	Target	2002	16
	Tshepong	1991	27
	Masimong	1985	33
	Bambanani	1969	49
	Unisel	1979	39
	Joel	1988	30
Evander Goldfield	Winkelhaak	1958	60
Non Wits Gold mines	Agnes	1888	130
	Barbrook	1880	138
	Fairview	1887	131
	Kalgold	1995	23
	Lily	1888	130
	New Consort	1885	133
	Sheba	1874	144
	Klipwal	1898	120
	Transvaal Gold Mining Estates	1895	123

(Adapted: DME, 2003; Handley, 2004)

This is due to the fact that there has been lack of investment in the development of new gold mines in the past three decades. This period is characterised by the

continued decline in the South Africa gold production as older mines deepen and become expensive to operate, coupled with declining grades and mineable reserves, and therefore closure of some of the mines. Of the mining operations listed in Table 5.1, the youngest operation to be commissioned is Target Mine which is 16 years old followed by Kalgold and Tshepong Mines at 23 and 27 years respectively. The last gold mine to be developed South Africa is Burnstone operation near Balfour in Mpumalanga which started developed in 2008 but all development and production activities were abruptly suspended due to shortage of working capital necessary to break even by the owner Great Basin Gold.

More concerning is the fact that Statistics South Africa's 2017 Environmental Economic Accounts Compendium estimates that 39 years' worth of gold production, depending on the prevailing modifying factors, was left in 2014 – although this was an improvement from 21 years' worth of gold production in 2002 as demonstrated at Figure 5.7.

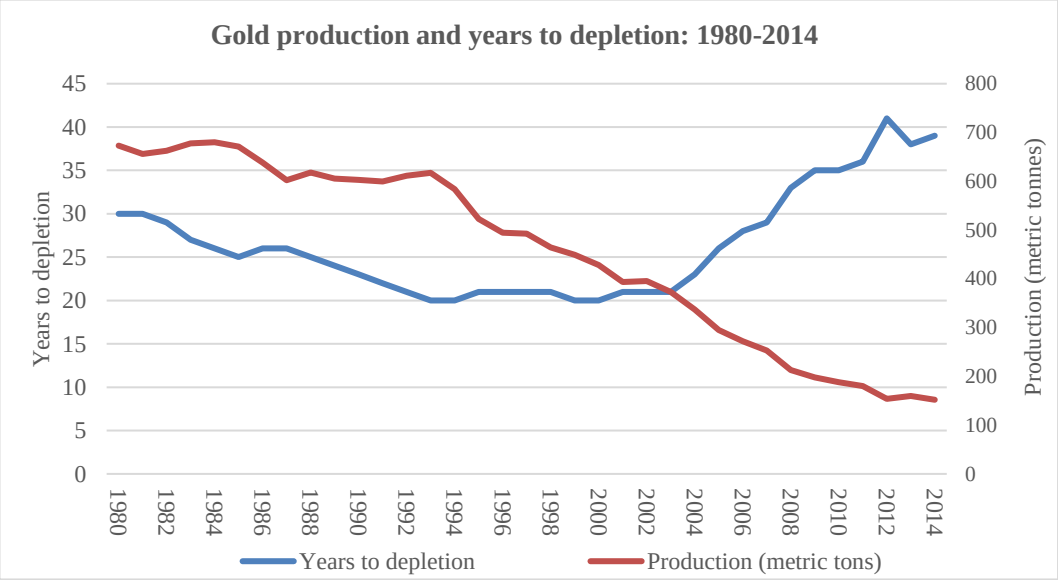


Figure 5.7 Numbers of years left before depletion of gold reserves in South Africa at the current production rate

(Source: Statistics South Africa Environmental, 2014 & 2017)

5.5 Operational challenges facing the South African gold mining industry

South Africa has experienced above-inflation average annual tariff increases since 2003 and unreliable power supply. However, up until the 2008 financial year, the country was the world's cheapest producer of electricity and average tariff increases were below inflation as indicated in Figure 5.8 (Eskom, 2008). Due to the energy intensive nature of mining, especially deep level gold mining, the continuous above-inflation Eskom increases have significantly impacted the cost base of mining operations.

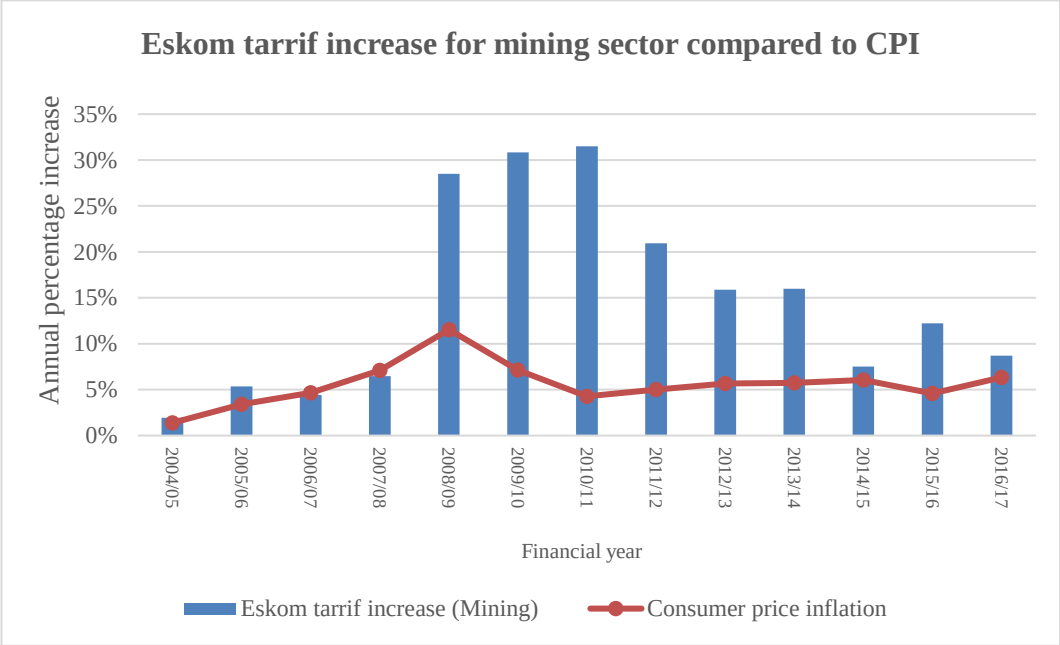


Figure 5.8 Eskom tariff annual increases for the mining sector

(Source: Eskom, 2018)

In the case of Sibanye Gold, which was mainly a deep level gold mining company until the acquisition of some platinum assets, electricity cost moved from being just 9% of total working cost expenditure in 2007 to 19% in 2016 as indicated in Figure 5.9. Labour remains the largest component of working cost expenditure which remained at over 50% since 2007. Stores and materials share of working cost expenditure has increased from 18% in 2007 to 21% in 2016. The electricity cost inflation, although other items have escalated as indicated in Figure 6.11, has led to

some of the marginal gold mines shutting down as profitability dried up. Turner (2017) argued that the electricity inflation in the past 15 years has not been aligned with the national agenda of economic growth and job creation to realise the full value of gold resources in South Africa, mining operations require stable input costs to reach operational targets and to extend the life of mine of some operations. Failure to curb the ever increasing electricity cost will lead to operational restructuring which will lead to job losses and no new investment into the sector.

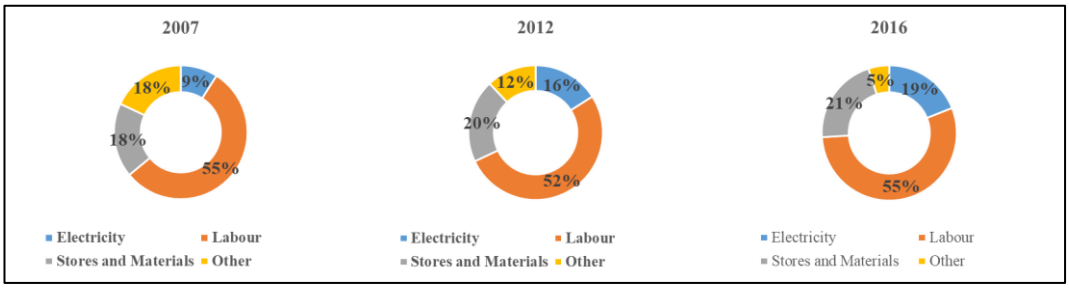


Figure 5.9 Sibanye Gold working cost composition

(Source: Turner, 2017)

5.6 Impact of post-apartheid legislation in the development of the gold mining industry in South Africa.

From 1990 there was an accelerated decline in gold production, at an average of seventeen tons per year, and only stabilising around 2000. This period coincides with major political change in South Africa that brought about a new democratic dispensation. This period was also characterised by a shift in regulatory and legislative environment of the mining industry to reflect the new political order. This accelerated decline in production appears to be a result of the continuing closing of unprofitable Witwatersrand gold mines due to diminishing mineable reserves and the escalations in the cost of mining. Despite significant increase in gold price from 2002, this period was characterised by almost no new development of gold mines in South Africa.

Figure 5.10 illustrates the value of capital expenditure and type of project in the gold mining industry from 1993 to 2016 detailing the efforts to replace depleting

reserves for future mining. A detailed analysis of Appendix 12.1 illustrates that currently new mine investment in gold mining industry is non-existent. From 2004, which is the year the MPRDA was promulgated, investment was directed mainly towards expanding current operations and retreatment of old tailings dams with minimal funds earmarked for the development of new operations. In fact, if the investment into South Deep Mine is to be discounted the graph plotted in Figure 5.10 would look completely different in terms of investment value directed into gold mining in South Africa in the past two decades.

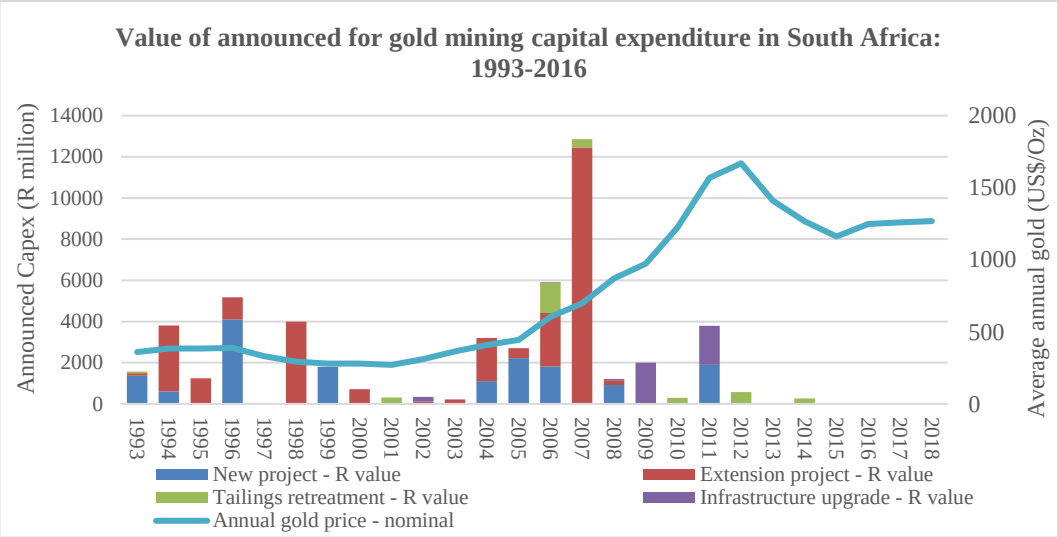


Figure 5.10 Gold mining capital expenditure in South Africa: 1993-2018

(Adapted: Nedbank, 2017)

Some of the factors that have been put forward as limiting investment in the gold mining industry are high energy costs and above inflation labour increments, coupled with low productivity and a volatile labour relations environment. Other operational challenges such as aging infrastructure, greater distances to working areas, reduced flexibility and declining grades have all contributed to a consistent decline in production and increase in cost of mining.

5.7 Chapter summary

The South Africa gold mining started in the 1886 and production has been in decline in South Africa from a peak of over 1000 tons of gold in 1970 to a meagre 130 tons in 2018. From the 1970 peak of over 1000 tons, production has been gradually dropping with an annual production of 146 tons in 2016. Gold price has experienced exponential growth in the past two decades, peaking in 2012, largely driven by increase in jewellery demand from China and India. This accelerated decline in production appears to be a result of the continuing closing of unprofitable Witwatersrand gold mines due to diminishing mineable reserves and the escalations in the cost of mining. Yield in the gold mines declined in yield from 21.41 g/t in 1970 to 2.72 g/t in 2016.

As the older, higher grade, mines came to the end of their economic life starting in the 1970's, efforts to replace these deposits with new deposits was not successful. The expansion of some of these mines was not pursued because remaining resources are at greater depth and therefore increasing pay limits. With the publication of the Minerals and Mining Policy of 1998, it appears that the gold mining industry had anticipated a politically more difficult environment to operate in which would be associated with declining profit margins and policy uncertainty. Two years prior, the enactment of the Mine Health and Safety Act of 1996 made it clear that the area of health and safety and human resource development in the gold mining, which historically had been plagued with serious occupations accidents and fatalities would be shifting. Because of these expectations in the future, gold mining houses consolidated and focused on international opportunities and therefore was no capital investment into the exploration and development of the industry for long-term sustainability.

The cost of mining for the remaining gold mining operations has also substantially increased mainly due to above-inflation salaries increments and the cost of electricity, have led to reduced profitability and closure of some shafts. The cost associated with the new legislative framework, such as black empowerment ownership requirements, have further increased the cost of mining in the industry.

These reasons have deemed the gold mining industry unattractive for investment from investors. The lack of investment in the sector means that there have been limited efforts towards the discovery of new gold deposits or the extension of known deposits. The focus of investment in the gold mining sector, in the past two decades, was towards the exploitation of the current known reserves utilising the available infrastructure.

6 SOUTH AFRICAN PLATINUM MINING INDUSTRY

6.1 Introduction

This chapter analyses the impact of the post-apartheid mineral regulation, and other challenges, on the competitiveness of the platinum mining and exploration in South Africa in the past two decades.

6.2 Platinum demand drivers

Due to limitations in terms of known uses in the early 1900s, the platinum demand growth was restricted to jewellery manufacturing. It was with the outbreak of both the first and second World Wars where the suitability of platinum metal in industrial, chemical and electrical uses was considered on a grand scale (Davenport, 2013). Figure 6.1 captures the historical demand of platinum comprising of purchase in manufacturing of automotive catalysts; jewellery fabrication; investment in forms in the form of bars and coins and exchange-traded funds (ETFs) backed by physical platinum; and applications in the chemical and electrical industries. In 1975 global demand of platinum totalled 2.580 million ounces and is expected to reach 7.9 million ounces in 2019.

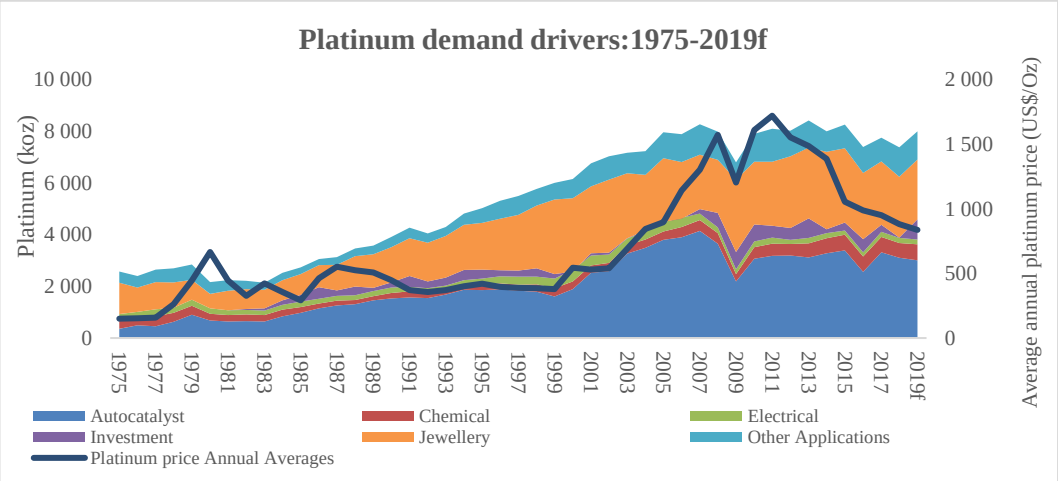


Figure 6.1 Platinum demand drivers

(Adapted: Johnson Matthey, 2016 & 2019)

South Africa and Zimbabwe are the only primary source of platinum, with platinum in Russia and North America mined as a by-product of other metals (mainly copper and nickel in Canada; palladium in in Russia and USA) (USGS, 2012: World Platinum Investment Council, 2017). The ratio of platinum to palladium varies across the Busheveld Complex: is 62%:38% for the Merensky reef in the Western and Eastern Limbs; 53%: 36% in the UG2; and 43%: 47% in the Northern Limb (World Platinum Investment Council, 2017). Unlike in other countries where the development of PGMs deposits is influenced by factors affecting copper, nickel and palladium, South African PGMs mines are developed with the view to primarily mine platinum with palladium and rhodium recovered as by-product. Therefore this research focuses mainly of the mining of platinum.

Apart from jewellery and industrial demand, from the early 1970s and onwards, platinum demand grew as a result of mainly United States and European governments' decision to reduce pollution of the environment by vehicle emission, whereby platinum-bearing catalysts would be used to clean up car exhausts (Davenport, 2013) (see Figure 6.2).

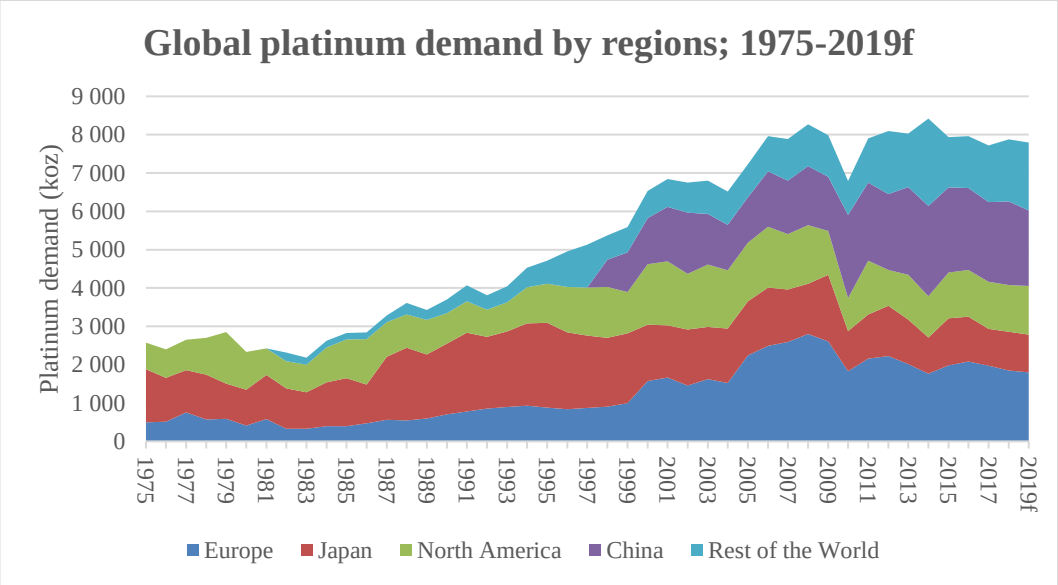


Figure 6.2 Global platinum demand by regions

(Adapted: Johnson Matthey, 2016 & 2019; GFMS, 2019)

For many years, until the late 1990s, Japan was a dominant consumer of platinum mainly due to popularity in jewellery manufacturing and applications in the automotive industry until it was surpassed by Europe as the majority of countries tightened the emissions control regulation especially for diesel engines. Beginning in the late 1990s China's jewellery demand for platinum has been on the rise.

Demand from the motor industry grew from 0.3 million ounces in 1975 to 3.1million ounces in 2018. Up until 2008, the demand for platinum was heavily tilted to the auto industry peaking at 4.1 million ounces in 2007. However, due to the decline in new vehicle sales, as a result of the Global Financial Crisis of mid-2008, the platinum metal demand from the auto industry has been in declining from a peak of 3, 9 million ounces in 2006 to a forecast of 3, 0 million ounces in 2019.

Demand from the jewellery industry has increased mainly spearheaded by growth in China and other emerging markets currently experiencing high economic growth as indicated in Figure 6.2. Jewellery demand is also dependent on high income growth and availability of disposal income especially in developing countries; in the 1975 this demand totalled 1, 2 million ounces, peaked at 3, 0 million ounces in 2014, and is expected to reach 2, 3 million ounces by end of 2019.

Platinum is considered an industrial mineral and its demand is a direct response to the need for the metal in industrial applications and therefore demand will only grow in periods of global economic growth. Periods of subdued economic performance will call for less usage of platinum in industrial applications and therefore demand will be subdued in this period. The industrialisation of China impacted this demand segment especially between 2000 and 2008.

Jewellery demand is also dependent on high income growth and availability of disposal income. Currently, a substantial amount of the platinum demand sits in China, of which the economy has slowed down, Eurozone and Japan, currently experiencing low economic growth. Investment demand for platinum bullion and other investment products backed by the physical metal is relatively minor at this juncture and this can be attributed to the historical nature of how individuals and institutional investors perceive gold as a superior holder of value in times of both

global economic and political uncertainty. The contribution of physical platinum investment demand for the past 30 years can be attributed to the lack of understanding of fundamentals as a result of promotion. However, the main contributor to physical platinum investment has been driven by Japan and the United States. On the other hand, newly-established South African ETFs – NewPlat and AfricaPlatinum – have recently contributed to a demand growth of physical-backed exchange traded funds (Thomson Reuters, 2015).

Overall demand for platinum has been driven mainly due to the popularity of platinum as jewellery in China and growth in the auto-catalyst demand from Europe and the Americas. During this period, demand outstripped supply. However, the problem with a platinum demand driven by the jewellery sector is that it is dependent on the availability of disposable income, as household income increases from boosted economic activity, and thus susceptible to volatility and that does not impact producers positively. On the other hand, demand from auto-catalyst and industrial applications are also heavily proportional to the global economic performance and how stringent the legislations aimed at curbing environmental pollution from the vehicle emissions are.

6.3 Platinum supply

South Africa and Russia have dominated the global production of platinum from the early 1970s and the market share structure has not significantly changed since then. The dominance of platinum group metals in South Africa is due to the presence of large economic resources called the Bushveld Complex while other countries such as Russia, Canada, Zimbabwe, and the United States play a minor but important role as indicated in Figure 6.3 (Mudd, 2010). PGMs supply in Zimbabwe and USA is derived from the Precambrian mafic to ultramafic layered intrusions called the Great Dyke and Stillwater Complex respectively which are similar to the Bushveld Complex but smaller in scale. In Canada and Russia PGMs production is derived as a by-product of copper and nickel mining (Wilburn, 2012).

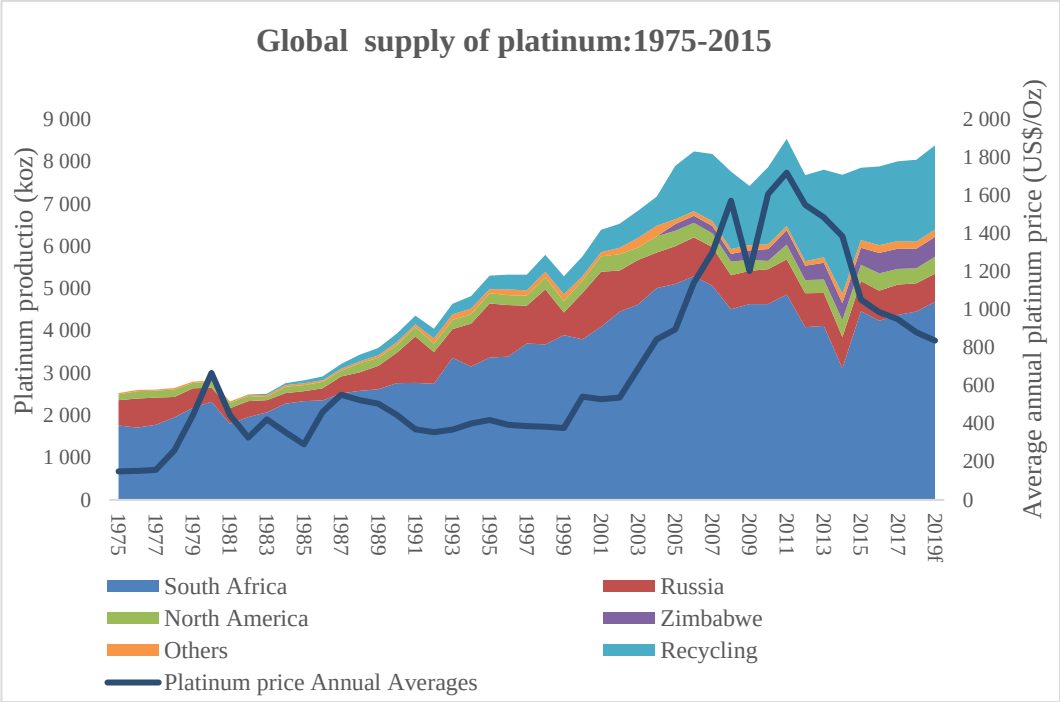


Figure 6.3 Global supply of platinum

(Adapted: Johnson Matthey, 2016 & 2019)

Since the commodity boom of 2002 to 2007, led mainly by Europe and China, there has been a substantial supply growth of platinum from 6, 5 million to 8, 1 million ounces of platinum as a result of the global demand of the metal as indicated in Figure 6.3. The major drive for this demand was, and still is, growth in the auto-catalyst demand from Europe and the Americas and due to the popularity of platinum jewellery in China as discussed in section 6.2. During this period, demand outstripped supply and hence the record-high platinum prices were enjoyed. From 2012 onwards, the demand has outstripped supply, and this is expected to remain so until 2021, but yet the spot price of platinum has dropped from an annual average price of US$1552 per ounce in 2012 to US$882 per ounce in 2018. This movement of the platinum price appears to be defying supply and demand dynamics; however, it is attributed to the declining rate of depletion of the above-ground global inventory as the price declined since 2012.

Outside of southern Africa, Russia is a significant producer of palladium: almost all of the platinum produced in Russia is from Norilsk Nickel where platinum is produced as a by-product of nickel and palladium. Figure 6.4 illustrates the dominance of palladium production by Russia. South Africa comes second in terms of palladium which is mined as a by-product of platinum in the Bushveld Complex.

