

EXAMINING THE MINING SECTOR'S CONTRIBUTIONS TO GROSS
DOMESTIC PRODUCT AND EMPLOYMENT CREATION IN THE SOUTH
AFRICAN ECONOMY

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Declaration

I declare that this research report is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other university.

Signed

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Ndansi Benard

This..... day of..... year.....

Abstract

South Africa holds an estimated value of US\$2.5 trillion of non-energy, in-situ mineral wealth, making it the world's wealthiest mineral resource-rich nation. The presence of these abundant mineral resources creates potential for sustained growth and development, such as in revenue generation, gross domestic product (GDP), employment creation, and foreign direct investment (FDI). However, the mining sector continues to face major challenges, including commodity price volatility, labour unrest, weak institutional framework, shortage of skilled labour, and other structural challenges. As a result, mining's contributions to GDP and employment creation has witnessed significant downturn over the years. For instance, its contribution to GDP dropped from 21% in 1970 to 7.3% in 2016, while employment numbers in the sector declined by 17% between 1997 and 2009. It has equally failed to benefit many South Africans, and the country continues to suffer from socio-economic challenges such as high unemployment rates, income inequalities, high levels of poverty, and slow economic growth rates. It is in line with the above views that this study was centred on examining mining's contributions to GDP and employment creation in South Africa over the period 1993 to 2015. Data was sourced from credible sources such as the Chamber of Mines of South Africa, the World Bank, and Quantec. Findings revealed that mining's contributions to the overall GDP and employment creation in the South African economy witnessed significant decline over the period under review. This can be attributed to a decline in gold sector's contribution to GDP and employment creation. Yet whilst gold mining showed a sharp decline, the study also found that the contributions of platinum group metals (PGMs), coal, and iron ore to the share of mining GDP and employment numbers increased steadily during the period under review. Efforts to improve mining's contribution to long-term growth and addressing the developmental needs of the South African economy have seen the creation of measures such as the Mining Phakisa initiative, Africa Mining Vision (AMV), National Development Plan (NDP), Mining Vision 2030 goals, robust mineral policy, and the Mining Charter.

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Whose presence would have been vital to celebrate this achievement with me.

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1 INTRODUCTION

1.1 Overview of South Africa's Mining Sector

South Africa is endowed with an abundance of diverse mineral resources, and serves as host to some of the world's largest mining companies. Mineral reserves imply the ownership of scarce resources, which constitute a major form of wealth (Hlavova, 2015). The Chamber of Mines of South Africa (2011) holds that South Africa records an estimated value of US\$2.5 trillion of non-energy in-situ mineral wealth, making it the world's wealthiest mineral resource-rich nation. Whilst gold, platinum, diamond, and coal are most popular minerals and metals mined, the country also harbours other vital minerals such as vanadium, chrome, titanium, among others (Chamber of Mines of South Africa, 2016a). According