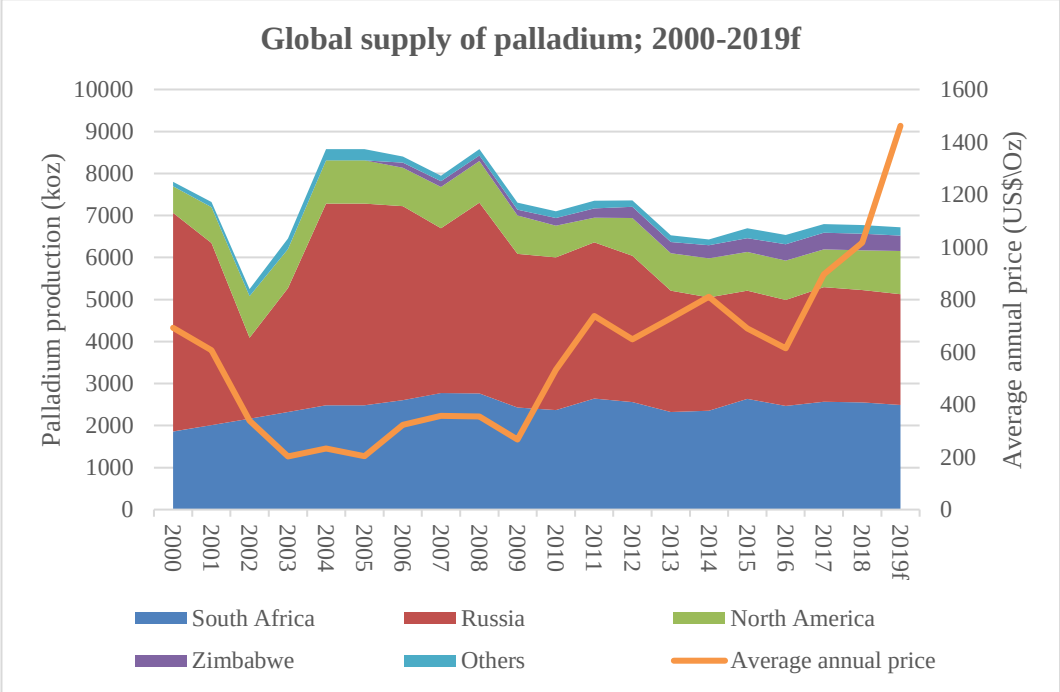


Figure 6.4 Global supply of palladium

(Adapted: Johnson Matthey, 2016 & 2019; GFMS, 2019)

Supply of platinum from recycling has gained momentum in the past two decades responding to the increasing price of the metal majority of which comes from the auto-catalysts; recycling supply reached 1.9 million ounces from 420 thousand ounces in 2000. Recycling of platinum and the urgency to replace platinum with palladium due to the fact that production of platinum is concentrated in southern Africa where some western consumers consider as an unreliable source due to perceived political risk. This has also led to a decline in primary platinum demand as can be seen with the United States having only consumed a meagre 950 000 ounces of platinum with a fraction of that used in the auto industry in 2013 (Anglo Platinum, 2014). The rising platinum supply from recycling may compete with

supply from primary mine production especially in low commodity price environment.

Low growth prospects for the world economy, led by the slowdown of the Chinese economy, Eurozone recession and marginal GDP growth in the USA, spells an uncertain market environment for South African platinum producers. Although international producers are also feeling the brunt of the low commodity prices, South African operations are especially at risk due to their high cost structure as a result of deep-level mining layouts, declining grades, and the fact that their operations are labour intensive.

6.4 Development of the South African platinum mining industry

In South Africa, the occurrence of the platinum group of metals (PGMs) was discovered in the Lydenburg district, in what is today Mpumalanga Province, by Dr. Hans Merensky (Davenport, 2013). Early in the 1700s platinum was considered of little commercial value due to its 'brittle nature and unworkability' because of platinum's melting point of 1769 °C (Creamer, 2000). However, in 1782 French Chemist Antoine-Laurent de Lavoisier succeeded in melting platinum using oxygen. Doors were then opened for platinum to be employed in the manufacturing of jewellery and the search for other industrial applications commenced (Davenport, 2013).

The primary production of PGMs in South Africa is extracted from the Bushveld Complex and its associated satellite intrusion Nkomati – Uitkomst Complex. The Bushveld Complex is subdivided into three limbs, namely: Western, Eastern and the Northern Limbs based on the geographical outcrops distribution of mafic and ultramafic rocks that make up the Rustenburg Layered Suite of the Bushveld Complex as illustrated in Figure 6.5 (Thormann et al., 2015). The main economic horizons being exploited are the Merensky and UG2 in the Western and Eastern Limbs, the Platreef is mined in the Nothern Limb.

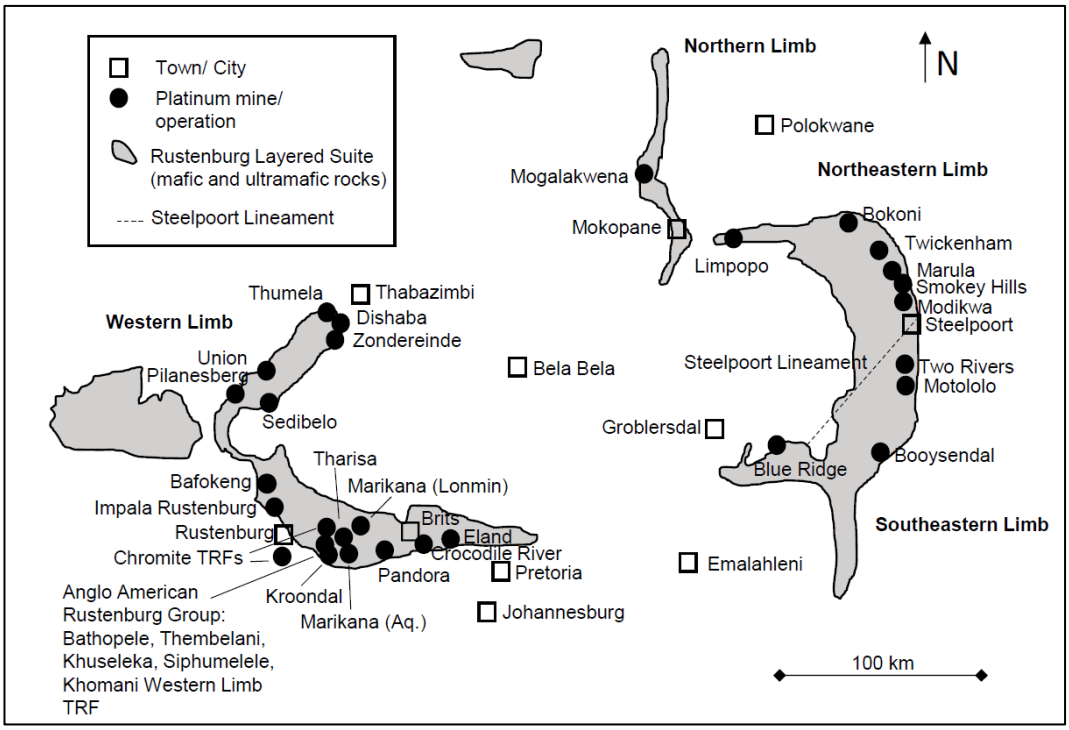


Figure 6.5 PGMs mines in the Bushveld Complex

(Source: Thormann et al., 2015).

The South African mining industry has evolved over the past century and a half - for many decades gold was the mainstay commodity and the dominant foreign exchange earner in terms of export mineral products as illustrated in Figure 6.6. On the other hand, the platinum sector has enjoyed tremendous growth, on the back of never-seen-before demand growth from North America, Europe and China as the effort to reduce the impact of emissions from automobiles. Currently South Africa contributes 70% of the global annual production and holds more than 80% of the world's known reserves (DMR, 2015a).

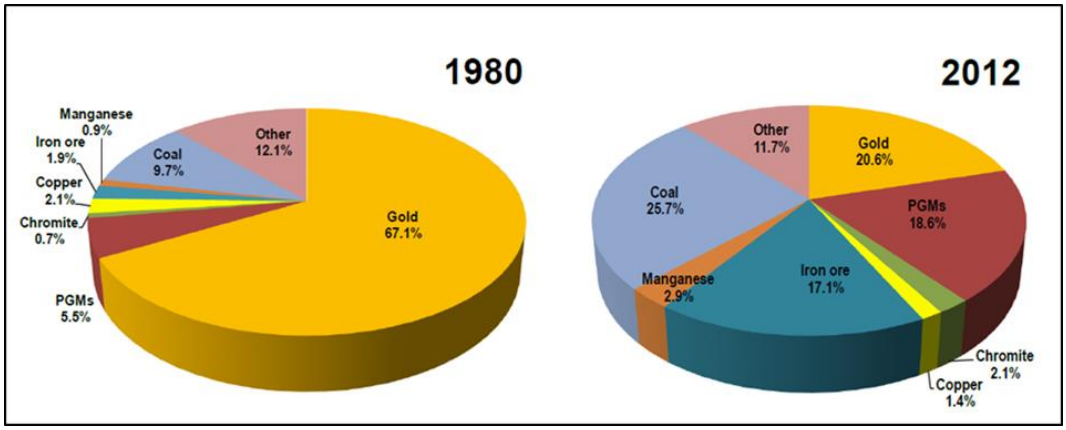


Figure 6.6 The change in significance of the platinum mining sub-sector in the South African mining industry.

(Source: Industrial Development Corporation, 2013)

In 1980 PGMs mining contributed a meagre 5.5% to the total mining output in South Africa with gold contributing a staggering 67.1%. However, by 2012 production had achieved a tremendous growth trajectory rising demand due to PGMs uses in auto-catalysts converters and was contributing 18,6% towards the total mining output. The South African gold mining industry, on the other hand, has been declining since 1970, for many years it absorbed the abundant unskilled labourers and was the major foreign exchange earner. By 2012 gold mining production contributed only 20.6% to the total mining output.

South Africa has been dominating the global production of platinum in the past four decades. As recently as 1968, Rustenburg Platinum was the only producer of platinum in South Africa; however, with demand expected to increase in the automotive industry due to new legislation which led to the introduction of catalyst converters curb emissions from cars, new mines were developed and current ones were expanded in the 1970s which led to the formation of Impala Platinum and Lonmin Platinum (Johnson Matthey, 2005). The development of new mines and expansion projects increased production from 1.7 million ounces in 1975 to 2.3 million ounces in 1908 – a staggering 32% increase in only five years. Expansion of platinum production, through the development of new mines and expansion of operating mines, continued in the second half of the 1980s due to higher prices of

platinum. During this period South African platinum production increased achieved almost 20% expansion peaking of 2.7 million ounces in 1990. The low price environment of the early 1990s, due to the combination for the emergence of palladium as a substitute for platinum in auto-catalysts and Russia increasing output after the fall of the Union of Soviet Socialist Republics (USSR), led to major new and expansion projects being put on hold although production increased by 38% during this period (Johnson Matthey, 2005).

6.5 Platinum production in the post-apartheid era

It was not until the turn of the millennium that the market again looked sufficiently promising for a further wholesale expansion in platinum mining to meet the rising demand. The expansion of production to meet the rising demand from early 2000s is indicated by new mines coming into production as indicated in Figure 6.7. The expansion of platinum production in the 2000s was fuelled by the commissioning of new mines and extension of operations already in existence and production peaking at 5.2 million ounces in 2007 – a 39% increase from the 2000 production level. Figure 6.7 shows that between 1995 and 2019 sixteen new PGMs mines were commissioned within the Bushveld Complex with one operation developed in the Nkomati – Uitkomst Complex satellite intrusion. Of the 16 news mines, 9 were developed in Western Limb and 8 were developed in the Eastern Limbs of the Bushveld Complex. Historically, PGMs production has been concentrated on the Merensky reef in the western limb of Bushveld Complex due to favourable PGMs grade distribution, lower chromite making it easier to process, geographical proximity to existing water, power, and transport infrastructure and human resource availability from the nearby Gauteng Province (Johnson Matthey, 2003; McGill, 2010). Due to depletion of reserves and increasing depth of the Merensky reef in the western limb of the Bushveld Complex new mines were developed on the UG2 reserves.

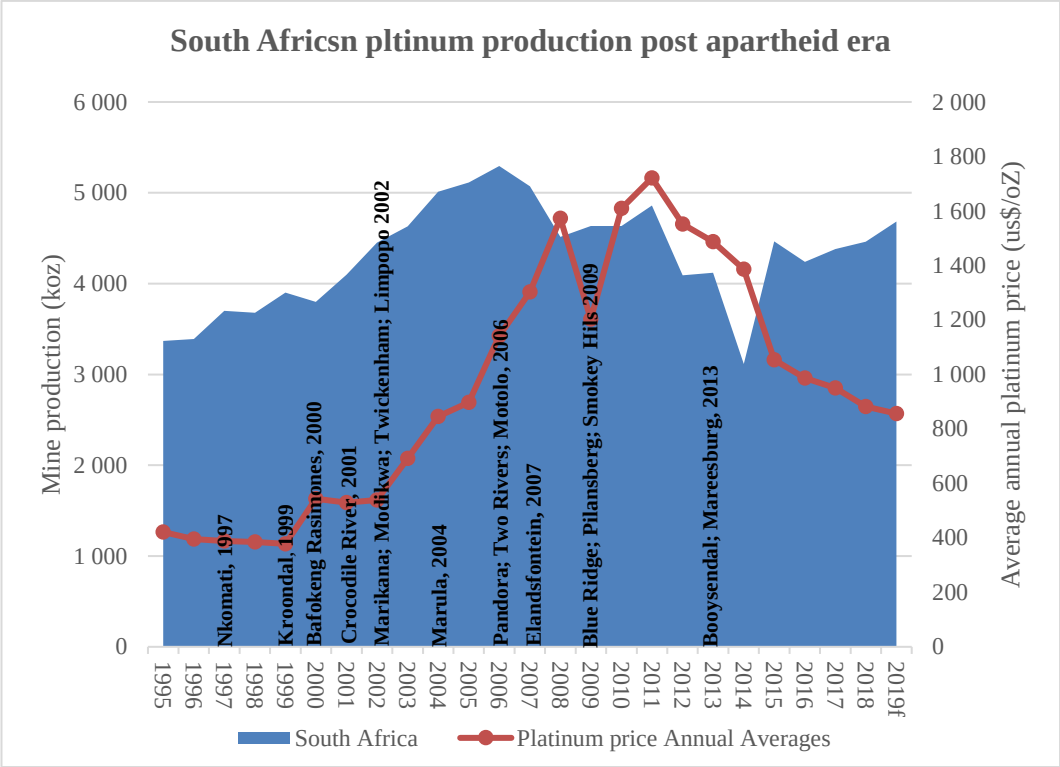


Figure 6.7 The impact of new mine into the platinum production in South Africa.

With the platinum price rising in the early 2000s, South African producers aimed to ramp up production to meet demand. Because Merensky reef reserves were depleting in the western limb, the less attractive potential of the Merensky reef and UG2 of eastern limb of became attractive (Johnson Matthey, 2003). The investment of exploration in the eastern limb of the Bushveld Complex brought about commissioning of 8 new mines between 2002 and 2009.

6.6 Operational challenges facing the South African platinum mining industry

Global mine production of platinum has been in decline since 2007 when the long term growth trend was interrupted by the Global Financial Crisis of mid-2008. South African primary platinum production has also been in decline, from 5.6 million ounces in 2007 to 3.1 million ounces in 2014, mainly as a response low

platinum prices, mothballing and shutting down of uneconomic mines due to increasing costs, reduction in capital expenditure and a five-month strike in 2014.

Since the Global Financial Crisis in mid-2008, the global demand of platinum dropped substantially due to the prevailing global economic climate. The resultant scenario is not desirable for the South African platinum producers because the demand - supply imbalance led to weak platinum prices. Depressed platinum prices, coupled with increasing operational costs, wages, energy costs and consumables and a drop in mined grades, profitability of the majority of mines was, and is still being, eroded (Surujhlal et al., 2014). This continuous negative platinum price does not bode well for the South African platinum producers and the economy by extension as operations are being shut down or mothballed resulting in loss of tax revenues and jobs.

The platinum mining industry has faced both operational and social upheaval which contributed to the reduction in profit margins. The violent labour disputes have led to prolonged mine closures; safety stoppages by the Department of Mineral Resources (DMR) have led to losses in revenues; and technically, the ore grades have continuously declined and mining depth increased and therefore resulting in higher operational costs.

Despite the efforts to change operational strategies by South African platinum mining companies to mitigate the more than five year slump in commodity prices since 2012, cost escalations that were augmented by the above inflation wage increases, energy costs and inflation on consumables, has resulted in some operations wiping off their profit margins. Although efforts are being made to minimise job losses as a result of shaft closures or mothballing some of the unprofitable mines, the inevitable consequence has been massive job losses on the platinum belt. The low commodity price environment resulted in marginal platinum mines being mothballed and delayed development of some orebodies.

Figure 6.8 indicates that in 2014, South Africa had enough platinum reserves to sustain mining for the next 335 years under prevailing modifying factors. However, this resource endowment does not necessarily translate to market power and hence

the future of platinum mining in South Africa depends on how well operations perform in factors that would make them more competitive than other mining jurisdictions. The challenge for platinum mining industry lies on how the industry should remain relevant in the face of recycling and substitution of mineral commodities. Surujhlal et al., (2014) suggested that to ensure the survival and sustainability of their operations, South African platinum miners should devise new operational strategies to withstand the uncertainty in the current market environment, such as:

- Cost management and productivity;
- Prudent capital allocation;
- Innovation/ research and development (exploration, metallurgy, substitute's development etc.); and
- Systems that make mining the more competitive than our other producers.

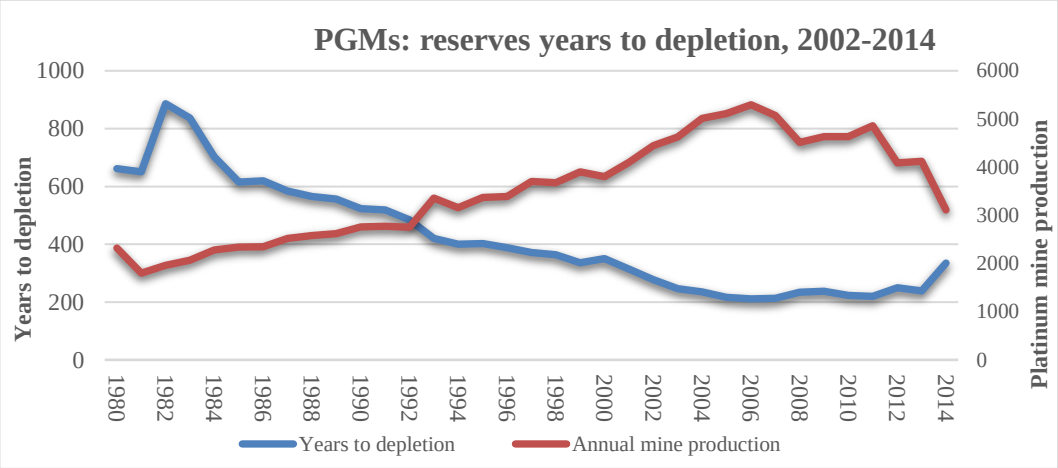


Figure 6.8 Number of years left before depletion of platinum reserves in South Africa at the current production rate

(Source: Statistics South Africa Environmental, 2014 & 2017)

6.7 Impact of post-apartheid legislation in the development of the platinum mining industry in South Africa.

As indicated in in section 6.3, due to improving platinum price towards the turn of the century, South African platinum producers responded by increasing exploration and developing new mines, expanding production in existing mines and increasing refining capacity which led to global dominance. This increase in platinum production peaked in 2007 at 5.2 million ounces of platinum.

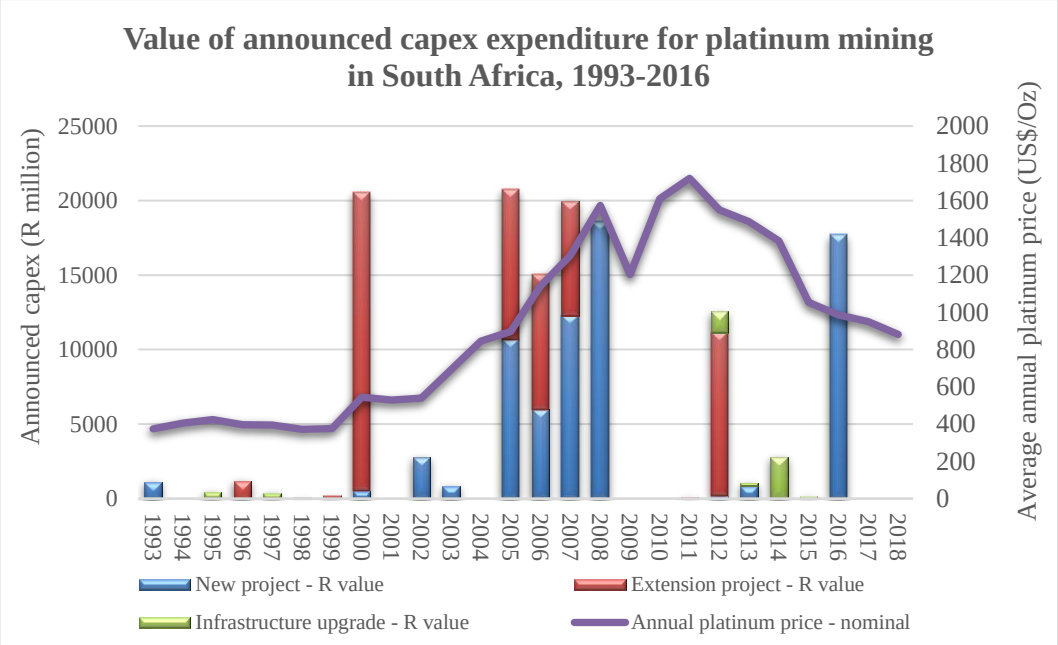


Figure 6.9 Platinum mining capital expenditure in South Africa, 1993-2018

(Adapted: Nedbank, 2017)

The enactment of the MPRDA in 2002 led to a shift from private mineral rights to custodianship by government. The mission of the MPRDA was for government to facilitate the participation of people of colour in the mining industry, who were previously unable to enter the industry due to structural exclusion, as a way to transform the industry. To this effect, government introduced the 'use or loose it principle' of prospecting and mining rights issued before 2002 and lay idle in their in their owners position. A combination of 'lose it or use it' principle in the MPRDA and the rising demand of PGMs in the early 2000s led to interest in the exploration

in the Bushveld Complex, especially the eastern section. In 2006 there was a total of 53 projects in the Bushveld Complex; 32 of those projects were in the exploration phases, 16 in feasibility studies and 6 in the construction phase (McGill, 2010). By 2010 projects in the exploration phase had increased to 37, projects in feasibility studies has also decreased to 15 and construction projects had reduced to only 3 (McGill, 2010).

A detailed analysis of Appendix 12.2 illustrates that since the Global Financial Crisis of mid-2008, investment in the platinum mining industry, both for new mine development and deepening of existing shaft, has declined due to subdued demand outlook. The investment that has been committed appears to be moving away from deep level, labour intensive conventional operations towards mechanised, low cost operations such as Twickenham, Mototolo operations and Ivanhoe's Platreef mine.

The development of new mines was a result of new entrants coming into the sector after legislation of the MPRDA. The increase in investment to develop new mines and expanding existing mines from henceforth can only be attributed to the opportunity unlocked by making available licenses that were not in use as indicated in Figure 6.9. This also unlocked the assets in platinum, of which the unintended consequence has been the disturbance of supply of this metal and hence the depressed price today. Mabuza (2016) argued that this might be one of the downside of MPRDA in the platinum mining industry.

Another important factor of how the post-apartheid legislation has impacted the platinum mining industry is through the HDSA ownership target requirements of the Mining Charter. The platinum mining industry has embraced this aspect of the legislation and numerous joint ventures have been formed between established platinum miners and black-owned companies such Royal Bafokeng Platinum and African Rainbow Minerals (ARM).

6.8 Chapter summary

With both the increase of platinum in jewellery application and the increase in the application of platinum in auto-catalysts to curb vehicle emissions and other

industrial uses, the metal has witness a tremendous demand growth in the past two decades. During this demand growth period demand outstripped supply and hence the platinum price achieved record spot prices in 2011 South Africa has been dominating the global production of platinum in the past four decades and currently contributes 70% of the global annual production and holds more than 80% of the world's known reserves. South Africa's production dominance was because of developing new mines and extending current working mines as a response to higher platinum prices in the 1970s and 1980s. The low price environment of the 1990s led to a few projects put on hold. However, South Africa was able to respond to the commodity boom of the 2000s by commissioning new mines and expanding working operations, which led to a peak production of 5.6 million ounces in 2007.

The South African PGMs production was traditionally concentrated on the Merensky reef in the western limb of the Bushveld Complex due to favourable grade distribution, favourable metallurgical properties, and proximity to infrastructure and human resource. Although there was depletion of reserves and increasing depth of the Merensky reef in the western limb of the Bushveld Complex, however, 9 new mines were, mostly on the lesser grade UG2, developed between 2002 and 2009. Due to the rising prices of PGMs of the 2000s exploration investment in the eastern limb of the Bushveld Complex which brought about the commissioning of 8 new mines in the same period. This development of new mines and expansion of existing of working operations can be attributed to the combination of higher price environment and the opportunity unlocked by making mining licenses available that were not in use before the legislation of the MPRDA.

The Global Financial Crisis in mid-2008 led to a subdued global demand of platinum due to the prevailing weak global economic conditions. The decline in platinum price, coupled with escalating costs, has had a negative impact on the viability of some platinum mines and has forced some mining operations being mothballed and the development of some projects put on hold. The platinum industry is an important component of the South African economy as a foreign exchange earner, its multiplier effect and the number of people it employs. It is

critical to create an environment for platinum mining industry to continue its growth path for the benefit of the economy at large.

7 SOUTH AFRICAN DIAMOND MINING INDUSTRY

7.1 Introduction

This chapter analyses the impact of the post-apartheid mineral regulation, and other challenges, on the competitiveness of the diamond mining and exploration in South Africa in the past two decades.

7.2 Demand and Supply of diamonds

Before the establishment of a large diamond mine in South Africa in 1870, diamonds were a very scarce gemstone only found in river beds in India and Brazil and therefore commanded high prices due to this rarity (Columbia Business School, 2002). Today the diamond market comprises mining companies that explore and mine rough diamonds and sell them through their distribution channels such as the De Beers Trading Company, midstream companies that cut and polish rough diamonds to produce polished diamonds and sell them to jewellers who then design and manufacture jewellery for the consumers through retailers as illustrated in Figure 7.1 (Bain and Company, 2018).

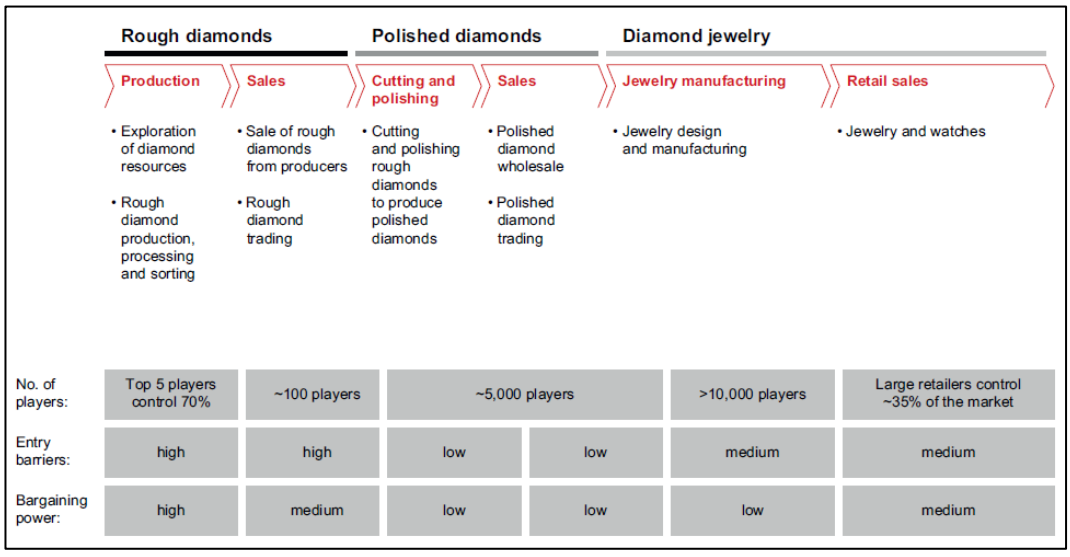


Figure 7.1 The diamond market value chain

(Source: Bain and Company, 2018)

Based on physical properties, naturally occurring diamonds are grouped into two main categories: gem quality and industrial grade diamonds. The demand for industrial grade diamonds is based on the physical characteristics used in a variety of manufacturing processes. Gem quality diamonds are rough diamonds that cut into gemstones and used in the manufacturing of jewellery. The desirability of gem quality diamonds in the market is mainly determined by four factors: colour, cut, clarity, and carat weight. In some cases high-quality large gemstones, often with special characteristics, purchased for investment purposes (Columbia Business School, 2002).

The demand for naturally occurring diamonds for industrial applications has significantly dwindled since the discovery of methods to produce synthetic diamonds in the 1950s, which are synthetic material with the same chemical composition, crystal structure, optical properties and physical behaviour as natural diamonds. Due to the advanced and cost effectiveness in the production of industrial grade diamonds, the demand for rough demands is driven almost exclusively by the jewellery and investment applications. For investment and jewellery applications purposes, demand is influenced by the availability of the disposable income on a global level. The demand constitutes of luxury items especially in the United States of America, China, India, Japan and some European countries who are large consumers globally. The global demand for diamond is highly associated with the total global GDP growth and consumer confidence.

The introduction of synthetic gem quality diamonds threatens to alter the diamond market structure. The technological advancement in synthetic diamond production has resulted in improved quality in terms of colour, clarity and carat size similar to that of gem quality naturally occurring diamonds and may therefore result in the displacement of mined diamonds in the future (Grynberg et al., 2014). Although synthetic diamonds have dominated the industrial application of diamonds in the past three decades only 1.5% of global mined diamonds supply are used for industrial application. There is not sufficient information to determine whether synthetic gem quality diamonds will displace mined gem quality diamonds especially in jewellery application (Grynberg et al., 2014). In May 2018, De Beers,

one of the world's largest diamond mining companies, announced that it be will entering the synthetic diamond market (Business Live, 2018). The strategy by De Beers is to gain control of supply for both synthetic and mined diamonds. By offering uncertified synthetic diamonds at $800 dollars a carat, as opposed to pegging them to the price of mined diamonds as has been the norm, the giant diamond miner is set to highlight the rarity and prestige of mined diamonds and in this way completely changing the pricing dynamics (Financial Times, 2018).

Global supply of diamond is dictated by the political stability of countries where mining operations are occurring and responds to new deposits coming into production stream (see Figures 7.2 and 7.3). Due to the declining success rate of exploration, coupled with the fact that major global diamond mines are maturing and have passed their peak production levels, particularly as some open pit producers have to transition to be underground operations, supply is expected to decline in years to come with global peak production having been reached in 2005 (Petra Diamond Limited, 2019).

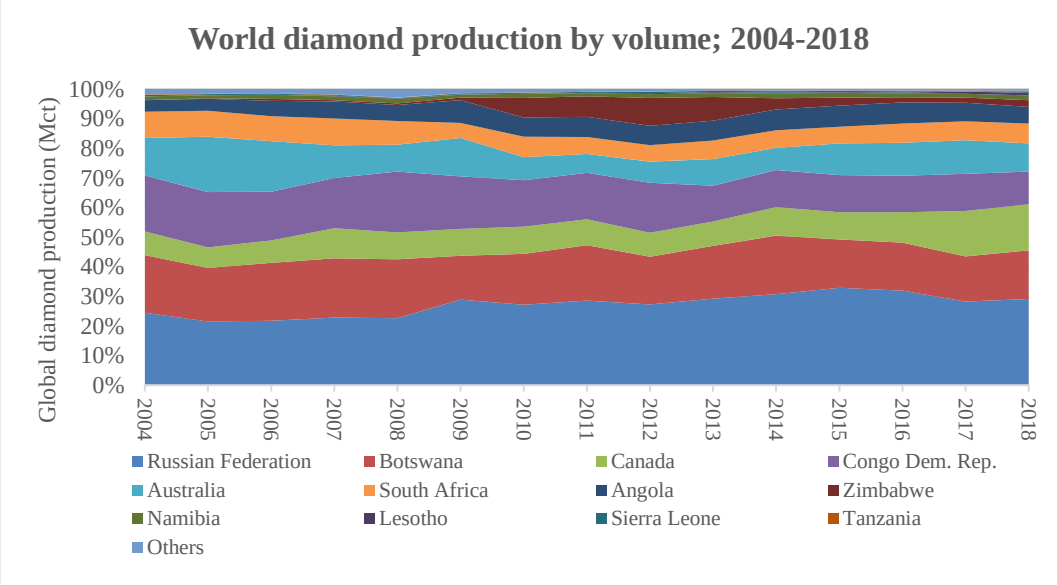


Figure 7.2 Global diamond production by volume

(Adapted: Diamond Producers Associated)

From the beginning of commercial diamond mining in 1870 in Kimbelery, South Africa remained the world's top producer in both carat weight and value terms until 1933, when it was overtaken by Zaire in carat weight terms, but it continued to be the world's top producer by value until 1960 when Russia began producing diamonds (DMR, 2007). Due to closure of some of the aging mines and discoveries of new mines in other parts of the world, South Africa was the 5th largest producer of diamond, and by 2012 it was ranked 8th (DMR, 2014) . The Russian Federation now dominates the global diamond production in both carat weight and value (see Figures 7.2 and 7.3).

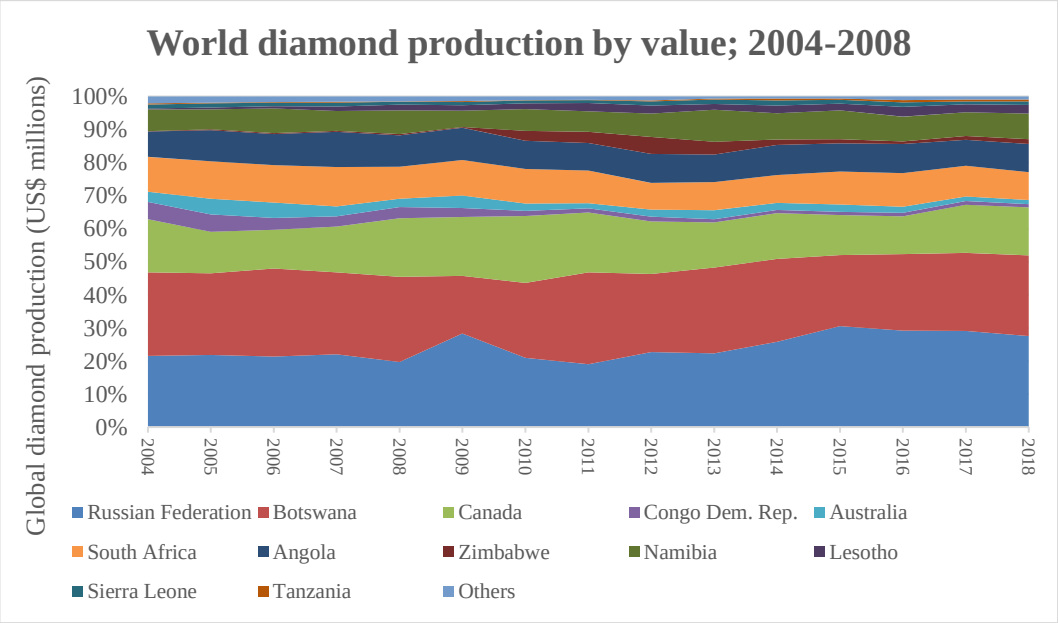


Figure 7.3 Global diamond production value

(Adapted: Diamond Producers Associated)

7.2.1 Supply of conflict diamonds

In the early 2000s there was a revelation that civil wars in Angola and Sierra Leone were being financed and sustained by revenues from artisanal diamond workings. This revelation had the potential to tarnish the global diamond mining industry as consumers would not want diamonds coming from conflict zones especially as they were marketed as a symbol of purity (Goreuz, 2001). The industry was confronted

with the need to maintain confidence by introducing integrity to the diamond supply chain through an international certification scheme of rough diamond which was agreed upon as the Kimberley process. The Kimberley process, an international multi-stakeholder initiative, was established in 2003 with the aim of increasing transparency in the diamond industry to eliminate trade in conflict diamonds.

7.3 Development of the South African diamond mining industry

In South Africa, diamond mining started in 1869 after the accidental discovery of an alluvial diamond in the banks of the Vaal River in the vicinity of what is today Barkley West (Wagner, 1924, in Field et al., 2008). The alluvial diamonds were later traced to volcanic rocks source later named kimberlites in the vicinity of Kimberley in 1870. Figure 7.4 illustrates the location of both alluvial and kimberlite diamond mines in South Africa. The discovery and subsequent mining of diamonds was to set South Africa in a prosperous path in that it laid the foundation for the later discovery of gold, platinum, coal and other metals of economic significance (Field et al., 2008).

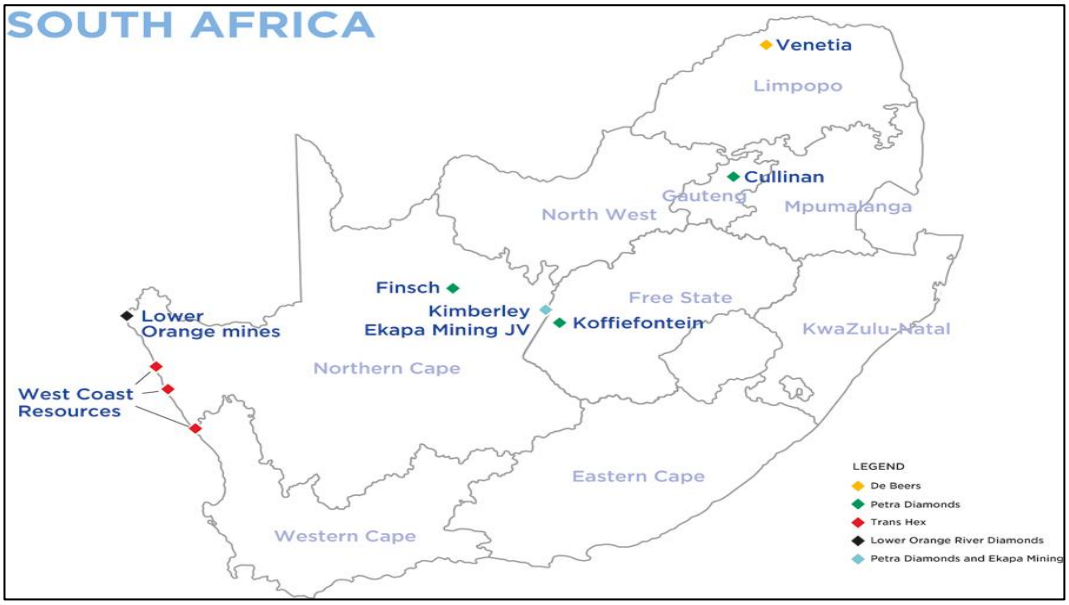


Figure 7.4 South African diamond mines location

(Source: Minerals Council of South Africa, 2019)

Production, per carat weight, quickly increased as discoveries of kimberlite pipe-hosted diamonds in 1870 (see Figure 7.5). It was at this point when the initial understanding of the origin of diamonds being volcanic was developed (Field et al., 2008). This newfound knowledge of how diamonds were formed enabled the ensuing successful exploration discoveries of other diamondiferous kimberlite and lamproites pipes in other parts of Africa and the world. Figure 7.5 illustrates the fluctuation in diamond production per carat weight, in South Africa since 1870. When analysed in conjunction with Table 7.1, it is deduced that South African diamond production responded to fluctuations in global demand, the discovery of new economic deposits and closure of depleted or uneconomic operations.

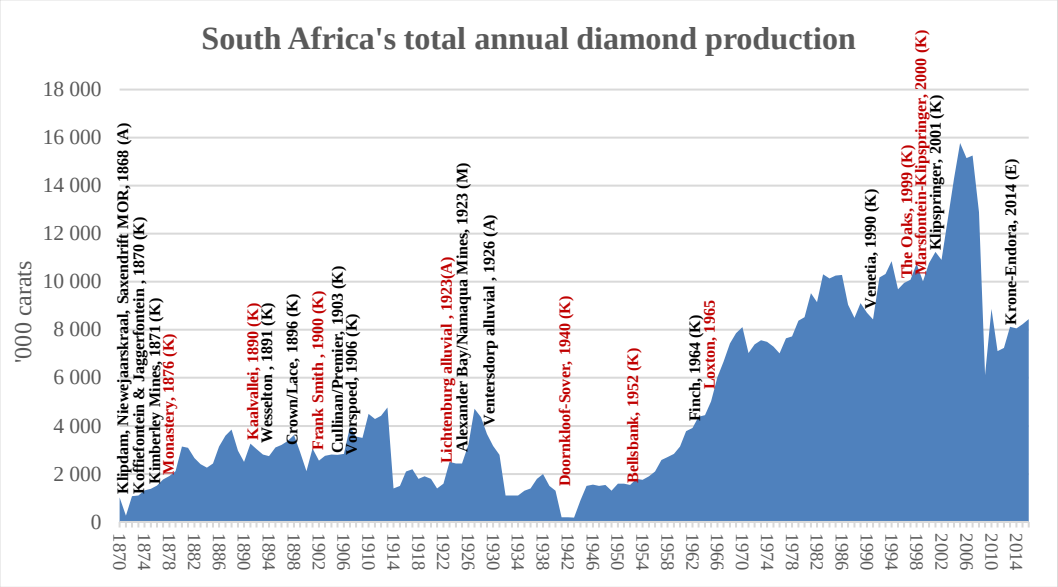


Figure 7.5 South African diamond annual production by weight and major producing mines

(Source: DMR, 2007 & 2016)

The discovery of the following kimberlite pipes deposits; Jagersfontein and Koffiefontein in 1870, Voorsuitzicht and Kimberley in 1871, and Wesselton in 1891 was responsible for the sudden increase in production to over 3.6 million carats in 1898. The discovery and commissioning of other new major deposits had a similar impact on production, the Lichtenburg alluvial and Namaqua beach

deposits in 1923, Finch Mine in 1964, and lately the Venetia Mine in 1992 (Janse, 2005).

Both the first and second South African Anglo Boer Wars led to a drop in production as Kimberley was under siege (Janse, 2005). The great depression of the 1930s, which was characterised by a world-wide economic depression, negatively impacted the demand for diamond especially in the USA. The first and second World Wars resulted in the shift of production capital towards the war efforts and also resulted in dwindling disposable income which led to a significant decline in both the demand and supply of diamonds (Janse, 2005).

Table 7.1 Major political and economic events since the start of diamond mining in South Africa

Year	Event	Impact on demand & production
1869	Discovery of diaomnds in river deposits; diamond mining beg	Increased production
1870	Koffiefontein, Jagersfontein and Kimberley pipes discovery	Increased production
1900 -1902	Boer War and siege of Kimberley	Declined production
1914 - 1918	World War I	Declined demand
1920-1921	Post World War I depression	Declined demand
1923	Lichtenburg alluvial & Nmaqua marine field discovered	Increased production
1929 - 1933	Great Depression	Declined demand
1939 -1945	World War II	Declined demand
1948	Premier and Kimberly mined re-opened	Increased production
1960	Sharpeville riots	No impact on production
1968	Finch mine commissioned	Increased production
1976	Soweto riots	Slight decrease in production
1986-1991	State of emergency/Economic sanctions	Siginicant drop in production
1990	End of aprtheid (unbanning of political parties)	Insignificant
1992	Venetia mine commissioned	Significant increase in production
1994	New ANC-led government	Insignificant
1996	Mine Health and Safety Act	Insignificant
1998	Mining and Mineral Policy	Slight decrease in production
2004	MPRD; Mining Charter I	Insignificant
2008-2009	Global finincial crisis; MPRDA Ammendment Act	Significant decrease in global demand
2009	Eskom energy shortages	Insignificant
2010	Mining Charter II	Insignificant
2012	Marikana platinum mine riots	Insignificant
2017	Mining Charter III	Insignificant
2017	Mining Charter III (revised)	Insignificant

7.4 Diamond production in the post-apartheid era

Historically, South Africa was a crucial producer of diamonds and dominated the world ranking until 1932, in terms of value and carat weight. It was in South Africa,

after all, where the initial understanding of process of diamond formation led to the discovery of diamond bearing kimberlite pipes. The new found knowledge led to better exploration methods which discovered kimberlites pipes firstly in Southern Africa and then later to other parts of the world. Although Cullinan, Finch and Venetia Mines are still producing, major South African mines have reached their economic limit and were closed in the first decade of the twenty first century and hence South Africa is overtaken by other countries in terms of production dominance. Jaggasfontein, Wesselton and Kimberley Mines were major contributors to the South African production when it accounted for about 95% of the world production, both in carat weight and volume, in the late 1800s. The underground mining of diamonds at the Kimberley Mine continues today although at a limited scale with the main focus directed towards the reprocessing of old tailings dumps (Minerals Council of South Africa, 2019). Wesselton mine was closed by De Beers in 2005 after underground operations were uneconomic. Underground operations were ceased at Jaggasfontein Mine in 1971. In 2017 sixty percent of South Africa diamond production came from Venetia and Finch Mines.

7.5 Impact of post-apartheid legislation in the development of the diamond mining industry in South Africa.

Bristow (2017) reported that in 2017 there were 150 alluvial diamond-mining operations which employed 3000 people, down from 2000 companies which employed 25 000 people in 2004 (see Figure 7.6). This decline can be attributed to the increasing regulatory and administrative burdens in the mining industry such as BEE ownership requirements and compliance with the social labour plans. Beyond legislative requirements that came with the MPRDA, the diamond industry received new regulations: amendments to the Diamond Act 56 of 1985 and the Diamond Act 15 of 2007 (DMR, 2016), which are additional regulatory layers that must be complied with at additional costs.

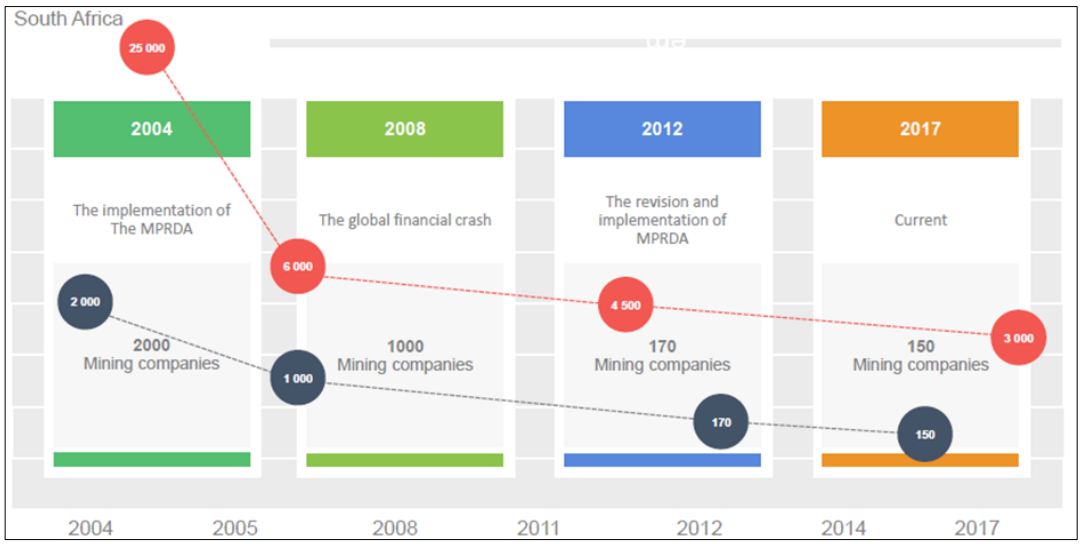


Figure 7.6 The impact of legislation on the activities of alluvial diamond mining in South Africa

(Source: Bristow, 2017)

Although South Africa was considered a mature area for diamond exploration in the past two decades smaller but nevertheless economic diamond discoveries were made in South Africa with small mines developed at The Oaks, Klipspringer, Masrsfontein and Kronne-Endora which is adjacent to Venetia (McKechnie, 2019). Based on exploration expenditure diamond exploration is directed towards to discovery of kimberlite deposits in previously inaccessible parts of Africa due to conflict or other reasons with – the majority of budget in Southern African was spent in Botswana (43%), Angola (37%), Namibia (11%), South Sfrica (6%) in 2017 (McKechnie, 2019). However, South Africa's diamond mining and prospecting licenses increased from 74 in 2000 to 235 in 2012 (DMR, 2014).

7.6 Chapter summary

Beyond responding to the demand for diamonds, geopolitics - both local and abroad - has had a strong influence on the production of diamonds in South Africa. Since the commercial mining of diamonds started in 1869, production has responded to fluctuations in demand and the discovery of new deposits and closure of depleted orebodies. Historically South Africa has dominated the global production rankings

of diamond, both in terms of carat weight and value, until 1933 when it was surpassed by Zaire in terms of value rankings, but it continued to be the world's top producer by value until 1960 when it was overtaken by Russia.

The majority of current South African diamond production comes from ore bodies that were discovered many decades ago with no major new ore body discovered in the past two decades. South African diamond mining industry is very mature with all the large deposits having being discovered and mined in the past 150 years, with the application of new exploration technology there is still opportunity to discover new deposits or extension of known deposits.

There is a need for South Africa to intensify efforts in exploration to replace depleting reserves from aging or closed operations. Namibia is now the fifth largest producer of diamonds in the world and all those operations are alluvial and beach deposits. South Africa, on the other hand, has declined from 2000 companies involved in mining in 2004 to a meagre 150 companies in 2017, and despite a positive market environment in the past two decades.

South Africa has a potential to discover those types of deposits provided an enabling legislative environment is cultivated. Although South Africa has an opportunity to develop low-grade mines from alluvial deposits in western coast and adjacent to know kimberlite pipes. However, such undertakings require large capital expenditure to develop larger operations to process high tonnage to offset the low-grade deposits. The raising of the required capital is difficult due to the legislation requirement of previously disadvantaged shareholding as a prerequisite for granting of exploration and mining permits as stipulated in the Mining Charter. The other area of concern in this sector is the slow processing and associated corruption of mining rights applications.

8 SOUTH AFRICAN COPPER MINING INDUSTRY

8.1 Introduction

This chapter analyses the impact of the post-apartheid mineral regulation, and other challenges, on the competitiveness of the copper mining and exploration in South Africa in the past two decades.

8.2 Copper demand and supply drivers

Copper is utilised in a variety of applications due to its unique property to conduct heat and electricity efficiently; resistant to corrosion and there is currently no feasible substitute (Schipper et al., 2018). Copper is used in construction of buildings, power generation and transmission and application in the manufacturing of machinery and transportation vehicles (United States Geological Survey, 2009). Since the beginning of the twenty first century and as nations industrialised to improve the life of citizens the demand for the metal increased in infrastructure development. The expansion of Asian emerging economies, led by China and, to a lesser extent India, drove the copper demand starting in 2003 with a brief drop in 2008-2009 due to the financial crisis and indicated in Figure 8.1.

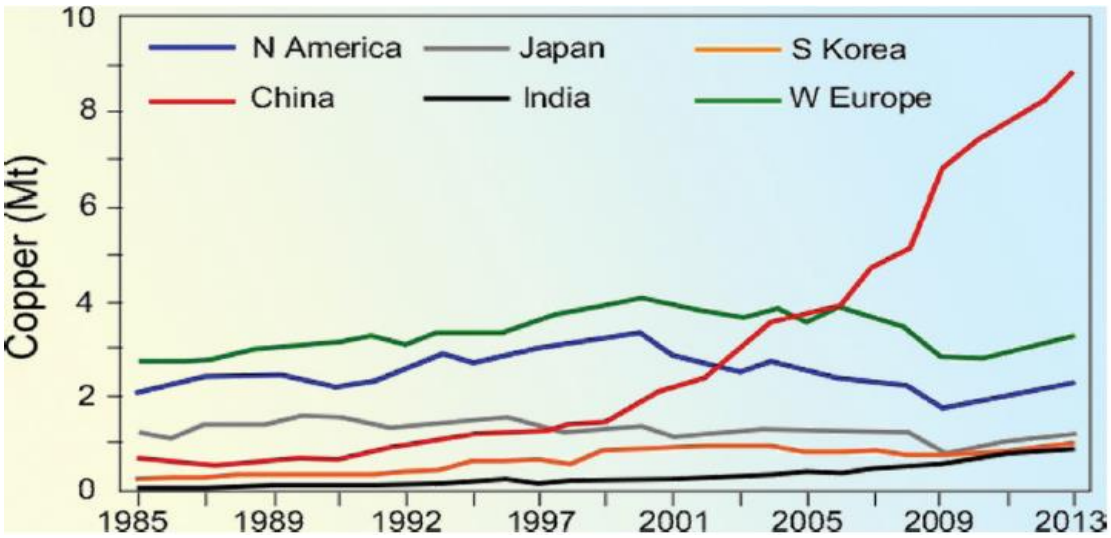


Figure 8.1 Major copper consumers

(Source: Geochemical Perspectives, 2017)

The main driver responsible for the increase in demand is the increase in infrastructure expenditure in the emerging countries in the past two decades. The demand for copper is expected to increase in the future due to its application in electrification of transportation technologies to combat carbon emission from gasoline engines (Schipper et al., 2018).

The world's supply of copper has increased dramatically in the past 25 years as a new projects were commissioned to respond to the corresponding increase in demand as illustrated in Figure 8.2. However, the South African production has continued to decline over the past three decades due to the closure of uneconomic operations. From 1990 to 2003 copper mine production decline from 179 to 102 million tonnes which is a fourty-three percent reduction. From 2003 to 2007 mine production increased by fourteen percent which is attributed to an increase in copper production from PGMs mines.

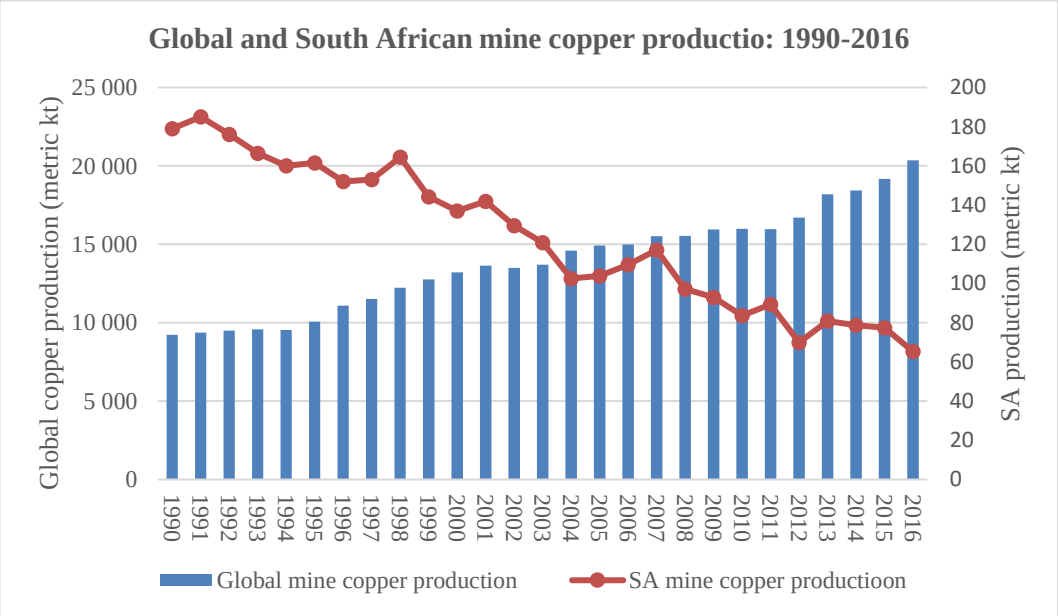


Figure 8.2 Global and South African copper mine production

(Source: DMR, 2014 and Mineral's Council of South Africa, 2017)

From 2008 onwards South African mine copper production continued to decline with a current output of 65 million tonnes in 2016 down from 117 million tonnes in 2007 which a fourty-four percent contraction.

8.2.1 Copper recycling

In the past two decades and a half the consumption of copper has steadily increased as more people in developing countries gained access to electricity, plumping and modern appliances. Developed countries also need to refurbish their aging infrastructure and there copper demand is expected to continue on a growth trajectory into the foreseeable future. The utilisation of copper in modern technologies such as electric cars will also ensure that the demand is maintained. Other than meeting demand through mine production is through recycling of metal within the global economy. Due to the fact that copper is infinitely recyclable without losing loss of its proper, it provides a potential solution of supplementing supply through recycling (International Copper Association, 2017). Figure 8.3 illustrates that due to the fact that copper is infinitely recyclable, of the 440 million tonnes of copper used in 2015 globally, 8 million of that was supplied through recycling and thus recycled copper contributed about a third of the total global demand and therefore a crucial role in the supply of the metal.

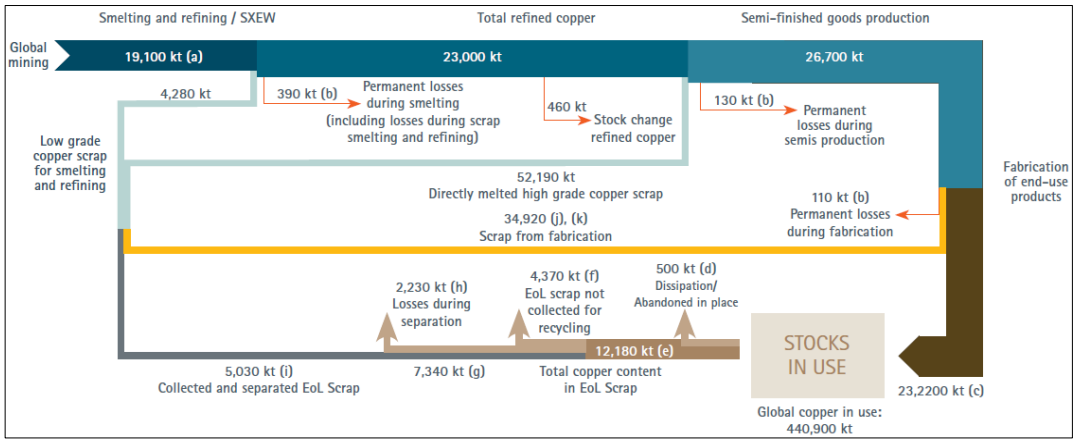


Figure 8.3 Copper and the circular economy

(Source: International Copper Association, 2017)

8.3 Development of the South African copper mining industry.

South Africa is not dominant in terms of global ranking of known copper reserves and production. Phalaborwa mine is currently the only mine that primarily produces copper with the remainder derived from PGMs mines and zinc mining as by-products (DMR, 2015a). In the recent past, however, seven mining companies were primarily mining copper in South Africa as illustrated in Figure 8.4. All the other workings, except for Palaborwa mine, were closed due to having reached their economic life as a result of declining grades and unfavourable trading environment (Beale, 1985).

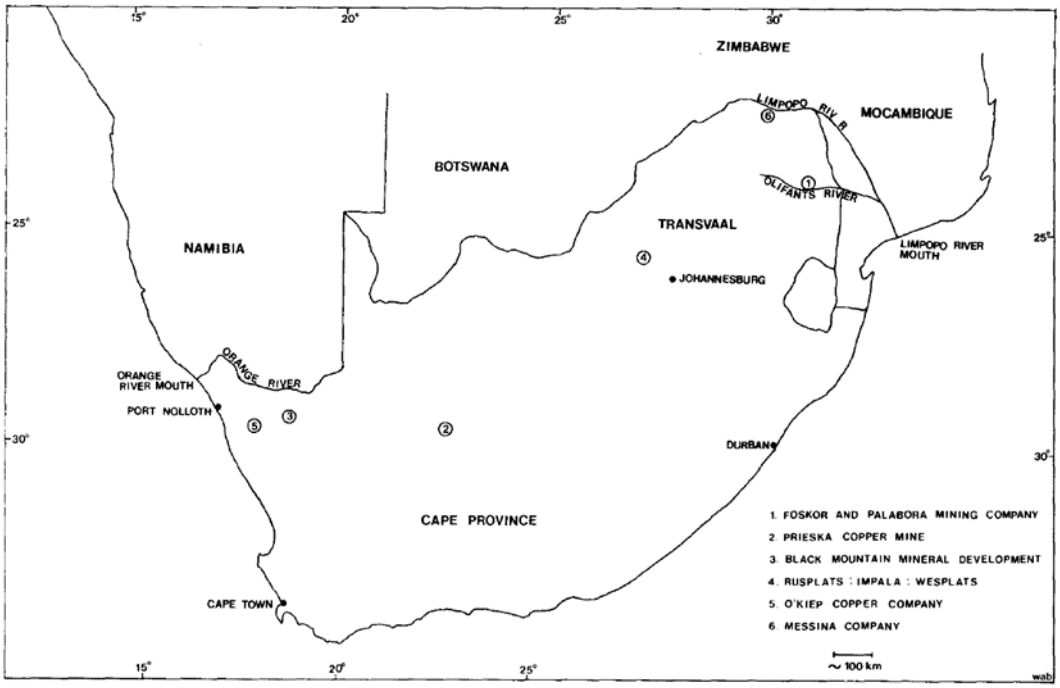


Figure 8.4 Historical sites of copper mining in South Africa

(Source: Beale, 1985)

8.4 Copper production in the post-apartheid era

Although the copper price has increased since 2003, the continuous decline in the South African mine copper production is a direct consequence of the closure of operations. Messina Copper Mine was closed in 1992 due to declining economic

viability. Prieska Copper Mine operated from 1971 and shut down in 1991, when the uncertain economic outlook and the high cost of capital influenced its closure. However, talk of this operation re-opening is gaining momentum (Mining Weekly, 2017). Orion Minerals from Australia announced that it intends to re-open the mine at a cost of R4 billion (Business Day, 2019). Mountain Mining (Pty) Ltd., which was formerly known as Africa Black Mountain Mining (Pty) Ltd., primarily exploited zinc and lead, with copper and silver recovered as by-product (Bloomberg, 2018). Mining in the O'kiep Copper District is the first commercial extraction of mineral resources in South Africa. When mining operation ceased in 2002, a total of two million tonnes of copper had been produced starting in 1852 (Clifford and Barton, 2012).

Due to the closure, South African primary copper mines in the three decades, employment numbers have declined from 5193 people in 1993 to 2366 people in 2016 which is a fifty-four percent contraction and illustrated in Figure 8.5.

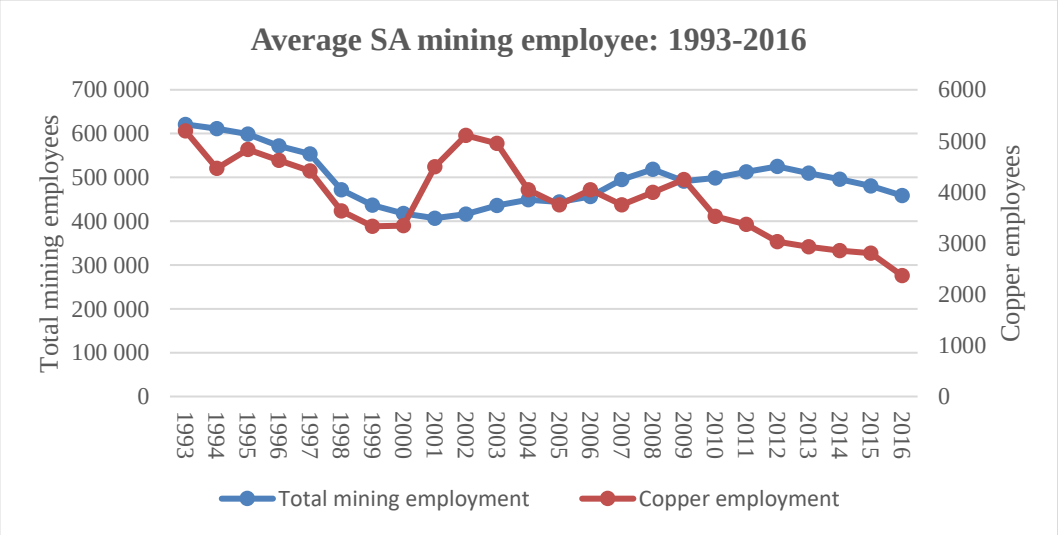


Figure 8.5Average South African mining and copper employment

(Source: DMR, 2014; Minerals Council of South Africa, 2017).

Although the majority of mining companies embarked on capacity expansion to meet the increasing demand of mineral commodities in the past two decades, there seemed to have been very little of such effort in the copper mining sector. Both

production output and employment numbers indicates a sector in decline despite a period of substantially higher copper prices in that period and hence a mining contribution to the GDP as illustrated in Figure 8.6.

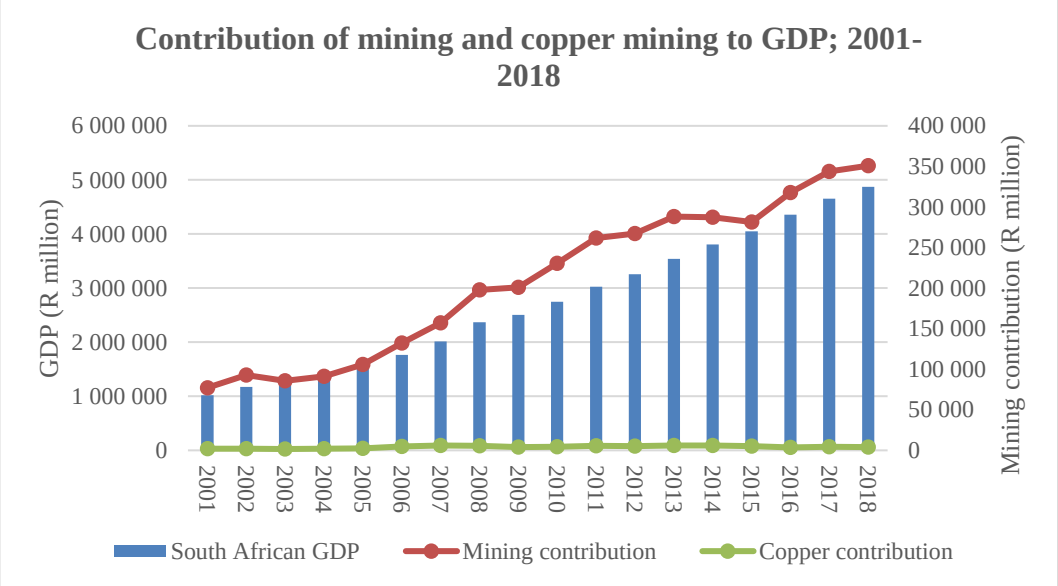


Figure 8.6 Contribution of total and copper mining to total GDP; 2001-2016

(Source: Minerals Council of South Africa, 2017, 2018)

8.5 Impact of post-apartheid legislation in the development of the copper mining industry in South Africa.

In the 1950s, a number of copper mines were discovered in Zambia Copper Belt using a new exploration technique of soil geochemistry and geophysical techniques (Forsyth, 1987). In addition to new exploration methods for base metals through the discoveries of the 1950s in Zambia and other parts of the world, it was discovered that virtually all the base metals deposits occur in Mobile Metamorphic Belts such as the Kaapvaal Craton and hence the focus on the Namaqualand Belt (Forsyth, 1987). The increase in the copper price during this period, coupled with the perceived threats of depletion of operating copper mines fuelled the increase in exploration expenditure for base metal deposits in South Africa. The declining market for copper in the 1980s led to a decline in exploration expenditure for base metal deposits.

The declining copper mining industry in South Africa should be viewed in terms of lack of investment, especially greenfields exploration, in the past three decades. Although this author could not determine the level of copper green exploration in monetary terms, Appendixes 12.4 and 12.6 illustrate that major copper mining investment projects were the expansion of capacity at Palaborwa mine and the Gamsberg exploration project by Vedanta mining.

8.6 Chapter summary

Although demand for copper has increased as most developing countries have strived for industrialisation, South African mined production has been declining. This decline was attributed to closure of uneconomic deposits and lack of discovery of new deposits to replace the depleted ones due to unfavourable regulatory environment.

9 DISCUSSIONS

9.1 Mineral projects development in the past two decades

Mineral commodities supply raw materials to the manufacturing of most goods and are therefore the engine of the global economy. Production of mineral commodities is driven by the increased intensity of use of minerals in national economies. As more developing countries in the past two decades, especially China and India, have forged ahead with their industrialisation efforts, the demand for mineral commodities has drastically increased and as a result commodity prices increased.

The unprecedented increase in commodity prices in the past two decades has driven technological advancement in exploration, production and processing of minerals to meet the growing demand (Prior *et al*., 2011). Prior *et al*., (2011) noted that it is because of the rise in commodity prices in the past two decades that yielded improved technology that led to production of minerals and metals at unprecedented rates. The availability and supply of minerals and metals are driven by technology and costs of producing and processing, coupled with geopolitical forces.

9.2 Decline in production of some mineral commodities in South Africa

South Africa has experienced a decline in the production of gold, platinum, and copper with diamond having witnessed an improvement in weight carats. The capital expenditure in mining projects, especially new mine development as indicated in Figure 9.1, illustrates a declining investment sentiment in the current South African mining regulatory and administrative environment (Nedbank, 2017). As indicated in Figure 9.2, even during the global commodities boom from 2001 to 2008, the country's mining industry contribution to GDP shrank by 0, 11%, while mining sectors in other jurisdictions expanded by 5% a year on average (Leon, 2010).

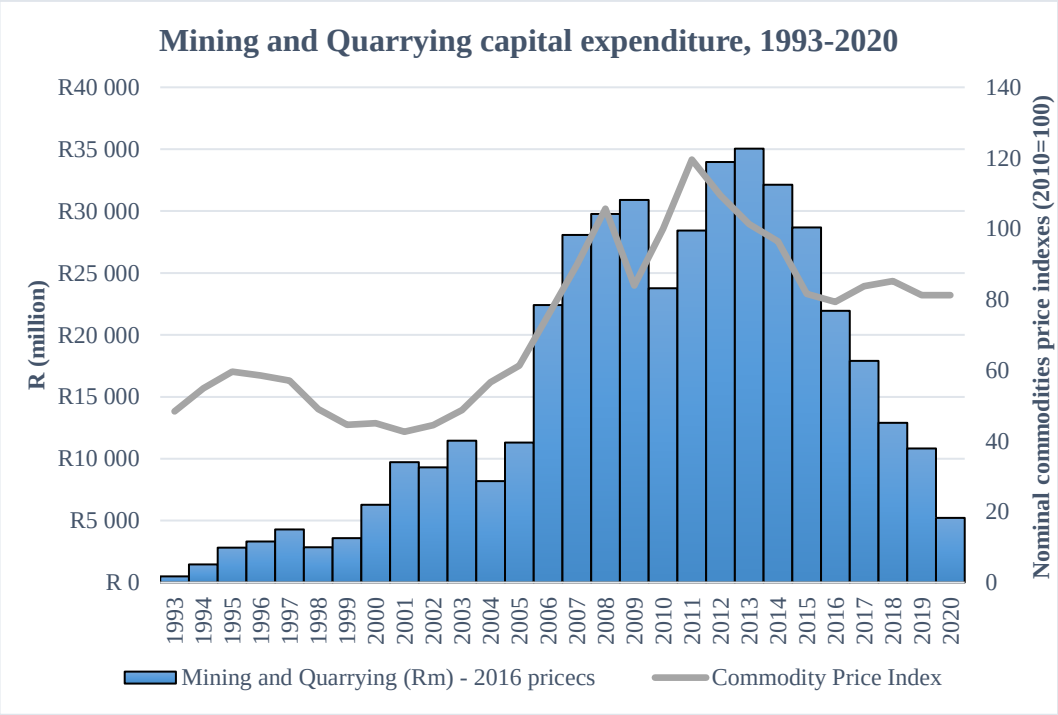


Figure 9.1 Value of announced capital investment in the mining industry in South Africa

(Adapted: Nedbank, 2017; World Bank Commodity Price Data, 2019)

Low growth prospects of the world economy, led by the slowdown of the Chinese economy, spells an uncertain market environment for South African mining companies. Although international producers are also feeling the brunt of the low commodity prices, most major South African mining operations are especially at risk due their high cost structure as a result of deep-level mining layouts, declining grades, and the fact that their operations are labour intensive. Figure 9.2 illustrates that gold, platinum, diamond and to a lesser extent copper assets have endured operational challenges and low commodity price environment resulting in reduced profitability. The period indicated in Figure 9.2 represent the recovery of global mineral prices after the 2008-2009 financial crisis and subsequently decline from 2011 onwards. Due to declining prices, mining operations in South Africa and abroad have experienced a reduction in operational margins. In the case of South African mining operations, above-inflation salary increases and higher electricity prices during this period was characterised by substantial reduction in margins and

impacted return on investment of these assets as illustrated in Figure 9.2. Based on the various return on investment plotted in Figure 9.2, mining operations of the various commodities in South Africa are not desirable for investment.

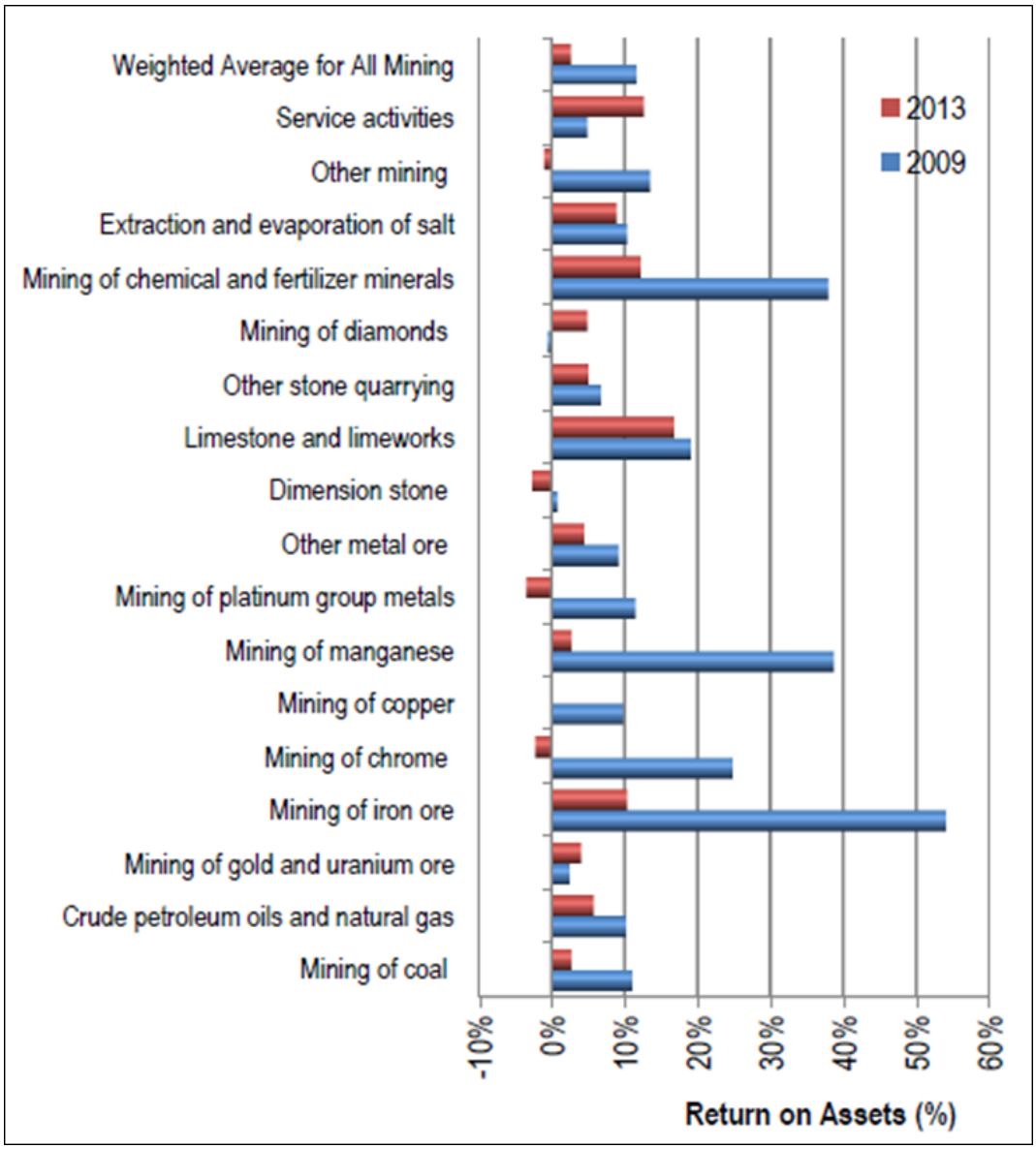


Figure 9.2 Comparative return on assets of different minerals in South Africa, 2009 and 2013

(Source: Lockwood, 2016)

Depletion of economically viable mineral resources, accompanied by the lack of discovery of new mineral deposits from exploration activities, is the main driver for

the decline in the production of some historically important mineral commodities in South Africa. For instance, in the case of gold and copper, the current mineral policy appears to have accelerated the decline of the production of these commodities as investment for these commodities were directed to other mining jurisdictions in the world. However, the declining economic viability of some of the available mineral resources has been a consequence of unfavourable prevailing economic and political environment within the country.

9.2.1 Gold production decline

Despite South Africa's massive mineral endowment, production output in the mining industry has continued declining in the past two decades, and in the case of gold production there has been a decline since 1970. The research study concedes that, as indicated by Viljoen (2009) and Phillips (2013), the main factor driving the gold production decline is due to lack of discovery of new gold deposits since Evander in 1958. More than 95% of gold ever mined in South Africa came from ore-bodies within the Witwatersrand Basin. These seven large discrete goldfields are tabular and extended on strike for hundreds of kilometres but are now being mined out, and getting deeper and harder to access and mostly at low grade. As indicated by Viljoen (2009), there is still scope for developing remaining deep and lower shallow resources within the Witwatersrand. However, the cost of electricity and labour, coupled with regulatory uncertainty make it difficult to commit major investments for sinking deep shafts that would take up to 10 years to get in production. The regulatory uncertain has been brought about by the changes in the ownership component of the Mining Charter which has negatively affected the security of tenure. This industry appears to be focused on extracting the remaining reserves utilising the current infrastructure and processing of tailings and less concerned about searching for new orebodies.

9.2.2 Platinum production decline

South Africa dominates the global platinum production and contributes over 70% of the annual mine production and is also known to have the majority of known reserves with the remainder located in Zimbabwe and Russia. Although the industry

can sustain mining for over 300 years to come, in terms of known reserves, the reduced demand in the metal price poses a serious threat to the industry. In the past two decades South Africa's mine production increased substantially as new projects were being commissioned and existing ones expanded. The expansion of production was a response to an unprecedented demand of the platinum metal from 2002 onwards. The shift in mineral policy resulted in idle mineral rights becoming available due to the "use it or lose it" principle and enabled the investment from foreign companies and newly-formed Black Economic Empowerment companies.

The increase in demand of electric and hybrid automobiles, and diesel engines losing favour in most advanced economies could impact platinum demand in the long run. Strategies by South African platinum mining companies to mitigate the low metal price environment, coupled with declining grade and rising costs, is crucial in maintaining margins for the survival of the industry.

Although South Africa contains the majority of known global reserves of platinum group metals, this mining sector, in conjunction with government, should pre-occupy itself on how the industry should remain relevant in the face of recycling and substitution of the platinum metal. There should be a concerted effort to facilitate the long-term sustainability of the current platinum operations, and develop new mines out of the immense platinum reserve that is known to exist in South Africa, thus providing employment and generating foreign exchange. There is, therefore, an urgent need to facilitate mechanisms to induce long-term platinum demand growth from either developing new applications, such as is currently the case with the fuel cell and, and existing applications such as in industrial and investment use.

9.2.3 Diamond production

The diamond mining in South Africa has been active since 1869 and large kimberlite deposits that underpinned early South African production have reached their economic life. Smaller, nevertheless economic, kimberlites deposits were discovered and developed in the past two decades. Due to lack of discoveries to

replace depleted resources South Africa diamond production is expected to continue declining.

Although South Africa has an opportunity to develop high grade alluvial deposits, such as the Krone-Endora adjacent to Venetia Mine, such undertakings require large capital expenditure to develop larger operations to process high tonnage to offset the low grade deposits. The raising of the required capital is difficult due to the legislation requirement of previously disadvantaged shareholding as a prerequisite for granting of exploration and mining permits as stipulated in the Mining Charter. The other area of concern in this sector is the slow processing and associated corruption of mining rights applications. The Chief Executive of De Beers in South Africa, Mr. Phillip Barton, alluded to the fact that his company has had fifty-two exploration applications outstanding for a long time and only 16 of those licences were granted in 2018 (Reuters, 2018).

9.2.4 Copper production decline

The only primary copper production mine in South Africa is the Palaborwa Mine with the remainder produced from PGMs mined as a by-product. Besides the closing of uneconomic and aging mines, the continuous decline in total production is attributed to the declining grades at this mine (DMR, 2015a). In terms of investment for the copper mining industry, expansion investment has been ongoing at the Phalaborwa mine with US$162 billion invested for capacity expansion. At Gamsberg Zinc Mine, where copper is produced as a by-product, a substantial investment of a new open-pit mine was made in 2015. The open pit was completed in 2018 with a life of mine expected to be 13 years. South African copper mine production is expected to continue declining with Phalaborwa approaching its end of life if replacement deposits are not found.

9.3 Labour productivity

The South African mining industry, especially deep level mining, utilised the abundant and low-cost labour as a means of competitive advantage. Due to relaxed labour laws prior to the new democratic dispensation, mining methods and designs

were optimised through more cost effective labour and ensured many operations were profitable. The emergence of black trade unions changed the low-cost nature of labour, labour advancement, safety on the job, and the abolishment of discriminative legislation in the mining industry in South Africa (Wagner, 1986). Figure 9.5 illustrates the rate at which unit labour cost has been on the rise starting in 1982 when the National Union of Mineworkers (NUM) was recognised by mining companies.

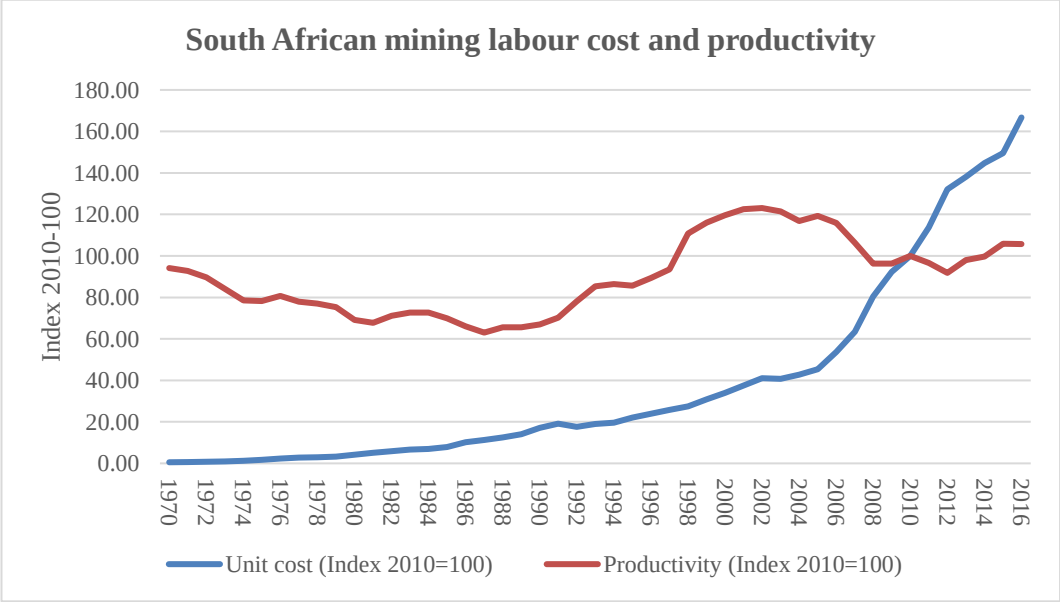


Figure 9.3 South African labour cost and productivity

(Source: Minerals Council South Africa, 2017)

From 2005 onwards, the unit cost of labour has more than doubled and this era was characterised by militant trade unions, with rivalry amongst unions fighting for subscription from workers, demanding higher wages. However, this increase in labour cost in the same period was accompanied by a decline in labour productivity. As a result of this trend currently, labour cost contributes about 50%–60% of the total cost for the mature deep-level underground mines. Due to high commodity price in the first decade of the 21st century, most mining companies were able to absorb this ballooning cost element. The continuing above inflation salary increases, coupled with a reduction in labour productivity in a weaker commodity

environment, will continue to reduce profits especially of those labour intensive deep level mining operations.

9.4 Decline in exploration investment in the post-apartheid South Africa

In any given mining jurisdiction, exploration expenditure and productivity is driven by the global demand of mineral commodities, potential for discovering an economically viable mineral deposit and the regulatory environment in the minerals industry. Naturally, countries with comparative advantage in terms of mineral endowment, such as South Africa, should be experiencing an influx of investment and as a result high mineral production in the sector. However, as indicated in Figure 9.3, a shift in regulatory environment has led to shrinkage in investment attractiveness in the past two decades. The introduction of the MPRDA in 2002, coupled with the introduction of the Mining Charter and other supporting legislation, has led to the regulatory uncertainty. In the past two decades, each time there has been an amendment to a piece of legislation that affects mining regulation, more uncertainty ensued. Due to the inconsistencies and uncertainties of mining regulations in South Africa, the country's rankings of the Fraser Institute's Annual Survey of Mining Companies continues to decline. Each time the Mining Charter is amended, instead of bolstering investor confidence through regulatory certainty, more uncertainty arose in terms of either ambiguous provisions or clauses or government imposing a revised charter without consensus from other stakeholders.

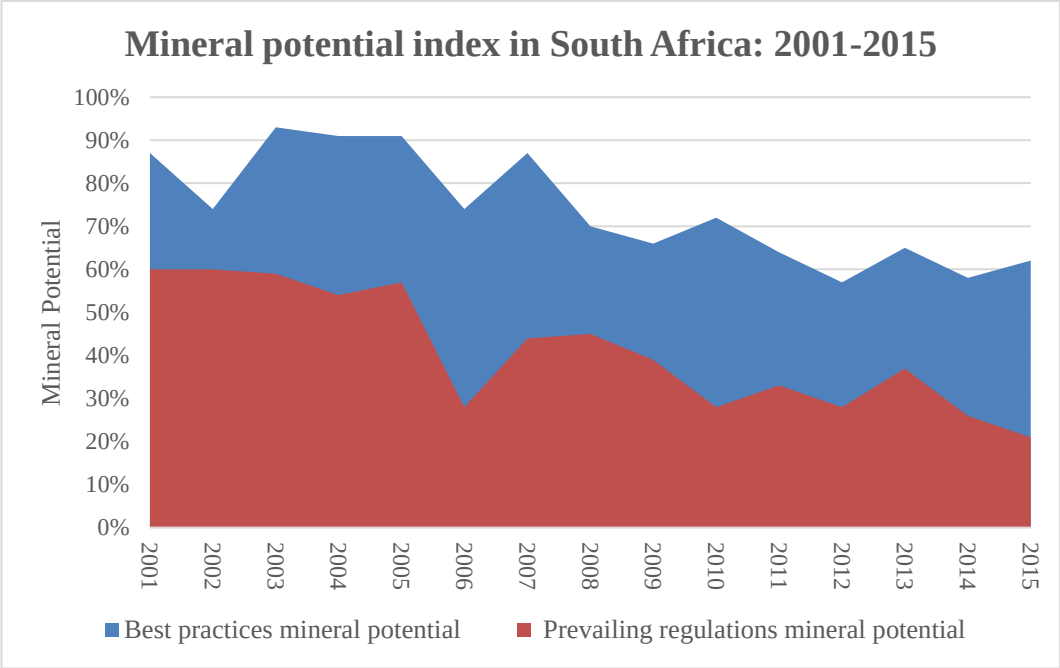


Figure 9.4 Best practices versus prevailing regulation mineral potential indexes in South Africa, 2001-2015

(Adapted from the Fraser Institute, 2001-2015)

In terms of exploration investment the picture looks even more concerning. Figure 9.4 illustrates that the current level of exploration in South Africa is worryingly low in the past two decades. Although, globally the decline in exploration activities is due to a negative outlook in commodity prices, the extent of the decline in South Africa could have been avoided. Although there is a gap in the data plotted in Figure 9.4, it is observed that exploration projects increased as demand for commodities picked up in the early 2000s, with highest maximum of 52 projects in 2004. It also observed that from 2004 onwards, the number of exploration projects continued declining with 8 projects in 2017.

If this investment pattern is to continue unabated, even with its known immense mineral endowment, South Africa would soon run out of economically viable mineral deposits to mine due to lack of investment in greenfields exploration. In order to arrest the continued decline of the mining industry, which is a critical component of the South African economy, an assessment of the current mineral

regulatory framework is required with a view to identifying bottlenecks. There is a need to identify those aspects of the regulatory framework that bring about uncertainty with a view to unlock a favourable investment environment for mineral exploration. In many of the mature mining jurisdictions, including South Africa, easy-to-find near-surface mineral deposits are either being currently mined or were mined in the past. New discoveries of mineral deposits in mature mineral belts in general and in South Africa in particular require a new approach to maximise the use of advancements in technology and to form an understanding of ore-forming processes which would require substantial investment in research and development in the mining industry.

The mining industry in South Africa is currently facing a variety of challenges, both internal and external, and since the Global Financial Crisis of mid-2008, it has faced robust competition for foreign direct investment due to a dwindling revenues as a result of low commodity prices coupled with above-inflation electricity and labour cost escalations. Most importantly, mining investors require policy certainty and continuity because upfront capital expenditures are astronomical and a typical mining project has long lead times before income is generated.

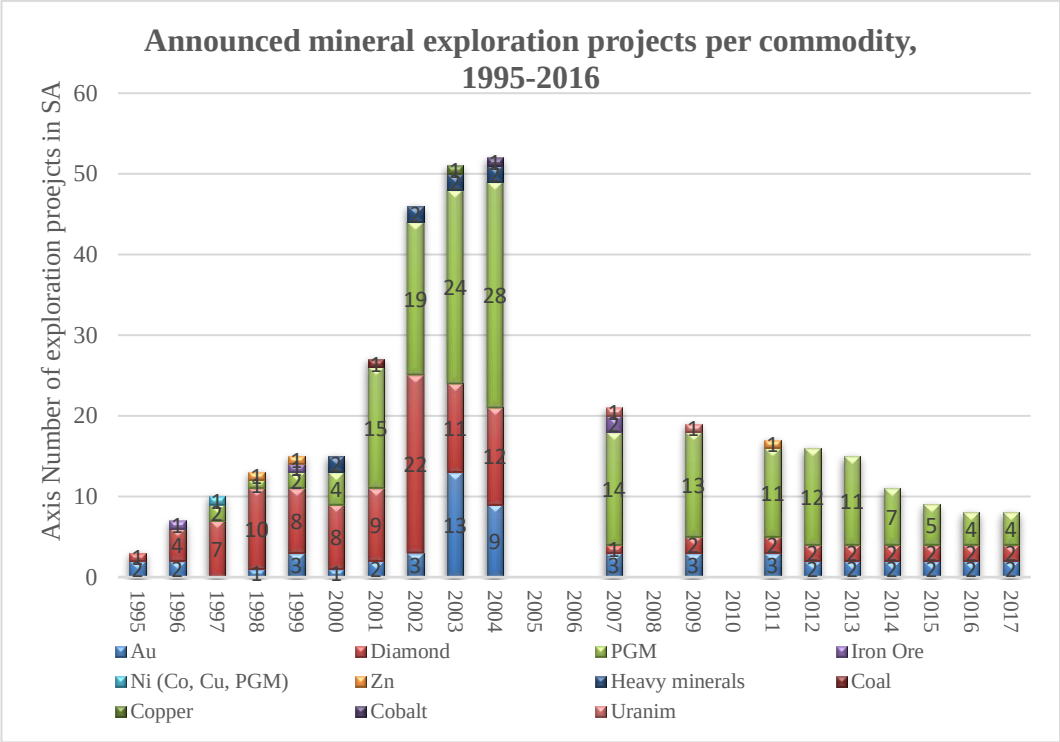


Figure 9.5 Announced mineral exploration projects per commodity in South Africa, 2017

(Source: USGS Exploration Review 2015, 2009, 2011, 2012, 2013, 2014, 2015, 2017)

Due to an investment environment that is perceived as uncompetitive, mining companies re-direct their investment expenditure to other parts of the world that are considered conducive and stable. It is prudent for the South African government to actively participate in the efforts of creating an attractive environment in the industry, especially greenfields exploration as it guarantees future mineral output and the country can continue reaping the benefits. Mining has very large employment, foreign exchange earnings and GDP multipliers. However, regulatory environment is as important as mineral endowment in terms of factors influencing investment into the sector. Regulatory uncertainty factors appear to have impeded the conversion of South Africa's comparative advantage in mineral endowment into a competitive advantage, globally. The cost of labour and electricity in the past decade has also resulted in the cost of mining escalating.

9.5 Chapter summary

The current South African mining investment environment, that is perceived as uncompetitive to mining companies, has led to investment being directed to other parts of the world that are considered stable. It is critical for South Africa to actively participate in the efforts of creating an attractive environment for investment in the industry, especially greenfields exploration as it guarantees future mineral output and the country can continue reaping the benefits. Mining has a very large employment potential, foreign exchange earnings and GDP multipliers. However, regulatory environment is as important as mineral endowment in terms of factors influencing investment into the sector. Regulatory uncertainty factors appears to have impeded the conversion of South Africa's comparative advantage in mineral endowment into a production competitive advantage, globally.

10 CONCLUSIONS & RECOMMENDATIONS

10.1 Introduction

Starting with the White Paper on Minerals and Mining Policy of 1998 and subsequent policies such as the National Development Plan, the South African government had signalled its intention to reform the regulatory environment of the industry such that there is very little disruption. The Minerals and Mining Policy of 1998 thus stresses "the importance of a stable macro-environment for economic growth in which measures that encourage investment in mining, as in other industries, are adopted" (DME, 1998). However, the decline in greenfields exploration projects, critical in their role of replacing depleting reserves as noted by Lockwood (2016), illustrates the failure of South Africa in capturing mining investment for future production.

The rise in government's expectations and resource nationalism has led to an expectation of an increase in the share of value to be derived from mining projects, not just in developing countries, but also in the developed world. This increase in the resource rents expected by host governments put pressure on project margins and, ultimately, project viability, pushing out payback periods on the capital invested. Stakeholder groups such as employees, communities living where mining is taking place, now expect more from mining companies. The South African mining industry has experienced an increase in demands from employees through increased salaries and improved housing benefits. Government has also sought to derive more revenue through increased tax from the new royalty regime adopted in 2008. Communities where mining projects are located have demanded more value from mining operations through corporate social responsibility programs as encapsulated in the various versions of the mining charter. Continuous engagement, faithful delivery of commitments, and focus on sustainability and the environment are now fundamental requirements.

10.2 Findings

The post-apartheid era, South African mining legislation and supporting instruments were aimed at redistribution of the mineral wealth of the nation, through the Mining Charter, and ensure participation of the previously disadvantaged people in the sector. The role of mineral policy in countries where the mining industry dominates the national economy, such countries have to leverage their mineral endowment to realise their developmental aspirations. When the ANC led government came into power after the 1994 democratic elections, there was a need to forge a new nation where all people will have an opportunity to participate in the mainstream economy. Any sphere of society that resembles the injustices of the past had to be brought in line to reflect the ideals of the new society being forged. Historically, the mining industry had been complicit in the subjugation of black people through such practices as the unfair labour practices and displacement of indigenous people for mining projects, under apartheid rule.

The transformation of the mining industry through a new regulatory framework in the new political dispensation, although necessary, was meant to cause little disruption in the industry in terms of production output and investing in growth. This research study concludes that the post-apartheid mining legislative and administrative framework has failed to re-invigorate exploration investment and growth in the industry. However, as indicated in the previous chapters, South African mining production output and exploration investment has been declining. Therefore, in the post-apartheid era, South Africa has failed to deploy the right policy instruments to stimulate mineral development and attracting investment to improve the lives of the people on the back of the massively rich mineral endowment.

The demand-driven price increases of mineral commodities in the first decade of the twenty-first century stimulated new capacity through successful exploration and development of new mineral deposits and extension of known deposits in major mining jurisdictions. Although the commodity prices were high for the most part of the past two decades the profitability of some of the operations have declined due

to cost of complying with the additional governance, regulatory, administrative and burdens in the mining industry. These additional costs have brought about an uncompetitive investment environment in the mining industry in South Africa due to the increased cost of compliance to regulatory requirements such as the improving of living conditions for mine workers and corporate social responsibilities for areas affected by mining operations. The reduction of margins in these operations has often deterred investment, particularly greenfields exploration investment, especially since the decline of prices starting in 2012. South Africa failed to leverage this higher commodity price environment of the first decade of the twentieth century to stimulate growth in the mining industry.

10.2.1 Gold mining industry

South African gold mining production was achieved in 1970s and has been in decline since then despite of high gold prices. Gold production is expected to continue to decline in the short-term mainly due to the cost of labour, electricity and consumables. The lack of new discoveries of large and low cost deposits indicates that gold mining will continue declining unabated. The production is coming off aging mines with an average age of 24 years – with depth increasing and grades declining. The higher cost associated with gold mining, especially in the ultra-deep mines of the Witwatersrand Basins would mean marginally mines only will be developed when prices are at a level never achieved before.

Another aspect that has influenced the unsustainability of the gold mining industry is the prevailing lack of regulatory certainty as well as concerns over security of tenure under the current version of the MPRDA and makes it difficult to invest in gold mine projects that take 5-10 years in developmental phase before production commences. Although South Africa is known to have large gold resources, both local and global factors make it undesirable for investment, especially greenfields exploration. Currently mining companies are utilising the available infrastructure to extract available reserves and not much effort is being put in developing the available resources.

10.2.2 Platinum mining industry

The Bushveld Complex is known to contain 90% of the world's known PGMs resources. Due to high demand of platinum prices in the 2000s, exploration investment led to new mines being developed and existing operations being extended, especially in the eastern Bushveld Limb. The development of new mines and extension of current workings led to a growth in production output from 3.8 million ounces in 2000 to a peak of 5.2 million ounces in 2006. The shift in mineral ownership through the enactment of the MPRDA ensured that all unused prospecting rights were redistributed and utilised during the commodity of the 2000s. The continued decline of platinum price, coupled with escalating electricity and labour costs, has had a negative impact on the viability of some platinum mines and has forced some mining operations being mothballed and the development of some projects put on hold.

10.2.3 Diamond mining industry

South Africa has been mining diamonds for the past 150 years with some of the current production coming off ore bodies that were discovered many decades ago with no major new ore body discoveries to add to the production. Although the South African diamond mining industry is mature, the application of new exploration technology could result in the discovery of new deposits or extension of known deposits.

In the past two decades small to medium scale alluvial diamond operations have reduced from 2000 in 2004 to a mere 150 in 2017. This decline can be attributed to the increasing regulatory and administrative burdens in the mining industry such BEE ownership requirements and compliance with the social labour plans

10.2.4 Copper mining industry

Copper mine production has continued to decline as older unprofitable operations have closed down. The decline in production is attributed to lack of greenfields exploration investment in the past three decades and the lack of discovery of new deposits. In the past two decades primary copper production has been coming from Palaborwa Mine and as a by-product in PGMs mining operations.

10.3 Summary of findings

Hypothesis 1: There has been a decline in exploration expenditure, especially greenfields projects expenditure, in South Africa since 1998

Global exploration investment had been increasing from early 2000s, as a response to the increase in commodity prices, until the global Financial Crisis in 2009, which led to a decrease demand of mineral commodities. However, global exploration investment level recovered well from the 2009 low to an all-time peak of 33 billion Dollars in 2012 as mineral commodity demand recovered. From a peak expenditure in 2012, global exploration expenditure has been in decline across all the commodities with the lowest expenditure reached in 2017 due to the declining demand of commodity prices.

In the case of South Africa exploration expenditure also increase in the face of commodity price increase starting in the early 2000s. However, exploration started declining in 2007 due the growing concern around the nationalisation of mines debate. Exploration increase after 2009 as the commodity prices recovered; however, the increase was short-lived as the decline in commodity prices from 2012 led to reduced exploration expenditure. Even the rebound in commodity prices, starting in 2015, was not sufficient to re-invigorate exploration expenditure.

Hypothesis 2: The decline in greenfields and brownfields projects expenditure has resulted in the decline of the discovery of new ore deposits and decline of extension of current reserves since 1998 in South Africa.

Although the South African mining investment was dominated by brownfields exploration in operating mines, there were news PGMs mines that were developed as result of the commodity boom of the first decade of the 21st century. A combination of 'lose it or use it' principle in the MPRDA and the rising demand of PGMs in the early 2000s led to interest in the exploration in the Bushveld Complex, especially the eastern section. New mines PGMs mined were developed mainly in the Eastern and Northern Limb of the Bushveld Complex in the past two decades. In terms of gold mines only South Deep and Burnstone are new gold mines that

were developed in the past two decades. There were 150 alluvial diamond-mining operations in 2010 which employed 3000 people, down from 2000 companies which employed 25 000 people in 2004. Noticeable copper mining investment projects were the expansion of capacity at Palaborwa mine and the Gamsberg exploration project by Vedanta mining.

Hypothesis 3: The decline in the discovery of new ore deposits and extension of current deposits has influenced the South African production of key commodities: gold, platinum, copper and diamond.

The South African mining industry has experienced minimal growth, only 0, 11% GDP growth from 2001 to 2018, even in the high commodity price environment of the past two decades. The recovery of mineral commodity prices from 2016 to 2018 has not had a positive impact on the mining GDP.

The South Africa gold mining started in the 1886 and production has been in decline in South Africa from a peak of over 1000 tons of gold in 1970 to a meagre 130 tons in 2018. From the 1970 peak of over 1000 tons, production has been gradually dropping with an annual production of 146 tons in 2016. This accelerated decline in production appears to be a result of the continuing closing of unprofitable Witwatersrand gold mines due to diminishing mineable reserves and the escalations in the cost of mining. The cost of mining deep level underground mines, coupled with high electricity prices has discouraged the development on new mines in the Witwatersrand.

Due to high demand of platinum prices in the 2000s, exploration investment led to new mines being developed and existing operations being extended, especially in the eastern Bushveld Limb. The development of new mines and extension of current workings led to a growth in production output from 3.8 million ounces in 2000 to a peak of 5.2 million ounces in 2006. The continued decline of platinum price, coupled with escalating electricity and labour costs, has had a negative impact on the viability of some platinum mines and has forced some mining operations being mothballed and the development of some projects put on hold.

Historically South Africa has dominated the global production rankings of diamond, both in terms of carat weight and value, until 1933 when it was surpassed by Zaire in terms of value rankings, but it continued to be the world's top producer by value until 1960 when it was overtaken by Russia. Today South Africa is still a major diamond producer, but ranks 5th in terms of carats and 3rd in terms of value. South Africa has been mining diamonds for the past 150 years with some of the current production coming off ore bodies that were discovered many decades ago with no major new ore body discoveries to add to the production. Although the South African diamond mining industry is mature, the application of new exploration technology could result in the discovery of new deposits or extension of known deposits.

In the past two decades small to medium scale alluvial diamond operations have reduced from 2000 in 2004 to a mere 150 in 2017. This decline can be attributed to the increasing regulatory and administrative burdens in the mining industry such BEE ownership requirements and compliance with the social labour plans

The continuous decline in the South African mine copper production is a direct consequence of the closure of operations. Messina Copper Mine was closed in 1992 due to declining economic viability. Prieska Copper Mine operated from 1971 and shut down in 1991. The only producers of primary copper is Palaborwa Mine and Black Mountain Mine with the rest of copper produced as by-product from PGM operations.

Hypothesis 4: Regulatory framework impediments have contributed in the decline of exploration expenditure of gold, platinum, copper and diamond since 1998 in South Africa

South Africa is well endowed with a number of the world's giant ore deposits. or districts including gold (and uranium) resources in the Witwatersrand Basin; Kalahari manganese fields; chromium, platinum, and vanadium resources of the Bushveld Igneous Complex; ilmenite, rutile, zircon-bearing heavy mineral sands of South Africa (Namaqualand, Natal Zululand) diamond deposits of Kimberly, South Africa, and west Namaqualand in Kwazulu Natal. It is leading in known global

reserve for PGMs, chrome and manganese and to a lesser extent gold, which accounts for 94, 40, and 11 percent respectively.

The unprecedented commodity boom of the early 2000s brought about an unprecedented demand of multiples of commodity minerals and with it, unprecedented prices increases. To benefit from the high commodity prices environment, mining companies increased the efforts and expenditure to locate new mineral deposits around the world. South Africa failed to leverage this higher commodity price environment of the first decade of the twentieth century to stimulate growth in the mining industry.

Despite South Africa's massive mineral endowment and the mature mining, share of African exploration expenditure peaked at just thirty-seven percent in 2003 and has been declining since then in 2017 was recorded at eight percent. Other African nations, such as DRC, and Zambia, previously considered risky, unstable and undeveloped received more exploration expenditure than South Africa in the past decade. Although the commodity prices were high for the most part of the past two decades the profitability of some of the operations have declined due to cost of complying with the additional governance, regulatory, administrative and burdens in the mining industry. These additional costs have brought about an uncompetitive investment environment in the mining industry in South Africa due to the increased cost of compliance to regulatory requirements such as the improving of living conditions for mine workers and corporate social responsibilities for areas affected by mining operations. The reduction of margins in these operations has often deterred investment, particularly greenfields exploration investment, especially since the decline of prices starting in 2012

10.4 Recommendations

The 1998 policy's intention was intended to dismantle apartheid injustices and policies. However, a new urgency to transform mining in terms of role of mining in the economy has emerged and hence additions are being made to the legislation (MPRDA) and hence the various amendments. The emotional baggage to the mining sector in developing countries, especially former colonies, need not hinder

or limit the mineral policy direction adopted to move the sector in the right direction. In the case of South Africa, with the historical role of the mining sector in the oppression of the black majority during the apartheid years, the current and future administration ought to fully integrate the industry into the 'new vision' and economy strategy. More importantly if South Africa does not sort out the current regulatory uncertainty, the country will miss out on the next upswing cycle of metal price as that case in the previous commodity boom of 2002 to 2008.

In the post-apartheid era, South Africa has failed to deploy the right policy instruments to stimulate mineral development and attracting investment to improve the lives of the people on the back of the massively rich mineral endowment. If this investment pattern is to continue unabated, even with its known immense mineral endowment, South Africa will soon run out of economically viable mineral deposits to mine due to lack of investment in greenfields exploration. To encourage significant increase in exploration investment, South Africa needs to encourage private investment from major international mining companies, which are the main source capital and expertise in discovering and developing mineral deposits by creating a conducive investment environment.

The development of South Africa's potential wealth through the extraction of mineral resources has been obstructed and frustrated by bundles of regulatory red tape in the past two decades. Although investment has been gaining momentum in the past year or so, investors might still need some convincing, through policy certainty, that the damage of the last two decades can be reversed. South Africa will not mend its investment risk image in an instant. At a minimum, progress will take renewal of confidence in institutions that are critical to the mining industry, coupled with regulatory certainty, led by leaders with a different moral compass.

Mining projects require large capital outlay upfront and yet their gestation periods are long. Furthermore, greenfields exploration investment is high risk because success of the discovery of an economically viable deposit is not guaranteed. Mining investors therefore require a certain degree of predictability in the mineral policy and legislative environment in order to forecast future income from mineral

projects with confidence and hosting governments are central to cultivating such an environment. If South Africa desires to attract back the lost investment in the mining industry, a concomitant action by government is required to address those aspects of the regulatory environment that are currently deemed hostile to investment.

Since the watershed leadership elections of the ruling ANC in December, 2017, South Africa appears to have engaged on the path for accountable leadership and governance. Mr. Cyril Ramaphosa, who was elected president of the ANC in the above mentioned conference and is now president of the country, has been on a crusade for government institutions to adopt policies that will put the country's economy on the growth path. A seven month long series of engagements resulted in the adoption of the revised Mining Charter in September 2018 which appears to have instilled some confidence in the mining industry. The aim of this version of the Mining Charter is aimed at ending regulatory uncertainty that has shrunk investment into the mining industry. Government appears to concede that the Mining Charter is but only a tool to effect transformation in the industry; however, transformation in the mining industry must go with competitiveness and sustainability. In his maiden medium term budget statement, Finance Minister Tito Mboweni announced the withdrawal of the highly contentious MPRDA amendment bill, which had been referred back to parliament by then President Mr. Jacob Zuma.

The investment summit convened in October 2017 by the President Mr. Ramaphosa attracted some R150 billion investment with mining companies Anglo America and Vedanta having promised R71, 5 billion and R21, 4 billion, respectively, committed by both local and foreign investors.

The South African mining industry has a particular structure and legacy: it is both labour and power intensive. Labour productivity has been declining in the past two decades and yet salaries have increased at rates higher than inflation. The mining industry depends exclusively on Eskom for power and the higher cost of electricity has impacted many of the marginal mines. These factors have led the mining industry being uncompetitive in global terms partly due to the rise of input costs.

This increase in cost of mining in South Africa, and the prospect of little or no return on investment, coupled with a hostile policy environment has led to the country being downgraded in terms of being a favourable investment destination amongst other mining jurisdictions. Improving the country's investment desirability should not only be restricted to addressing the regulatory environment in the mining industry, but should also include: the supply of reliable energy at reasonable cost and creating a less volatile labour environment that is productive to ensure that mining operations are profitable.

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12 APPENDIX

12.1 South African gold mining capital expenditure

(Source: Nedbank, 2017)

Announced date	Project name	Announced value (Rmillion)	Estimated completion date	Project discripton	Project type	Project status
May-93	Buffelsfontein Gold Mine	75	May-94	Surafce dump treatment project. The plant at the Pioneer shaft will be producing 130 kg/month by May 1994	Tailings retreatment	Complete
May-93	Kinross Gold Mine	46	Dec-94	Further development at the Kinross mine, including the extension of two decline shafts	Extension	Complete
May-93	Beatrix Gold Mine	77	Dec-95	Development of a sub-vertical shaft at the Beatrix mine. The development will add 5 years to the LoM	Extension	Complete
Sep-93	South Deep Exploration Company	500	Apr-95	Development of South Deep Gold Mine	New project	Complete
Oct-93	Target Gold Exploration	150	Dec-96	Mining exploration at Loraine Mine	New project	Complete
Oct-93	Driefontein Gold Mine	350	Jun-95	Gold Fields is to replace a replacement mine for its Division	New project	Complete

Oct-93	Freegold Mine	371	Dec-02	Anglo is to sink a new shaft at Freegold mine	New project	Complete
Jul-94	Witwatersrand Nigel Gold Mine	200	Dec-95	Wits Nigel plans to develop a new gold mine (including the opening of no.11 at Wits Nigel	New project	Complete
Oct-94	Kloof Gold Mine	150	Dec-95	Expansion of Kloof operation (Leeuwdoorn & no 4 shafts)	Extension	Complete
Oct-94	Winkelhaak Gold Mine	500	Dec-96	Development of sub-vertical shaft at Winkel Mine	Extension	Complete
Oct-94	Randfontein Gold Mine	400	Dec-97	Develop the Doornkop no 2 shaft at Randfontein	New project	Complete
Oct-94	Oryx Gold Mine	380	Dec-98	Continued development of the Oryx Gold Mine	Extension	Complete
Oct-94	Deelkraal Gold Mine	400	Dec-99	Develop the no 1 tertiary shaft at Deelkraal	Extension	Complete
Oct-94	Joel Gold Mine	375	Dec-00	Capex to bring Joel Mine into full production	Extension	Complete
Oct-94	Western Deep Gold Mine	1200	Dec-07	Develop a sub-vertical shaft at its Western Deep operation	Extension	Complete
Jan-95	South Deep Gold Mine	1100	Dec-99	Capex to develop mine to full production	Extension	Complete
Oct-95	Joel Gold Mine	150	Dec-95	JCI to convert its Joel operation to conventional mining	Extension	Complete
Jul-96	Western Deep's shaft deepening project	1000	Jan-05	Deepening South Mine's existing sub-shaft to approximately 4km. The move will extend the LoM by 14 years to 2016	Extension	Complete
Aug-96	Doornkop South Reef mine	805	Dec-03	JCI to mine the South Reef at Doornkop section of Randfontein Estates	New project	Complete

Aug-96	Shaft-sinking at Target and Sun MINES	2500	Dec-04	To sink a 2,5km single shaft system at Target Gold mine as well as a 2,8km single drop system at Sun South Mine in Free State	New project	Complete
Aug-96	Joel Gold Mine expansion	70	Dec-97	extension of declines and the development of ore reserves	Extension	Complete
Aug-96	South Deep expansion projects	235	Dec-98	Expansion include further mining development, new underground equipment, pumping equipment and infrastructure.	New project	Complete
Oct-96	Freddies no 4 shaft	561	Sep-00	To sink new shaft at Freddies, with a depth of 2,4km	New project	Complete
Oct-96	Consolidated Murchison development	86	Mar-00	Beta shaft is to be equipped and developed to a depth of 650 metre, and is expected to add 15 years of LoM	Extension	Complete
Oct-98	Driefontein shaft deepening	4000	Dec-05	Shaft no 5 shaft deepening to 4km	Extension	Complete
Feb-99	South Deep Gold Mine	1800	Dec-03	Complete shaft sinking at South Deep gold mine, operate South Deep and adjacent Western Areas	New project	Complete
Apr-00	Gold Mine Free State	718	Jan-02	Capex to improve mining production in Free State	Extension	Complete
Oct-00	The African Gold Zone	65	Sep-03	Construction of Africa's first competitive gold jewellery manufacturing near Johannesburg		Complete
May-01	Greenfields Gold metallurgical	315	Jan-02	plant is being constructed in Westonaria	Tailings retreatment	Complete
Apr-02	Blyvooruitzicht gold mine expansion	65	Jan-03	Blyvoor to increase gold output to 720 kg/month in 2003	Extension	Complete

May-02	Moab Khotsong Gold Mine	3800	Oct-03	A new gold mine	New project	Complete
Aug-02	Driefontein Mine plant modernisation	20	May-03	The supply of conveyors and refurbishing of 10 existing conveyors at the no 1 plant.	Infrastructure upgrade	Complete
Aug-02	Aflease gold-mine expansion	115	Jun-03	The expansion of exploration work and underground mining at the Aflease gold mine near Klerksdorp, to double gold production at the mine.	Extension	Complete
Dec-02	Driefontein Mine No 1 plant	200	Jun-03	The replacement of the existing crushing and milling plant with two SAG mills at the Driefontein no 1 mine	Infrastructure upgrade	Complete
Feb-03	Elandskraal gold mining project	600	Jun-08	To expand Elandskraal goldmine in a shaft deepening project	Extension	Complete
Aug-03	Tshepong North Decline project	280	Mar-04	The development of a twin decline system at Freegold's Tshepong North Shaft gold mine	Extension	Complete
Sep-03	Mponeng Gold Mine shaft-deepening proejct	1300	Oct-03	A shaft-deepening project to prolong the LoM of Mponeng gold mine to 2012. It was to close in 2007	Extension	Complete
Mar-04	Doornkop South Reef mine project	1102	May-09	The upgrading of the sub-vertical shaft - part of a three-phase development of Harmony's Randfontein operations in order to access the South Reef.	New project	Complete
Jun-04	Kloof Gold Mine drop-down project	2100	Jan-13	Exploiting the still-substantial gold resources below existing infrastructure at the Kloof extension area.	Extension	complete

Jun-05	Elandskraal gold mining project	806	Dec-10	Shaft-sinking project at Elandsrand on the West Rand to amalgamate Elandsrand and Deelkraal operations and exploit 9.8 million ounces of reserves and output of an estimated 450 000 ounces of gold a year.	New project	complete
Jul-05	Dominion uranium mine	620	Mar-07	The Dominion mine is to be developed, and projected to produce 4 million pounds of uranium by 2011 and at least 90k ounces of gold as a by-product	New project	complete
Aug-05	Blyvooruitzicht gold mine expansion project	83	Mar-07	Estalishment of mining at the no 2 sub shaft in two phases and an expansion of the slimes dam project.	Extension	complete
Sep-05	Argonaut project	800	Mar-17	Southern down dip extension of the Central Rand Goldfield	New project	complete
Oct-05	Driefontein depth extension project	400	Jun-09	Deepening of the existing no 9 sub-vertical shaft sysyem from the current depth of 1 988 metres to a final depth of 4 121 metres, making it the deepest mine in the world.	Extension	complete
Jan-06	Backfill upgrade at Driefontein Gold Mine	22	Feb-06	Upgrade of the backfill plant at the no 1 plant of the Gold mine.	Infrastructure upgrade	complete
Feb-06	Burnstone project - a new gold mine	1000	Jun-21	Contruction of a new gold mine on a relatively shallow but marginal prospect in the north-eastern part of the Witwatersrand Basin.	New project	In progress

Jun-06	New Modder East Gold Mine	814	Dec-09	Construction of a new 60 000 tons a month gold mine	New project	complete
Jun-06	Mogale gold tailings project	272	Seo-10	Mogale gold tailings treatment operations in west Witwatersrand to produce 45 000 ounces of gold a year.	Tailings retreatment	complete
Jun-06	Kloof Gold Mine drop-extension area depth extension project	1400	Jun-16	Project will extend the depth below surface from 3217 metres to 355 metres and access additional 1,8 million ounces of gold at a head grade of 12 g/t	Extension	complete
Sep-06	Tau Tona below 120 carbon leader	1200	Feb-12	Twin decline shaft to 3 902 metres below datum to mine additional 1,2 million m^2 and yield 7,2 g/t of gold	Expansion	complete
Nov-06	Mine dump treatment project	1200	Dec-09	This entails the implementation of three Ergo-style mine-dump retreatment projects (of R400 million each), which would unlock as much as 500 000 ounces of gold a year for a number of years	Tailings retreatment	complete
Mar-07	Mponeng Gold Mine shaft-deepening proejct	2000	Dec-13	To extend the LoM of its deep-level Mponeng mine by further eight years, as it prepares to deepen the mine to 3 600 metres below surface.	Expansion	complete
May-07	Ezulwini underground mining project	1958	Jun-08	The proposed project entails the recommissioning of underground uranium and gold-mining operation located about 40 km from Johannesburg.	Expansion	complete
May-07	South Deep Gold mine projects	8500	Oct-16	Expansion of South Deep gold mine to 800 000 ounces a year from 270 000 a year	Extension	complete

Nov-07	Ergo Mining Project	400	Jun-09	To produce 200 kg per month of gold from a gold-from-dumps operation	Tailings retreatment	complete
Feb-08	Ryst Kuil uranium project	912	Dec-09	New uranium mine with an average output of 1 745 tons per year at the Karoo region	New project	complete
Apr-08	Pamodzi Gold mine expansion	60	Jun-09	Repair and refurbish the engineering infrastructure at its newly acquired President Steyn mine in the Free State.	Infrastructure upgrade	complete
Apr-08	Simmers and Jack mining project	217	Dec-10	To undertake various projects to boost its gold and platinum reserves.	Extension	complete
Jul-08	Sub Nigel 1 Project	29	Jul-10	To establish a number of underground production areas to produce 6000 ounces of gold per year at Sub Nigel	Extension	complete
Aug-09	Kopanang Mine Uranium	2000	Mar-11	New plant at Kopanang mine to increase the uranium production capacity to 2 million pounds a year.	Infrastructure upgrade	complete
Aug-10	DRDGold pipeline project	300	Mar-11	DRDGold wikk construct a 50km pipeline, which will run from Roodepoort to Brakpan. It will link mine dumps around Johannesburg with the Ergo treatment plant,	Tailings retreatment	complete
Jan-11	Tshepong, Phakisa and Masinmong uranium project	1400	Mar-11	This will involve rerouting the milled ore from Tshepong, Phakisa and Masimong mines, which is treated at the Harmony 1 gold plant, to a uranium plant. The plant will extract 750 000 pounds a year of uranium oxide.	Infrastructure upgrade	complete

Feb-11	Ventersburg gold project	1900	Jun-15	A twin vertical shaft system for primary access to the orebody of Ventersburg	New project	complete
Sep-11	Vaal River South uranium recovery expansion project	500	Jun-13	Upgrading infrastructure at their operation at Vaal River to increase uranium production	Infrastructure upgrade	complete
Mar-12	Barberton tailings treatment project - phase 1	325	Mar-12	Development of a tailings storage facility in Barberton	Tailings retreatment	complete
Jul-12	Ergo flotation and fine circuit	250	Jul-13	The project entails the construction of a new flotation and fine grind at Ergo's surface retreatment operation in Brakpan.	Tailings retreatment	complete
Jun-13	Rietfotein underground gold mine reopening	30	Sep-13	Reopening of the Rietfontein gold mine, starting at a rate of 5 000 tons a month and targeting 1 294 ounces of gold for 2013 and increasing to 8 200 ounces by 2014	New project	complete
Apr-14	Evander tailings retreatment	200	Dec-15	Constructioon of a R200 million tailings retreatment facility, which is expected to treat 2,16 million tons a year of gold tailing for 14 years	Tailings retreatment	complete
Jun-14	Ergo plant upgrade project	60	Sep-15	Upgrade of Ergo's plant, in Brakpan, to increase treatment capacity by 300 000 t/month to a total of 2,1 million tons a month	Tailings retreatment	complete

12.2 South African platinum mining capital expenditure

(Source: Nedbank, 2017)

Announced date	Project name	Announced value (Rmillion)	Estimated completion date	Project description	Project type	Project status
Sep-93	Rustenburg Platinum Mine	30	Apr-94	To install three flash dryers to dry platinum concentrates at its Waterval and Mortimer smelters	Infrastructure upgrade	Complete
Nov-93	Impala Platinum Mines	1100	Dec-98	Impala Platinum to develop a replacement shaft	New project	Complete
Apr-95	Impala Platinum's refinery upgrade	431	Jun-98	Impala Platinum to upgrade its metal refinery in three phases.	Infrastructure upgrade	Complete

Sep-96	Boschkoppies Platinum Mine expansion	1200	Dec-02	Anglo American Platinum Corporation to exploit the Boschkoppies reserves through two sets of twin incline shafts	Extension	Complete
May-97	Potgietersrust Platinum mine expansion	350	Dec-99	Potgietersrust platinum mine's concentrator capacity is to be expanded from 250 000 tons a year to 375 000 tons a year.	Infrastructure upgrade	Complete
Aug-98	Platinum production	71	May-00	The project entails the expansion of the Atok operation, including the expansion of the process plant to 10 000 tons a month, adding a further 21 000 ounces to the mine's yearly production of 80 000 ounces.	Extension	Complete
Jan-99	Amandebult, Rustenburg Platinum Mines	202	Dec-00	Part of R1, 8bn expansion programme, concentrator capacity and recovery activities to increase platinum production to 2, 25 million ounces.	Extension	Complete
Mar-00	Messina Platinum Project	524	Dec-03	The development of a platinum mine in Messina in the Northern Province	New project	Complete
Jun-00	Amplats's Mining Expansion	20000	Dec-06	Amplats will expand its mining processing capacity of boost annual production by 75% from 2 million ounces to 3,5 million ounces in 2006	Extension	Complete

Apr-02	Two Rivers Platinum	500	Sep-03	Avin and Impala have formed a new joint venture company, Two Rivers Platinum, to develop, manage and operate a new platinum group metals mine.	New project	Complete
Apr-02	Marula Platinum Mine	1700	Mar-04	Impala Platinum in a joint venture with Mmakau Mining is developing a platinum, which will produce 103 000 ounces a year of platinum during the initial phase.	New project	Complete
Jul-02	Marikana Platinum group metals mine	600	Dec-02	Marikana platinum mine is being developed in North West with production expected to be between 145 000 and 160 000 ounces per year.	New project	Complete
Jun-03	Everest South Mine	850	Dec-06	Aquarius Platinum will establish a platinum mine 30km west of Lydeburg in Mpumalanga to produce 225 000 ounces of platinum per year	New project	Complete

Jul-05	Impala Shaft no 16 - Rustenburg	7200	Aug-11	This forms part of Impala Platinum's R6,6 billion expansion of its Rustenburg operations. No 16 shaft will produce 226,5 kilotons of reef a month from seven operational levels, accessing the Merensky and UG2 reef horizons, requiring a downcast rock and man-material shaft, an upcast ventilation shaft and fulltime refrigeration	Extension	Complete
Jul-05	K4 Shaft East of Rustenburg	1662	Dec-06	The K4 shaft project is aimed at replacing the ore reserves for Lonmin's Karee mine.	New project	Complete
Jul-05	Impala Platinum 20 shaft project	6800	Dec-13	The project entails the sinking of tow vertical shafts and developing three 2, 5 km declines to access and transport reef. The two trackless declines will be situated between the Merensky and UG2 reef planes	New project	Complete

Aug-05	Brakfontein Merensky Platinum (Bokoni) Expansion Project	1100	Jun-09	The project has both a replacement and extension element. The plan is to extract down to level 7 into what is a large ore body, situated on the eastern extremity of the greater Lebowa Platinum lease area and on farm Brakfontein. The project should produce 120 000 tons of ore a month from surface, with 85 000 tons a month replacement and 35 000 tons a month expansionary.	Extension	Complete
Aug-05	Bafokeng Rasimone Platinum Expansion Project	1200	Dec-09	The project entails the extension of both the north and south shaft complexes of Bafokeng Rasimone mine by sinking six decline shafts, three at each existing shaft compelx, deepening the current operations from 6 level to 10 level.	Extension	Complete

Aug-05	Turfontein replacement ore-reserve platinum project	580	Dec-06	The project at Turffontein platinum mine is an ore-replacement project designed to keep production output at a constant of 120 000 tons a month. The first phase is to expand the mine to level 34, only high-grade Merensky reef will be mined in the first phase and the project will extend the life of mine to 2012.	Extension	Complete
Sep-05	Mototolo Platinum Mine	1350	Sep-07	Angloplat and Xstrata alloys is to develop a platinum group metals mine and a concentrator on the eastern limb of the Bushveld Complex in Mpumalanga. The project is expected to produce about 132 000 ounces of platinum and 82 000 ounces of palladium in concentrate a year.	New project	Complete

Mar-06	Potgietersrust Platinum replacement project	4000	Jul-09	Anglo Platinum will undertake a 200 000 tons a year platinum-replacement project at its Potgietersrus Platinum's open pit mine. In addition Anglo Platinum has the rights to undertake a substantial expansion project, increasing capacity by a further 230 000 ounces a year. A new milling and concentrating capacity will also be installed at the pit.	Extension	Complete
Mar-06	Rustenburg UG2 phase 2 project	2400	Dec-08	The project entails the expansion of production line to an annual rate of 2,9 million ounces of refined platinum by end of 2006. The project will also include the doubling of capacity of the UG2 Waterval concentrator to process an additional 400 000 tons of ore a month.	Extension	Complete
Mar-06	Elandsfontein platinum project	1100	Jun-08	The project involves the establishment of a mine on the Farm Elandsfontein 440 JQ on the Western Limb of the Bushveld Igneous complex, near Brits.	New project	Complete

Jun-06	Leeuwkop Platinum Mine	3000	Mar-13	The project involves the establishment of a mine at the 400 ha Leeukop property of the western limb of the Bushveld complex. The mine will produce 300 000 ounces of platinum a year.	New project	Complete
Oct-06	Paardekraal (Thambelani) no 2 shaft project	2600	Feb-11	This is a replacement project that will gain access to deeper Merensky reserves at a rate of 100 000 tons a month, replacing 120 000 ounces of platinum a year by 2015	Extension	Complete
Oct-06	Zandfontein decline development project	65	Oct-08	The project entails developing two declines 2 and 5 at the Crocodile River mine and all the associated horizontal development required to generate an 18-24 month available reserve. The plan is ramp up production from Zandfontein section to 140 000 tons a month by mid-2009.	Extension	Complete
Oct-06	Kalahari Platinum	550	Dec-10	The project entails the development of a platinum mine in the Kalahari basin.	New project	Complete
Nov-06	Smokey Hills platinum project	324	Dec-08	The project entails the development of platinum, palladium, rhodium and gold mine in Limpopo	New project	Complete

Nov-06	Pilansberg platinum-group metals (PGM) project	1000	Dec-10	The project entails the development of platinum mines in 25 portions of land on eight farms, with total area of 14 511 ha. The mine will have an estimated full production capacity of 250 000 ounces a year.	New project	Complete
Jan-07	Amandebult (Dishaba) expansion programme	1600	Dec-12	The project entails the expansion of Amandebult mine in Bushveld Complex. The output will be increased by 100 000 tons per year. The capital programme include the UG2 East Upper project and the UD2 concentrator upgrade to 210 000 tons per month.	Extension	Complete
Mar-07	Twonlands ore-replacement project	1000	Dec-09	The project forms part of Anglo Platinum's Rustenburg section mines plan to address the declining Merensky reef reserves. The project will enhance UG2 production from the existing vertical and decline shafts by providing three additional access points and a refrigeration plant.	Extension	Complete

Apr-07	Rustenburg Platinum Smelter	800	Oct-09	Impala Platinum is to expand its Rustenburg smelter to produce 2,8 million ounces of platinum a year, up from the current 1 million plus level	Extension	Complete
Apr-07	Wesizwe Platinum's Bakubung Platinum Group Metals Mine	7900	Apr-18	A mine will be constructed on the farms Frischgewaargd portions 3, 4 and 11 and the farm Ledig. The project will have a total run of mine production of 2, 1 million ounces of 4E 9platinum, platinum, rhodium and gold) concentrate.	New project	Underway
Aug-07	Platinum refinery expanion project	1900	Oct-10	The project entails the construction of a new 33 000 tons per year fully automated refinery in Rustenburg	New project	Complete
Sep-07	Potgietersrust Platinum North Expansion project	4250	Jul-09	PPRust mine in Potgetersrus will be expanded to produce 989 000 tons per month of ore from the current 385 000 tons a month. The project will also include a village relocation project.	Extension	Complete
Sep-07	Booysendal platinum project	2500	Dec-13	The project entails the construction of a platinum mine at Booysendal in the eastern limb of the Bushveld Complex	New project	Complete

Feb-08	Impala No 17 shaft - Rustenburg	11100	Dec-21	A new shaft at Impala Platinum will be established to replace production from old shafts that are nearing the end of production life	New project	Underway
Oct-08	Styldrift 1 expansion project	7500	Dec-19	The project will exploit one of the last major Merensky mining blocks on the Western Bushveld. Styldrift 1 will deliver an underground operation, which will be accessed through a twin vertical shaft system, with the main shaft being sunk to 758 metres and the services shaft to 723 metres.	New project	Complete
Jun-11	North shaft chairlift project	110	Mar-15	The North shaft chairlift project includes the development and installation of a chairlift from surface to level 5	Extension	Complete
Feb-12	Lesego platinum project	150	Mar-20	The project contains a South African Code of the Reporting of Exploration Results, Mineral Resources and Mineral Reserves compliant resource 42 million ounces, at an average of grade of 6,61 g/t between depth of 700 metres and 2 200 metres.	New project	Complete

Mar-12	Northam housing project	1400	Dec-14	Anglo Platinum plans to build 12 000 and 8 000 houses in North West and in Limpopo respectively for its employees, as part of the 'Each-One-Settle-One' campaign launched by the Department of Human Settlements.	New project	Complete
Jun-12	Royal Bafokeng Platinum and Anglo American Platinum's Bafokeng Rasimone Platinum Mine North Shaft Merensky Phase 3	11010	Aug-17	The project involves further replacement for Merensky production at the North shaft complex, through the extension of the existing decline from level 11 to 15 at the mining boundary, which will increase output by 70 000 tons a year of platinum.	Extension	Underway

Oct-13	Platreef platinum group metals/nickel/copper/gold project	818	Jun-16	The project involves the sinking of a bulk sample shaft to access the underground Platreef platinum/palladium/nickel/rhodium/gold discovery at Ivanhoe's Platreef project, on the northern limb of the Bushveld Complex. This will extend 800 metres below the surface	New project	Underway
Dec-13	Boiler emissions abatement plant	250	Dec-15	This involves the installation of an integrated plant at Impala's refinery complex in Springs. This will reduce the amount of waste residual and reduce the environmental impact from waste handling and disposal in the complex.	Infrastructure upgrade	Complete
Jun-14	Royal Bafokeng Platinum housing development	2800	Dec-20	Royal Bafokeng Platinum will construct 3 100 housing units and other relevant social structure for its employees. This is part of its objectives to provide affordable, appropriate and decent housing for its employees.	New project	Underway

Nov-15	Eternity Power thermal harvesting plant project	150	Jun-16	The project uses heat from the Anglo Converter Plant convertor cooling circuit to evaporate an organic liquid and drive an expansion turbine	Infrastructure upgrade	Complete
Apr-16	Ivanplats Platreef - platinum group metals, nickel, copper and gold mine - phase 1	17706	Dec-19	The project entails the mining of PGMs, copper, nickel and gold on the northern limb of South Africa's Bushveld Igneous Complex. The first phase of the project includes the development of a large, mechanised underground mine, with an initial 4-million-tonnes-a-year concentrator and associated infrastructure, as well as a planned, initial average yearly production rate of 433 000 ounces of platinum, palladium, rhodium and gold, and 19 million pounds of nickel and 12 million pounds of copper a year.	New project	Underway

12.3 Diamond mining capital expenditure projects, 1993-2018

(Source: Nedbank, 2017)

Announced date	Project name	Announced value (Rmillion)	Estimated completion date	Project description	Project type	Project status
Jan-96	Diamond exploration	130	Dec-00	Five year exploration programme. Bucket auger to arrive in June/July 99, Bauer-manufactured hydraulic grab excavator. Both used for alluvial diamond exploration off the east coast.	New project	Complete
Sep-98	Daimond mining	25	Dec-01	The company is converting a 61 metre oil rig supply vessel into a diamond mining vessel, bringing the total fleet to three and boosting production levels to 100 000 carats a year by 2001	New project	Complete

Apr-00	De Beers Construction plant	610	May-02	The construction of a combined 24 million carat plant in Kimbelerly	New project	Complete
Aug-01	Underwater diamond mining machines	42	Feb-01	An underwater diamond mining machine and a processing plant have been developed	New project	Complete
Jun-04	Proposed Diamond-mine project, Ventersdorp	231	Oct-04	The expansion of the Tirisano diamond mine as well as the possible development of the Blue Gum deposit.	Extension	Complete
Jun-05	Finch Mine Upgrade	417	Sep-06	The design, construction and commissioning of the upgraded facility, which will increase the fee rate from the various mining operations to the diamond plant to a maximum of 900 tons an hour.	Extension	Complete
Jun-05	Voorspoed diamond mine project	1300	Dec-07	The project entails the establishment of Voorspoed diamond mine, which should produce 900 000 carats a year	New project	Complete

Sep-05	Similotse Mine	26	Apr-06	Production at Similotse mine is expected to resume by November. Afgem is refurbishing winding gear at the second shaft and a new processing plant is to be installed by April 2006. The reserve of the mine are indicated at 155 000 tons at 85 carats a ton. At full production the mine should produce 2000 carats a month	Extension	Complete
Jun-06	Marine diamond-mining project	824	Jul-07	The project entails conversion of the ship, named Dock Express 20, into a marine mining vessel. The mining vessel is expected to yield up to 240 000 carats a year once fully commissioned.	New project	Complete
Sep-06	South African Sea Areas project	976	Jun-07	The project consist of the conversion of the Dock Express 20, a second-hand ship brought in 2005, into a marine mining vessel, fitted with a large undersea tracker mining too (crawler) and a treatment plant and is expected to yield up to 240 000 carats a year.	New project	Complete

May-11	Bakerville diamond project	90	Dec-13	A Swedish mining company, International Gold Exploration Resources, plans to develop a diamond mine in Lichtenburg in North West. Bakervilled as a verified resources base of 454 000 carats and additional potential resources of 579 000 carats.	New project	Complete
Feb-13	Lace diamond mine development project	384	Sep-14	Diamond Corp will expand its diamond mine in to produce more 500 000 carats a year of diamonds at peak production	Extension	Complete
Mar-13	Venetia underground diamond mine	20000	Dec-21	De Beers Consolidated Mines South Africa wants to build a new underground mine beneath the current operating open-pit in Limpopo, which will extend the life of Venetia mine to 2042 and re-place open-pit operation. This will yield 96 million carats during the life of mine.	Extension	Complete

12.4 Copper mining capital expenditure projects, 1993-2018

(Source: Nedbank, 2017)

Announced date	Company name	Project name	Announced value (R million)	Estimated completion date	Project description	Project type	Project status
Mar-96	Palaborwa Mining Company	Underground copper mine	1500	Jan-02	Phalaborwa Mining Company is to develop an underground mine to exploit the reserves below existing open pit. The mine will have a capacity of 90 000 tons a year	Extension	Complete
Jun-06	Thabex	Salt River base-mineral project	792	Feb-08	The project entails the exploration of the Salt River copper deposit in Northern Cape, construction of a pilot plant and	New project	Complete

					full mining of copper by early 2008		
Oct-11	Foskor	Foskor dryer debottlenecking project	162	Dec-14	Foskor will expand its drying and dispatching section of its Phalaborwa mine. The first phase of the project will involve the expansion of existing drying and dispatch units to increase its capacity, while the second phase will include the construction of additional kiln and silo.	Extension	Complete
Aug-15	Vendata Resources	Gamsberg zinc	8700	Mar-18	Vendata Resources is building a 4-million-ton-a-year open-pit mine in the Northern Cape. The project will also include a processing plant that will process	New project	Underway

					the ore into concentrate. The life of mine is expected to be 13 years		

12.5 South African mineral exploration projects: 1995-2005

(Source: USGS 1995-2005)

Site	Company	Commodity	Phase	Type	Activity type
South Africa (3 data points; 3 sites) Exploration Sites in 1995					
Eersteling	Caledonia Mining Corp.	Gold	Producer	Extension	Resource estimation
Marbrook	Caledonia Mining Corp.	Gold	Producer	Extension	Resource estimation
Rex	Rex Diamond Mining Corp.	Diamond	Producer	Extension	Delineation drilling
South Africa (10 data points; 7 sites) Exploration Sites in 1996					
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Exploration	New	Bulk sampling ongoing
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Exploration	New	Bulk sampling ongoing
Rooiberg	Redaurum Ltd.	Diamond	Exploration	New	Bulk sampling ongoing
Schweitzer	Casmyn Corp.	Diamond	Exploration	Continuing	Sampling, geophysics

Stoffberg	Bushveld Alloys Ltd.	Iron, Tin	Exploration	New	28-hole program completed
Water	Botswana Diamondfields Inc.	Diamond	Exploration	New	Drilling completed
Western Ultra Deeps	Anglo American plc.	Gold	Exploration	New	Geophysics planned
Worcester	Noble Peak Resources Ltd.	Gold	Exploration	New	Geochemical sampling completed
Worcester	Noble Peak Resources Ltd.	Gold	Exploration	New	Geochemical sampling, geophysics
Worcester/Barberton	Noble Peak Resources Ltd.	Gold	Exploration	New	Geochemical sampling, geophysics
South Africa (13 data points; 10 sites) Sites in 1997					
Crown	Rupert Resources Ltd.	Diamond	Exploration	New	Drilling ongoing
Hartbeeslaagte	Mountain Lake Resources Inc.	Diamond	Exploration	New	Trenching, 5,000 m program
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Exploration	Continuing	Exploration ongoing
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Exploration	Continuing	Sampling, drilling ongoing

Klipspringer/Marsfontein	SouthernEra Resources, Ltd.	Diamond	Exploration	Continuing	Bulk sampling completed
Kroondal	Aquarius Exploration NL	Platinum	Feasibility	Extension	Feasibility study ongoing
London Run	Kimberlite Resources Int'l. Ltd.	Diamond	Exploration	New	Bulk sampling, drilling planned
Mountain Ash	Ashton Mining Ltd.	Diamond	Exploration	New	5,000 m program planned
Nkomati	Avgold Ltd.	PGMs, Nickel, Cobalt	Developing	Extension	Development approved
Rooiberg	Redaurum Ltd.	Diamond	Exploration	Continuing	Bulk sampling ongoing
Water	Botswana Diamondfields Ltd.	Diamond	Exploration	Continuing	Bulk sampling ongoing
Winnaarshoek	Platexco Inc.	Platinumt	Exploration	New	Mapping, geophysics, 13,000 m program

Winnaarshoek	Platexco Inc.	Platinumt	Exploration	New	9-hole program completed
South Africa (15 data points; 13 sites) Sites in 1998					
Aardvark/Barkly West	Poplar Resources Ltd.	Diamond	Exploration	New	Bulk sampling planned
Crown	Rupert Resources Ltd.	Diamond	Exploration	Continuing	Bulk sampling, 5,000 m program planned
Crown	Rupert Resources Ltd.	Diamond	Exploration	Continuing	Bulk sampling, drilling ongoing
Crown	Rupert Resources Ltd.	Diamond	Exploration	Continuing	Drilling completed
Groen River valley	Firestone Diamonds plc.	Diamond	Exploration	New	Sampling completed
Gamsberg	Anglo American Corp.	Zinc	Developing	Extension	Plans to develop
Karmel	Poplar Resources Ltd.	Diamond	Exploration	New	Geophysics completed
Klipgat 18	Mountain Lake Resources Inc.	Diamond	Developing	Extension	Production approved
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Producer	Extension	Production started

Marsfontein	SouthernEra Resources, Ltd.	Diamond	Exploration	Continuing	Bulk sampling ongoing
Manieshoop	Superior Mining Corp.	Diamond	Exploration	Continuing	Trenching, drilling completed
Montrose	Global Diamond Resources Inc.	Diamond	Exploration	New	Bulk sampling planned
Mountain Ash	Ashton Mining Limited	Diamond	Exploration	New	Exploration terminated
South Deep/Western Areas	Western Areas Ltd.	Gold	Producer	Extension	Development planned
Winnaarshoek	Platexco Inc.	Platinum	Exploration	Continuing	Drilling ongoing
South Africa (23 data points; 15 sites) Sites in 1999					
Caber North	Southern Africa Minerals Corp.	Zink, Copper, Silver, Gold	Exploration	New	Geophysics ongoing
FSC	AfriOre Limited	Diamond	Exploration	Continuing	Drilling planned
Groen River valley	Firestone Diamonds plc.	Diamond	Exploration	New	Sampling ongoing
Groen River valley	Firestone Diamonds plc.	Diamond	Exploration	New	Mapping, geophysics, 3,835 m completed

Karmel	Leader Mining International Inc.	Diamond	Exploration	Continuing	Exploration planned
Khunwana	Gold Fields Ltd.	Gold	Exploration	New	Exploration planned
Klipgat 18	Mountain Lake Resources Inc.	Diamond	Developing	Extension	Production planned
Klipgat 18	Mountain Lake Resources Inc.	Diamond	Developing	Extension	Resource estimation
Klipspringer/Marsfontein	SouthernEra Resources, Ltd.	Diamond	Developing	Extension	Sampling, drilling planned
Marikana	Aquarius Platinum Ltd.	PGMs, Gold	Exploration	Continuing	Resource estimation
Marsfontein	SouthernEra Resources, Ltd.	Diamond	Producer	Extension	Sampling, trenching ongoing
Marsfontein	SouthernEra Resources, Ltd.	Diamond	Producer	Extension	6,000 m program completed
Marsfontein	SouthernEra Resources, Ltd.	Diamond	Producer	Extension	6,000 m program completed
Pniel Estate	Majestic Resources NL	Diamond	Exploration	Continuing	Mapping, bulk sampling completed

Pniel Estate	Majestic Resources NL	Diamond	Exploration	Continuing	1,882 m program completed
Swabies/Leeuvlei	Superior Mining Corp.	Gold	Exploration	New	783 m program completed
Townlands	Xstrata plc.	Ferroalloys	Exploration	New	Exploration planned
Winnaarshoek	Platexco Inc.	Platinum	Exploration	Continuing	Resource estimation
Winnaarshoek	Platexco Inc.	Platinum, Palladium, Gold	Exploration	Continuing	Resource estimation
Winnaarshoek	Platexco Inc.	Platinum, Palladium, Gold	Exploration	Continuing	Bulk sampling, drilling ongoing
Witkrans	Randgold Exploration Co Ltd.	Diamond	Exploration	New	74-hole program completed
Witkrans/Kafferskraal	Randgold Exploration Co Ltd.	Diamond	Exploration	New	Exploration planned
Wits Basin	Iamgold Corp.	Gold	Exploration	New	Exploration planned
South Africa (22 data points; 15 sites) South Africa (23 data points; 15 sites) Sites in 2000					
Caerwinning	Global Diamond Resources Inc.	Diamond	Exploration	New	Geophysics, drilling planned

Fairbreeze	Iscor Limited	Heavy minerals	Feasibility	Extension	Resource estimation
FSC	AfriOre Limited	Diamond	Exploration	New	Drilling ongoing
Richard's Bay area/Hillendale	Iscor Limited	Heavy minerals	Developing	Extension	Production development planned
Richard's Bay area/Hillendale	Iscor Limited	Heavy minerals	Developing	Extension	Resource estimation
Klipspringer	SouthernEra Resources, Ltd.	Diamond	Feasibility	Extension	Feasibility study completed
Marikana	Aquarius Platinum Limited	PGMs	Feasibility	Extension	Feasibility study completed
Marikana	Aquarius Platinum Limited	PGMs	Feasibility	Extension	Resource estimation
Marikana	Aquarius Platinum Limited	PGM	Feasibility	Extension	Resource estimation
Messina	SouthernEra Resources, Ltd.	PGMs	Feasibility	Extension	Resource estimation
Mooikloof	SouthernEra Resources Ltd.	Diamond	Exploration	New	Sampling completed
Palmietgat	Trivalence Mining Corporation	Diamond	Developing	Extension	Permit granted
Platreef	Anooraq Resources Corp.	PGMs, Gold	Producing	Extension	2,822 m program completed

Platreef	Anooraq Resources Corp.	PGMs, Gold	Producing	Extension	Drilling ongoing
Platreef	Anooraq Resources Corp.	PGMs, Gold	Producing	Extension	6,758 m program completed
Platreef	Anooraq Resources Corp.	PGMs, Gold	Producing	Extension	6,758 m program completed
Potgietersrus	Thabex Exploration Limited	PGMs, Gold	Exploration	New	Exploration planned
Trafalgar	Blue Ice Minerals Limited	Diamond	Exploration	New	Sampling, pitting, geophysics
Unnamed	Anooraq Resources Corp.	Diamond	Exploration	New	Exploration planned
Wits	Iamgold Corp.	Gold	Exploration	Continuing	Deep drilling ongoing
Wits	Iamgold Corp.	Gold	Exploration	Continuing	Drilling planned
Zuurverdiend	Vaaldiam Resources Ltd.	Diamond	Exploration	New	Exploration planned
South Africa (34 data points; 27 sites) Sites in 2001					
BB-TBM	Cluff Mining plc	PGMs	Exploration	New	Mapping, sampling, 2,322 m program
Blue Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Resource estimation

Blue Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Dwars River	Anglovaal Mining Limited	PGMs	Developing	Extension	Plan to develop
Dwars River	Anglovaal Mining Limited	PGMs	Developing	Extension	Feasibility study planned
Font Verde	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	
Font Verde	Cluff Mining plc	PGMs, Gold, Copper, Nickel	Exploration	Continuing	Drilling ongoing
FSC	AfriOre Limited	PGMs	Exploration	New	Drilling completed
Jagersfontein	De Beers Limited	Diamond	Exploration	New	Sampling of dumps completed
Kalgold	Harmony Gold Mining Ltd.	Gold	Exploration	New	New discovery
Kennedy's Vale	Impala Platinum Holdings Limited	PGMs	Exploration	Continuing	Geophysics ongoing
Maroelabult	Impala Platinum Holdings Limited	PGMs	Developing	Extension	Development ongoing
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Developing	Extension	Feasibility study completed
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Began production

Mellennium	SouthernEra Resources, Ltd.	PGMs	Exploration	Continuing	Mapping, 2,000 m program planned
Mooikloof	SouthernEra Resources Ltd.	Diamond	Exploration	Continuing	Sampling ongoing
Namakwa	Namakwa Diamond Company NL	Diamond	Exploration	New	Drilling ongoing
Namakwa	Namakwa Diamond Company NL	Diamond	Exploration	New	Drilling, trenching, bulk sampling
Orange River	Majestic Resources NL	Diamond	Exploration	New	Bulk sampling completed
Perdevlei/Eendrag	Tawana Resources NL	Diamond	Exploration	New	34-hole percussion drill program planned
Perdevlei	Tawana Resources NL	Diamond	Exploration	New	35-hole, 3,935 m program completed
Platreef	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	Drilling planned
Platreef/Rietfontein	African Minerals Ltd.	Platinum, Palladium,	Exploration	New	Drilling ongoing

		Copper, Nickel			
Pruissen/Vier-En-Twintig	Caledonia Mining Corp.	Platinum	Exploration	Continuing	Exploration planned
Reitfontein	Anooraq Resources Corp.	PGM, Copper, Nickel	Exploration	New	Drilling planned
Schweizer Reneke	Namakwa Diamond Co. NL	Diamond	Exploration	New	Mapping, bulk sampling planned
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Somkele	AfriOre Limited	Coal	Exploration	New	Exploration planned
Unnamed	Namakwa Diamond Co. NL	Diamond	Exploration	New	Drilling, pitting, trenching, sampling
Ventersdorp	Etruscan Resources Inc.	Diamond	Feasibility	Extension	Feasibility study completed
Winnaarshoek	Impala Platinum Holdings Limited	PGMs	Developing	Extension	Extensive drilling ongoing
Witwatersrand	Iamgold Corp.	Au	Exploration	Continuing	2,700 m hole

South Africa (73 data points; 46 sites) Sites in 2002					
Aurora	Pan Palladium Ltd.	PGMs, Nickel, Copper	Exploration	Continuing	Mapping, sampling, geophysics completed
Aurora	Pan Palladium Ltd.	PGMs, Nickel, Copper	Exploration	Continuing	Sampling, geophysics ongoing
Avontuur	Firestone Diamonds plc.	Diamond	Producer	Extension	312-hole, 6,053 m program completed
Blaauwfontein	Dwyka Diamonds Ltd.	Diamond	Exploration	Continuing	Geophysics completed
Blue Ridge	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	Resource estimation
Blue Ridge	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	To date, 77 holes, 26,558 m
Blue Ridge West	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	1,800 m + 6,735 m
Blue Ridge West	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	Resource estimation
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Feasibility work planned
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Drilling planned

Cazali	Monroe Minerals Inc.	Diamond	Exploration	New	Sampling, geophysics, drilling ongoing
Doornbult	Monroe Minerals Inc.	Diamond	Exploration	New	Geophysics ongoing
Drenthe	Anooraq Resources Corp.	PGM, Nickel, Copper	Exploration	Continuing	Drill testing ongoing
Dwaalboom	AfriOre Limited	Gold	Exploration	New	Exploration planned
Dwaalkop	SouthernEra Resources Ltd.	PGMs	Exploration	Continuing	Drilling planned
Fonte Verde	Cluff Mining plc	PGMs	Exploration	Continuing	Geophysics, 1,871 m +2,400 m
Goedgevonden	Caledonia Mining Corp.	Diamond	Exploration	New	7-hole program completed
Goubees	Superior Mining Corp.	Diamond	Exploration	New	Trenching, pitting, bulk sampling ongoing
Grass Valley	Pan Palladium Ltd.	PGMs	Feasibility	Extension	Feasibility study planned
Grass Valley	Pan Palladium Ltd.	PGM, Nickel, Copper	Feasibility	Extension	7,500 m program planned

Grass Valley	Pan Palladium Ltd.	PGMs, Nickel, Copper	Feasibility	Extension	7,800 m program ongoing
Grass Valley	Pan Palladium Ltd.	PGMs, Nickel, Copper	Feasibility	Extension	7,800 m program ongoing
Kamfersdam	New Diamond Holdings Ltd.	Diamond	Exploration	New	Drilling, sampling planned
Kareevlei	Tawana Resources	Diamond	Exploration	New	Bulk sampling planned
Kennedy's Vale	Impala Platinum	PGMs, Gold	Feasibility	Extension	Geophysics, drilling, bulk sampling completed
Kliprivier	Eurasia Mining plc.	PGMs, Gold	Exploration	Continuing	Mapping, geophysics, drilling planned
Kliprivier	Eurasia Mining plc.	PGMs, Gold	Exploration	Continuing	Mapping completed
Leeukop 402JQ	Central African Mining & Expl. Co. plc	PGMs, Gold	Exploration	New	Drilling planned
Leeukop 402JQ	Central African Mining & Expl. Co. plc	PGMs, Gold	Exploration	New	Resource estimation
London	Monroe Minerals Inc.	Diamond	Exploration	Continuing	Geophysics, drilling, bulk

					sampling completed
London	Monroe Minerals Inc.	Diamond	Exploration	Continuing	Geophysics completed
Messina	Majestic Resources	Diamond	Exploration	Continuing	Drilling completed
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Increased production
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Phase 2 feasibility study
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Production increase planned
Messina	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Commissioned concentrator
Millennium	SouthernEra Resources, Ltd.	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Namakwa	Namakwa Diamond Co. NL	Diamond	Exploration	New	Trenching, bulk sampling ongoing
Nooitgedacht	Dwyka Diamonds Ltd.	Diamond	Producer	Extension	Pitting, geophysics ongoing

Oena	Firestone Diamonds plc.	Diamond	Producer	Extension	1,100 m drilling completed
Perdevlei	Tawana Resources	Diamond	Exploration	Continuing	Bulk sampling ongoing
Phosiri	Pan Palladium Ltd.	PGMs, Gold	Exploration	New	11-hole, 17,000 m program suggested
Platreef/Reitfontein	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	2,000 m program ongoing
Platreef/Reitfontein	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	Drilling ongoing
Platreef/Reitfontein	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	21 holes to date.
Platreef/Reitfontein	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	24 holes to date.
Platreef/Reitfontein	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	25 holes to date.
Platreef/Reitfontein	Anooraq Resources Corp.	Gold, Gold	Producer	Extension	25 holes to date.
President Steyn	Thistle Mining Inc.	Gold	Producer	Extension	Resource estimation
President Steyn	Thistle Mining Inc.	Gold	Producer	Extension	Drilling ongoing

Pypklip	Dwyka Diamonds Ltd.	Diamond	Exploration	Continuing	Bulk sampling completed
Sea Area 14b	Diamond Fields Int'l. Inc.	Diamond	Exploration	New	Exploration planned
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Ongoing 30,000 m program
Star	Majestic Resources NL	Diamond	Producer	Extension	2-hole, 1,020 m program completed
Tirisano	Etruscan Resources Inc.	Diamond	Producer	Extension	Began production
Tirisano	Etruscan Resources Inc.	Diamond	Producer	Extension	Began production
Tormin	Mineral Commodities Ltd.	Heavy minerals	Exploration	Continuing	Bulk sampling completed
Turfspruit	African Minerals Ltd.	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Unnamed	De Beers SA	Diamond	Exploration	New	Exploration planned
Unnamed	Placer Dome Inc.	PGMs	Exploration	New	Exploration planned

Unnamed	Anooraq Resources Corp.	PGMs	Exploration	New	Exploration planned
Unnamed	Anooraq Resources Corp.	PGMs	Exploration	New	Geophysics, 3 holes to date
Unnamed	Anooraq Resources Corp.	PGMs	Exploration	New	Mapping, sampling, geophysics completed
Ventersdorp/Kooitgedacht/Hartbeestlaagte/Mooi	Etruscan Resources Inc.	Diamond	Developing	Extension	Bulk sampling planned
War Springs/Tweespalk	Platinum Group Metals Ltd.	PGMs	Exploration	New	5,000 m program planned
West Coast	Namakwa Diamond Co. NL	Diamond	Exploration	New	Bulk sampling planned
West Coast/Namakwa	Namakwa Diamond Co. NL	Diamond	Exploration	New	Bulk sampling ongoing
West Coast	Namakwa Diamond Co. NL	Diamond	Exploration	New	Sampling, trenching ongoing
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	New	Exploration planned
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	New	Drilling planned

Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	New	Sampling, drilling completed
South Africa (90 data points; 51 sites) Sites in 2003					
Albetros	Argosy Minerals Inc.	Diamond	Exploration	New	51-hole, 1,300 m phase 1 program
Albetros	Argosy Minerals Inc.	Diamond	Exploration	New	146-hole program planned
Aurora	Pan Palladium Ltd.	PGMs, Nickel, Copper	Exploration	Continuing	Exploration ongoing
Aurora	Pan Palladium Ltd.	PGMs, Nickel, Copper	Exploration	Continuing	18 holes during quarter
Blue Ridge	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	Geophysics completed
Blue Ridge	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	Feasibility study completed
Bokfontein	Nkwe Platinum Ltd.	PGMs, Gold	Exploration	New	Trenching, drilling ongoing
Bosele	Dwyka Diamonds Ltd.	Diamond	Exploration	New	Exploration ongoing

Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	20,000 m program ongoing
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	20,000 m program ongoing
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	20,000 m program ongoing
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Completed 20,000 m program
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Completed 20,000 m program
Burnstone/Area 1	Great Basin Gold Ltd.	Gold	Feasibility	Extension	32,000 m + 6,000 m
Burnstone/Area 2	Great Basin Gold Ltd.	Gold	Feasibility	Extension	19,000 m + 7,000 m
Burnstone/Area 3	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Ongoing 5,000 m program
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	25-hole, 19,000 m program completed
Burnstone/Area 1	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Resource estimation

Cazali	Monroe Minerals Inc.	Diamond	Exploration	Continuing	Sampling, geophysics, drilling ongoing
Daniel	Tawana Resources NL	Diamond	Exploration	Continuing	Sampling, drilling ongoing
Daniel	Tawana Resources NL	Diamond	Exploration	Continuing	Drilling ongoing
Daniel	Tawana Resources NL	Diamond	Exploration	Continuing	Drilling, bulk sampling completed
Doornbult	Monroe Minerals Inc.	Diamond	Exploration	Continuing	Prefeasibility stage
Doornkop	Harmony Gold Mining Co.	Gold	Developing	Extension	Development approval given
Dwaalboom	Cluff Mining plc	Gold	Exploration	Continuing	Exploration ongoing
Elandsfontein 102JQ farm	Platinum Group Metals Ltd.	PGMs	Exploration	New	2,000 m program planned
Elandsfontein	Platinum Group Metals Ltd.	PGMs	Exploration	New	35-hole, 1,050 m program ongoing

Elandsfontein	Platinum Group Metals Ltd.	PGMs	Exploration	New	41-hole program ongoing
Elandsfontein	Platinum Group Metals Ltd.	PGMs	Exploration	New	Completed 24 of 40 holes
Elandsfontein	Platinum Group Metals Ltd.	PGMs	Exploration	New	4-hole program completed
Everest South	Aquarius Platinum	PGMs	Feasibility	Extension	Feasibility study completed
FSC	Afriore Ltd.	Gold	Exploration	Continuing	Geophysics ongoing
Goedgenoeg	AngloGold Limited	Gold	Producer	Extension	Drilling
Grass Valley	Pan Palladium Ltd.	PGMs	Exploration	Continuing	25,663 m to date
Kareevlei Wes	Tawana Resources NL	Diamond	Exploration	Continuing	Bulk sampling
Kareevlei Wes	Tawana Resources NL	Diamond	Exploration	Continuing	25-hole program
Kareevlei Wes	Tawana Resources NL	Diamond	Exploration	Continuing	Drilling, bulk sampling
Kopanang	AngloGold Limited	Gold	Exploration	Continuing	Exploration planned
Kraaipan	Gold Fields/Harmony JV	Gold	Exploration	New	Exploration ongoing

London	Monroe Minerals Inc.	Diamond	Feasibility	Extension	Bulk sampling ongoing
Messina/Voorspoed	SouthernEra Resources Ltd.	PGMs, Gold	Producer	Extension	Drilling ongoing
Messina/Doornvlei	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Drilling ongoing
Messina/Doornvlei	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Drilling ongoing
Messina/Dwaalkop	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Drilling planned
Messina/Dwaalkop	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	6,000 m program completed
Messina/Dwaalkop	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Ongoing drilling
Messina/Dwaalkop/Doornvlei	SouthernEra Resources Ltd.	PGMs, Gold	Producer	Extension	Completed 19,600 m + 6,000 m to date.
Messina/Voorspoed	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Drilling ongoing
Messina	SouthernEra Resources Ltd.	PGMs, Gold	Producer	Extension	Ongoing 39,680 m program
Millennium	SouthernEra Resources, Ltd.	PGMs, Gold	Exploration	Continuing	Drilling ongoing

Millennium	SouthernEra Resources, Ltd.	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Moab Khotsong	AngloGold Limited	Gold	Developing	Extension	Developing mine
Moab Khotsong	AngloGold Limited	Gold	Producer	Extension	Drilling planned
Mponeng	AngloGold Limited	Gold	Producer	Extension	Drilling planned
Namakwa	Namakwa Diamond Co. NL	Diamond	Feasibility	Extension	Development planned
Namakwa	Namakwa Diamond Co. NL	Diamond	Feasibility	Extension	Sampling, trenching completed
Namakwa	Namakwa Diamond Co. NL	Diamond	Feasibility	Extension	Geophysics completed
Palabora	Palabora Mining Co.	Copper	Producer	Extension	Extension of deposit
Palmietfontein	OTR Mining Ltd.	PGMs	Exploration	New	Exploration ongoing
Perdevlei	Tawana Resources NL	Diamond	Exploration	Continuing	Bulk sampling planned
Phosiri	Pan Palladium Ltd.	PGMs	Exploration	Continuing	Exploration ongoing
Platreef/Northern Block	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	Resource estimation
Platreef/Drenthe	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	Resource estimation

Platreef/Drenthe	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	10-hole, 2,176 m program completed
Platreef/Drenthe	Anooraq Resources Corp.	PGMs, Gold	Producer	Extension	Resource estimation
PPrust Platreef	Thabex Exploration Ltd.	PGMs	Exploration	Continuing	Exploration ongoing
Rooderand	Active Gold Group Ltd.	Gold	Exploration	New	Mapping, sampling, drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	Joint venture planned
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	26,695 m to date at 50% of 2003 program
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	126-hole, 38,600 m program completed
South Block	Anooraq Resources Corp.	PGMs, Gold	Exploration	Continuing	Exploration completed
South Block	Anooraq Resources Corp.	PGMs, Gold	Exploration	Continuing	Mapping, sampling,

					geophysics completed
South Block	Anooraq Resources Corp.	PGMs, Gold	Exploration	Continuing	15-hole, 3,500 m program planned
Tau Tona	AngloGold Limited	Gold	Exploration	Continuing	Resource estimation
Tau Tona	AngloGold Limited	Gold	Producer	Extension	Drilling planned
Ticor	Ticor SA	Heavy minerals	Developing	Extension	Developing mine
Tirisano	Etruscan Resources Ltd.	Diamond	Producer	Extension	Geophysics, drilling completed
Tirisano	Etruscan Resources Ltd.	Diamond	Producer	Extension	Resource estimation
Tormin	Mineral Commodities Ltd.	Zircon	Feasibility	Extension	Feasibility study commenced
Tweespalk	Platinum Group Metals Ltd.	PGMs	Exploration	New	Exploration planned
Tweespalk	Platinum Group Metals Ltd.	PGMs	Exploration	New	Mapping, sampling planned
Tweespalk	Platinum Group Metals Ltd.	PGMs	Exploration	New	1,000 m program planned

Varkensfontein/Grootfontein	Sub-Nigel	Gold	Exploration	New	Drilling ongoing
War Springs	Platinum Group Metals Ltd.	PGMs	Exploration	New	5,000 m program planned
Weltevreden	AngloGold Limited	Gold	Producer	Extension	Exploration planned
West Coast	Namakwa Diamond Co. NL	Diamond	Developing	Extension	To develop
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	Continuing	Resource estimation
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	Continuing	Resource estimation
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	Continuing	24-hole, 735 m auger drilling program
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Exploration	Continuing	25,469 m in 2002
South Africa (81 data points; 52 sites) Sites in 2004					
Akanani	Afriore Limited	PGMs, Nickel, Copper	Exploration	New	9-hole, 13,000 m program ongoing
Albetros	Argosy Minerals Inc.	Diamond	Exploration	Continuing	22-hole auger drilling to date
Albetros	Argosy Minerals Inc.	Diamond	Exploration	Continuing	22-hole auger drilling

Aurora	Pan Palladium Ltd.	Platinum, Palladium, Gold	Exploration	Continuing	7-hole program completed
Aurora/La Pucella	Pan Palladium Ltd.	Platinum, Palladium, Gold	Exploration	Continuing	Drilling ongoing
Aurora/Kransplaats	Pan Palladium Ltd.	PGMs, Nickel, Copper	Exploration	Continuing	27-hole ongoing
Barbrook	Caledonia Mining Corp.	Copper	Producer	Extension	Drilling ongoing
Blue Gum	Etruscan Resources Ltd.	Diamond	Feasibility	Extension	Bulk sampling planned
Blue Ridge	Cluff Mining plc	PGMs, Gold	Developing	Extension	To develop
Bonte Koe	Firestone Diamonds plc.	Diamond	Developing	Extension	Production planned
Bosele	Dwyka Diamonds Limited	Diamond	Exploration	New	Drilling completed
Bosele	Dwyka Diamonds Limited	Diamond	Exploration	New	464 m program completed
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	15,221 m to date
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Drilling ongoing

Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	Resource estimate
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	37,629 m + 34,164 m
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	120,000 m in 24 months
Burnstone	Great Basin Gold Ltd.	Gold	Feasibility	Extension	84,715 m in 2004
De Wildt	Nkwe Platinum Limited	PGMs, Gold	Exploration	Continuing	Sampling, drilling ongoing
De Wildt	Nkwe Platinum Limited	PGMs	Exploration	Continuing	Resource estimate
Drenthe/Overysel	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	Drilling ongoing
Drenthe/Overysel	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	16,000 m drilling ongoing
Drenthe/Overysel	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	6,000 m + 10,000 m planned
Drenthe/Overysel	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	Resource estimate
Drenthe/Overysel	Anooraq Resources Corp.	PGM, Gold, Nickel	Exploration	Continuing	35,950 m in 2004

Drenthe/Witrivier/Overysel	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	88 holes, 16,662 m to date
Drenthe/Witrivier (Boikgantsho)	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	Resource estimate
Drenthe	Anooraq Resources Corp.	PGMs, Gold, Nickel	Exploration	Continuing	30,616 m program to date
Dullstroom	Jubilee Platinum plc.	PGMs	Exploration	New	Drilling ongoing
Eersteling/Roodepoort	Caledonia Mining Corp.	Gold	Producer	Extension	Sampling ongoing
Fountain Ridge	Ridge Mining plc.	PGMs, Gold	Exploration	New	Geophysics completed, drilling planned
FSC	AfriOre Ltd.	Gold	Exploration	Continuing	Geochemical survey, drilling
Ga-Phasha (Paschaskraaal)	Anooraq Resources Corp.	PGMs, Gold	Exploration	Continuing	Resource estimate
Ghost Mountain	Nkwe Platinum Limited	PGMs, Gold	Exploration	New	Mapping, sampling ongoing
Ghost Mountain	Nkwe Platinum Limited	PGMs, Gold	Exploration	New	Mapping, sampling ongoing

Globlersdal	Golden State Resources Limited	PGMs, Gold	Exploration	Continuing	Mapping planned
Groen River	Firestone Diamonds plc.	Diamond	Exploration	Continuing	Bulk sampling, drilling planned
Hope	SouthernEra Diamonds Inc.	Diamond	Exploration	Continuing	Drilling ongoing
Kliprivier	Eurasia Mining plc	PGMs, Gold	Exploration	Continuing	2-hole program ongoing
Leeuwkop	Southern African Resources plc.	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Mareesburg	Elgin Resources Inc.	PGMs	Feasibility	Extension	Geophysics completed, 3,300 m ongoing
Messina/Zebediela	SouthernEra Resources Ltd.	PGMs, Gold	Producer	Extension	Phase 4 drilling ongoing
Messina/Dwaalkop	SouthernEra Resources, Ltd.	PGMs, Gold	Producer	Extension	Drilling completed
Messina/Dwaalkop	SouthernEra Resources Ltd.	PGMs, Gold	Producer	Extension	25 holes to 1,000 m
Mooiplats	AIM Resources Limited	PGMs, Gold	Exploration	New	Geophysics, drilling planned

Mooiplats	AIM Resources Limited	PGMs, Gold	Exploration	New	Resource estimate
Nama	Caledonia Mining Corp.	Cobalt	Exploration	New	Sampling ongoing
North Target	Avgold Limited	Gold	Feasibility	Extension	Feasibility study ongoing
Onderstepoort	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	New	Drilling planned
Onderstepoort/Elandsfontein (5 sites)	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	New	Exploration planned
Pakwe	Petra Diamonds Ltd.	Diamond	Exploration	New	Sampling, drilling planned
President Steyn/Eldorado Massives	Thistle Mining Inc.	Gold	Producer	Extension	Resource estimate
President Steyn/Eldorado Reef	Thistle Mining Inc.	Gold	Producer	Extension	Resource estimate
Rooderand	Nkwe Platinum Limited	PGMs	Exploration	Continuing	Mapping, sampling ongoing
Rooipoort	Caledonia Mining Corp.	Platinum	Exploration	New	2,000 m program ongoing
Rooipoort	Caledonia Mining Corp.	Gold	Exploration	New	1,880 m during quarter, 6,879 m to date

Rooipoort	Caledonia Mining Corp.	Platinum	Exploration	New	Completed 23-hole program, ongoing 10-hole program
Roodepoort	Caledonia Mining Corp.	Gold	Exploration	New	Sampling, 300 m program planned
Roodepoort	Caledonia Mining Corp.	Gold	Exploration	New	3-hole program completed
Rooderand	Nkwe Platinum Limited	PGMs, Gold	Exploration	Continuing	Drilling ongoing
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Feasibility	Extension	Prefeasibility stage
Sheba's Ridge	Cluff Mining plc	PGMs, Gold	Exploration	Continuing	32,600 m to date
Smokey Hills	Platinum Australia Ltd.	PGMs, Gold	Exploration	New	3-hole program completed
South Deep	Placer Dome Inc.	Gold	Producer	Extension	Resource estimate
South Deep	Placer Dome Inc.	Gold	Producer	Extension	Resource estimate
Syferfontein	Petra Diamonds Ltd.	Diamond	Exploration	New	Sampling, drilling planned

Thusong	Anooraq Resources Corp.	PGMs, Gold	Exploration	New	Exploration planned
Tinderbox	Nkwe Platinum Limited	PGMs Gold	Exploration	Continuing	Mapping, trenching, geophysics ongoing
Tinderbox	Placer Dome Ltd.	PGMs, Gold	Exploration	Continuing	Exploration planned
Tinderbox	Nkwe Platinum Limited	PGMs, Gold	Exploration	Continuing	Ongoing mapping, geophysics, trenching.
Tirisano	Etruscan Resources Ltd.	Diamond	Feasibility	Extension	Bulk sampling, feasibility study planned
Tormin	Mineral Commodities Ltd.	Heavy minerals	Developing	Extension	Feasibility study ongoing
Tweespalk	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	Continuing	3-hole, 600 m program planned
Two Rivers	Paramount Mining Corp. Ltd.	Diamond	Exploration	New	Exploration ongoing
Unnamed	Firestone Diamonds plc.	Diamond	Exploration	New	Bulk sampling, drilling planned

Vaal River	Paramount Mining Corp. Ltd.	Diamond	Feasibility	Extension	Trial mining ongoing
Vlaklaagte/Zwartdoorns	Jubilee Platinum plc.	PGMs	Exploration	New	Completed percussion drilling
War Springs	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	Continuing	Mapping, sampling, geophysics
War Springs	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	Continuing	Drilling ongoing
War Springs	Platinum Group Metals Ltd.	PGMs, Gold	Exploration	Continuing	2,850 m to date
Wonderkop	Superior Mining Corp.	PGMs	Exploration	New	Drilling ongoing
Xolobeni	Mineral Commodities Ltd.	Heavy minerals	Feasibility	Extension	Feasibility study ongoing

12.6 Major mining investment projects in South Africa: 2000-2018

	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2000					
Gold	Target North	Harmony	Au	Operating, exp/plans	UG	
	Driefontein	Gold Fie;ds	Au	Operating, exp/plans	UG	
	Western Areas		Au	Operating, exp/plans	UG	
Copper	Palaborra	Rio Tinto	Cu	Construction	UG	
Iron Ore	Sishen	Anglo America	Fe	Operating, exp/plans	OP	

Nickel	Nkomati		Ni, Pd	Operating, exp/plans	UG	
PGMs	Bafokeng Rasimoe		Pt, Pd, Rh	Operating, exp/plans	OP+UG	
	Amandelbult Sec		Pt, Pd, Rh	Operating, exp/plans	UG	
	Atok		Pt, Pd	Operating, exp/plans	UG	
	Crocodile River		Pt, Pd, Rh	Operating, exp/plans	OP	
	Dwarsriviet		Cr, PGM	Construction	OP	
	Kroondal		Pt, Pd	Operating, exp/plans	OP+UG	
	Lebowa		Pt, Pd	Feasibility	UG	
	Maandagshoek		Pt, Pd	Construction	UG	
	Marikana		Pt, Pd	Construction	UG	
	Messina		Pt, Pd, Rh	Feasibility	OP+UG	

	Potgieterdrus		Pt, Pd, Rh	Operating, exp/plans	OP	
	Winnaarshoek		Pt	Operating, exp/plans	UG	
	Waterval		Pt	Operating, exp/plans	UG	
	Wonderkop		Cr	Operating, exp/plans	UG	
Silver						
Diamonds	Kimberley	De Beers, Ponahalo	Di	Operating, exp/plans	UG	
	Kimberley Tailing		Di	Operating, exp/plans	OP	
	Klipspringer		Di	Operating, exp/plans	UG	
	Braken		Di	Operating, exp/plans	UG	
Uranium						

Zinc/Lead	Gamsberg	Anglo America	Zn, Pb	Feasibility	OP	
	Aggeneys		Pb, Zn, Ag	Operating, exp/plans	UG	
Manganese	Nchwaning		Mn	Operating, exp/plans	UG	
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2001					
Gold	Driefontein	Gold Fie;ds	Au	Operating, exp/plans	OP+UG	
	Kloof Mine	Gold Fie;ds	Au	Operating, exp/plans	UG	
	Moab Khotsong	AngloGold Ashanti	Au	Operating, exp/plans	UG	
	Mponeng	AngloGold Ashanti	Au	Operating, exp/plans	UG	
	Paradise	Awgold	Au	Conceptual	UG	
	South Deep	Placer Dome	Au	Construction	UG	

	Target	Harmony	Au	Operating, exp/plans		
	Tau Tona	AngloGold Ashanti	Au	Operating, exp/plans		
	West Ultra Deep	AngloGold	Au	Construction	UG	
	Western Areas	AngloGold Ashanti	Au	Operating, exp/plans	UG	
Copper	Palabora UG	Rio Tinto	Cu	Construction	UG	
Iron Ore	Sishen	Anglo America	Fe	Operating, exp/plans	OP	
Nickel						
PGMs	Bafokeng Rasimoe		Pt, Pd, Rh	Operating, exp/plans	OP+UG	
	Bafokeng Styldrift	Anglo Platinum	Pt, Pd, Rh	Prefeasibility	UG	
	Atok		Pt, Pd	Operating, exp/plans	UG	
	Doornvlei		Pt, Pd, Rh	Prefeasibility	UG	
	Dwarsriviet		Cr, PGM	Construction	OP	

	Everest South		Pt, Pd	Prefeasibility		
	Kroondal		Pt, Pd	Operating, exp/plans	OP+UG	
	Lebowa		Pt, Pd	Feasibility	UG	
	Maandagshoek		Pt, Pd	Construction	UG	
	Marikana		Pt, Pd	Construction	UG	
	Maroelabult		Pt, Pd, Rh	Prefeasibility	OP+UG	
	Potgieterdrus		Pt, Pd, Rh	Operating, exp/plans	OP	
	Winnaarshoek		Pt	Feasibility	UG	
	Pandora		Pt, Pd	Feasibility	UG	
	Rustenburg Section	Anglo Platinum	Pt, Pd, Rh	Operating, exp/plans	UG	
	Union Section		Pt, Pd, Rh	Operating, exp/plans	UG	
	Waterval		Pt	Feasibility	UG	

	Wonderkop		Cr	Operating, exp/plans	UG	
Silver						
Diamonds	Kimberley	De Beers, Ponahalo	Di	Operating, exp/plans	UG	
	Kimberley Tailing		Di	Operating, exp/plans	UG	
	Klipspringer		Di	Operating, exp/plans	UG	
	Ventersdorp		Di	Operating, exp/plans	OP	
	Nooitgedacht		Di	Operating, exp/plans	P	
	Crown Diamond T		Di	Operating, exp/plans	OP	
Uranium						
Zinc/Lead	Gamsberg	Anglo America	Zn, Pb	Feasibility	OP	

	Aggeneys		Pb, Zn, Ag	Operating, exp/plans	UG	
Manganese	Nchwaning		Mn		UG	
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2002					
Gold	Driefontein	Gold Fie;ds	Au	Construction	OP+UG	336
	Kloof Mine	Gold Fie;ds	Au	Operating, exp/plans	UG	197
	Moab Khotsong	AngloGold	Au	Construction	UG	320
	Mponeng	AngloGold Ashanti	Au	Operating, exp/plans	UG	124
	Paradise	Awgold	Au	Conceptual	UG	224
	South Deep	Placer Dome	Au	Construction	UG	750
	West Ultra Deep	AngloGold	Au	Construction	UG	215
Copper	Palabora UG	Rio Tinto	Cu	Operating, exp/plans	UG	410

Iron Ore	Sishen South	Kumba Resources	Fe	Operating, exp/plans	OP	153
Nickel						
PGMs	Twickenham	Anglo Platinum	Pt, Pd	Conceptual	UG	343
	Marula	Implats	Pt, Pd	Construction	UG	191
	Bafokeng Styldrift	Anglo Platinum	Pt, Pd	Prefeasibility	UG	190
	Rustenburg Section	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	153
	Bafokeng Rasimoe	Anglo Platinum	Pt, Pd	Operating, exp/plans	OP+UG	120
	Two Rivers	Anglovaal	Pt, Pd	Feasibility	UG	118
Silver						
Diamonds	Premier	De Beers, Ponahalo	Di	Operating, exp/plans	UG	700
Uranium						
Zinc/Lead	Gamsberg	Anglo America	Zn, Pb	Feasibility	OP	
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**

	2003					
Gold	Driefontein	Gold Fields	Au	Operating, exp/plans	UG	271
	Moab Khotsong	AngloGold	Au	Construction	UG	478
	Paradise	Avmin	Au	Conceptual	UG	224
	South Deep	Placer Dome	Au	Operating, exp/plans	UG	750
	West Ultra Deep	AngloGold	Au	Construction	UG	215
Copper						
Iron Ore						
Nickel						
PGMs	Twickenham	Anglo Platinum	Pt, Pd	Conceptual	UG	343
	Marula	Implats	Pt, Pd	Construction	UG	191
	Bafokeng Styldrift	Anglo Platinum	Pt, Pd	Prefeasibility	UG	190
	Rustenburg Section	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	153
	Bafokeng Rasimoe	Anglo Platinum	Pt, Pd	Operating, exp/plans	OP+UG	120

	Pandora PGM	Anglo American, Lonmin, Implats	Pt, Pd	Prefeasibility	UG	150
Silver						
Diamonds	Premier	De Beers	Di	Operating, exp/plans	UG	700
	Finsch	Anglo America	Di	Operating, exp/plans	UG	208
Uranium						
Zinc/Lead	Aggeneys	Anglo America	Pb, Zn, Ag	Operating, exp/plans	UG	110
	Gamsberg	Anglo America	Zn, Pb	Feasibility	OP	860
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2004					
Gold	Driefontein	Gold Fields	Au	Operating, exp/plans	UG	271

	Kloof Mine	Gold Fie;ds	Au	Operating, exp/plans	UG	159
	West Ultra Deep	AngloGold	Au	Construction	UG	215
Copper						
Iron Ore	Sishen South	Kumba Resources	Fe	Operating, exp/plans	OP	350
Nickel						
PGMs	Twickenham	Anglo Platinum	Pt, Pd	Conceptual	UG	343
	Rustenburg UG2	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	370
	Two Rivers	Harmony, Implats	Pt, Pd	Construction	UG	118
	Everest South	Aquarius, Implats	Pt, Pd	Feasibility	OP+UG	121
	Blue Ridge PRM	Ridge Mining plc	Pt, Pd	Feasibility	UG	118
	Bafokeng Styldrift	Anglo Platinum	Pt, Pd	Prefeasibility	UG	190
	Rustenburg Section	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	153

	Bafokeng Rasimoe	Anglo Platinum	Pt, Pd	Operating, exp/plans	OP+UG	120
	Pandora PGM	Anglo American, Lonmin, Implats	Pt, Pd	Prefeasibility	UG	150
Silver						
Diamonds	Premier	De Beers	Di	Operating, exp/plans	UG	632
	Finsch	De Beers	Di	Operating, exp/plans	UG	208
Uranium						
Zinc/Lead						
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2005					
Gold	Driefontein	Gold Fields	Au	Operating, exp/plans	UG	444

	Kloof Mine	Gold Fie;ds	Au	Operating, exp/plans	UG	260
	Moab Khotsong	AngloGold	Au	Construction	UG	651
	Paradise	Harmony	Au	Conceptual	UG	221
	West Ultra Deep	AngloGold	Au	Construction	UG	215
Copper						
	Sishen South	Kumba Resources	Fe	Operating, exp/plans	OP	350
Iron Ore	Bruce, King	Assmang	Fe	Prefeasibility	OP	333
Nickel						
PGMs	Twickenham	Anglo Platinum	Pt, Pd	Prefeasibility	UG	450
	Rustenburg UG2	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	370
	Two Rivers	Harmony, Implats	Pt, Pd	Construction	UG	187
	Bafokeng Styldrift	Anglo Platinum	Pt, Pd	Prefeasibility	UG	250
	Rustenburg Section	Anglo Platinum	Pt, Pd	Operating, exp/plans	UG	202

	Mototolo	Anglo Platinum, Xstrata	Pt, Pd	Operating, exp/plans	UG	200
	Impala	Implats	Pt, Pd	Operating, exp/plans	UG	1028
	Sheba's Ridge	Ridge Mining, Anglo America	Pt, Pd	Prefeasibility	OP	691
	Leeuwkop	Southern African	Pt	Prefeasibility	UG	272
	Drenthe	Anglo Platinum, Anooraq	Pt	Conceptual	UG	153
	Waterval	Anglo Platinum		Construction	UG	151
	Pandora PGM	Anglo American, Lonmin, Implats	Pt, Pd	Feasibility	UG	440
Silver						
Diamonds	Premier	De Beers	Di	Operating, exp/plans	UG	632
	Finsch	De Beers	Di	Operating, exp/plans	UG	208
Uranium						

Zinc/Lead						
	Gamsberg	Anglo America	Zn, Pb	Feasibility	OP	860
	Project name	**Company**	**Commodity**	**Type**	**Phase[2]**	**Project Cost (US$ M)**
	2007					
Gold	Target North	Harmony		Prefeasibility	UG	785
	Mponeng (South)	Anglo gold		Operating, exp/plans	UG	252
	Ezululwini	JCI, SIS, Central Mg		Susp, restart plans	UG	250
Copper						
Iron Ore	Sishen	Anglo America		Operating, exp/plans	OP	752
	Welgevonden	Anglo America		Feasibility	OP	645

Nickel						
PGMs	Blue Ridge PGM	Zijin Mining, Imbani	Pt, Pd	Construction	UG	960
	Impala	Implats	Pt, Pd	Operating, exp/plans	UG	936
	Pogietersrus	Anglo America	Pt, Pd	Operating, exp/plans	OP	692
	Shebas Ridge	Zijin Mining, Anglo America	Pt, Pd	Prefeasibility	OP	691
	Akanani	Lonmin	Pt, Pd	Concept	UG	650
	Pilanesbrg	Wesizwe Platinum	Pt, Pd	Feasibility	UG	497
	Twickenham	Anglo America	Pt, Pd	Construction	UG	450
	Pandora	Anglo America, Lonmin, Babo Ba, Incwala	Pt, Pd	Construction		440
	Leeuwkop	Implats	Pt, Pd	Feasibility	UG	425
	Tjate PGM Mine	Jubille Platinum	Pt	Feasibility	UG	400
	Rustenburg Sect	Anglo America	Pt, Pd	Operating, exp/plans	UG	384

	Rustenburg UG2	Anglo America	Pt, Pd	Operating, exp/plans	UG	354
	WBJW Project	Anglo America, PGM Ltd, Africa Wilde	Pt, Pd	Prefeasibility	UG	2286
	Amandebult	Anglo America		Operating, exp/plans	UG	224
Silver						
Diamonds	Venetia	De Beers, Ponahalo		Operating, exp/plans	OP	922
	Cullinan	De Beers, Ponahalo		Operating, exp/plans	UG	632
Uranium	Ryst Kuil	Arewa		Conceptual	UG	368
Zinc/Lead	Gamsberg	Anglo America		Feasibility	OP	860
	2009					
Gold	Bloemhoek	Wits Gold	Gold	Conceptual	UG	1000
	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	909
	Target North	Harmony		Prefeasibility	UG	785

Copper						
Iron Ore						
Nickel						
PGMs	Bafokeng Pt	Anglo America, Royal Bafokeng	Pt, Pd	Construction	UG	1247
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Prefeasibility	OP	927
	Leeuwkop	Implats	Pt, Pd	Feasibility	UG	726
	Sedibelo	Barrick	Pt, Pd	Prefeasibility	OP	700
	Mogalakwena/Pogietersrus	Anglo America	Pt, Pd	Operating, exp/plans	OP	692
	Frischgewaad	Anglo America	Pt, Pd	Feasibility	UG	688
	Akanani	Lonmin	Pt, Pd	Conceptual	UG	650
	WBJW Project	Anglo America, PGM Ltd	Pt, Pd	Feasibility	UG	443
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	433
	Tjate PGM Mine	Jubille Platinum	Pt	Feasibility	UG	400
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	389

	Booysendal	Lonmin	Pt, Pd	Feasibility	UG	321
	Rustenburg Sect	Anglo America	Pt, Pd	Operating, exp/plans	UG	315
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/plans	OP	787
	Cullinan	Al Rajhl, Petra Diamonds		Operating, exp/plans	UG	787
Uranium	Ryst Kuil	Areva		Conceptual	UG	368
Zinc/Lead	Gamsberg	Anglo America; Exxaro		Feasibility	OP	860
	2011					
Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1148
	Bloemhoek	Wits Gold	Gold	Conceptual	UG	1037
Copper	Target North	Harmony	Gold	Prefeasibility	UG	785
Iron Ore						
Nickel						

PGMs	Bafokeng Pt	Royal Bafokeng Nation, Anglo American	Pt, Pd	Construction	UG	1782
	Garatau	Nkwe	Pt, Pd	Feasibility	UG	1134
	Afplats	Implats	Pt, Pd	Feasibility	UG	906
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	972
	Mogalakwena/Pogieter srus	Anglo America	Pt, Pd	Operating, exp/plans	OP	798
	Sedibelo West	Bakgatla	Pt, Pd	Prefeasibility	OP	700
	Frischgewaagd	JNMC, Anglo America	Pt, Pd	Construction	UG	688
	Akanani	Lonmin; Shanduka	Pt, Pd	Conceptual	UG	650
	Booysendal	Northam	Pt, Pd	Construction	UG	589
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	457
	Western Bushveld Project 1	PGM Ltd, JNMC, Anglo American		Feasibility	UG	443
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	888

	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632
Uranium						
Zinc/Lead	Gamsberg Mine	Vedanta, Exxaro Res	Zn, Pb	Feasibility	OP	860
	2012					
Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1156
	Bloemhoek	Wits Gold	Gold	Conceptual	UG	1000
Copper						
Iron Ore						
Nickel						
PGMs	Bafokeng Styldrift	Royal Bafokeng Nation, Anglo American	Pt, Pd	Construction	UG	1623
	Twickenham	Anglo America	Pt, Pd	Operating, exp plans	UG	1248
	Bakubung	JNMC, Anglo America		Construction	UG	1087
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Afplats	Implats	Pt, Pd	Feasibility	UG	741

	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Garatau	Nkwe		Feasibility	UG	659
	Akanani	Lonmin; Shanduka	Pt, Pd	Conceptual	UG	650
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	625
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	513
	Booysendal	Northam	Pt, Pd	Construction	UG	482
	Western Bushveld Project 1	PGM Ltd, JNMC, Anglo American		Feasibility	UG	443
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632
Uranium						
Zinc/Lead						
	2013					

Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1023
	Bloemhoek	Wits Gold	Gold	Conceptual	UG	1000
Copper						
Iron Ore						
Nickel						
PGMs	Bafokeng Styldrift	Royal Bafokeng Nation, Anglo American	Pt, Pd	Construction	UG	1437
	Twickenham	Anglo America	Pt, Pd	Operating, exp plans	UG	1248
	Bakubung	JNMC, Anglo America		Construction	UG	1087
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Afplats	Implats	Pt, Pd	Feasibility	UG	731
	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Akanani	Lonmin; Shanduka	Pt, Pd	Conceptual	UG	650
	Garatau	Nkwe		Feasibility	UG	659
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	625

	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	513
	Western Bushveld Project 1	PGM Ltd, JNMC, Anglo American		Construction	UG	443
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632
Zinc/Lead						
	2014					
Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1156
	Bloemhoek	Sibanye Gold	Gold	Feasibility	UG	1000
Copper						
Iron Ore						
Nickel						

PGMs	Twickenham	Anglo America	Pt, Pd	Operating, exp plans	UG	1248
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Afplats	Implats	Pt, Pd	Feasibility	UG	741
	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Garatau	Nkwe		Feasibility	UG	659
	Impala	Implats	Pt, Pd	Operating, exp/constr	UG	625
	Western Bushveld Project 1	PGM Ltd, JNMC, Anglo American		Construction	UG	443
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632
Zinc/Lead						
	2015					

Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1156
	Bloemhoek	Sibanye Gold	Gold	Feasibility	UG	1000
Copper						
Iron Ore						
Nickel						
PGMs	Twickenham	Anglo America	Pt, Pd	Operating, exp plans	UG	1248
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Garatau	Nkwe		Feasibility	UG	659
	Western Bushveld Project 1	PGM Ltd, JNMC, Anglo American		Construction	UG	443
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632

Zinc/Lead						
	2016					
Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1156
	Bloemhoek	Sibanye Gold	Gold	Feasibility	UG	1000
Copper						
Iron Ore						
Nickel						
PGMs	Waterberg	Platinum Group Metals	Pt, Pd, Au, Rh	Prefeasibility	UG	1060
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Garatau	Nkwe		Feasibility	UG	659
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	632
Zinc/Lead						

	2017					
Gold	South Deep	Gold Fields	Gold	Operating, exp/plans	UG	1156
	Bloemhoek	Sibanye Gold	Gold	Feasibility	UG	1000
Copper						
Iron Ore						
Nickel						
PGMs	Waterberg	Platinum Group Metals	Pt, Pd, Au, Rh	Prefeasibility	UG	1060
	Shebas Ridge	Aquarius, Anglo America	Pt, Pd	Feasibility	OP	927
	Sedibelo West	Palinghurst Res		Feasibility	UG	700
	Garatau	Nkwe		Feasibility	UG	659
Silver						
Diamonds	Venetia	Anglo American, Ponahalo		Operating, exp/feasib	OP	2100
	Cullinan	Petra Diamonds		Operating, exp/plans	UG	295
Zinc/Lead						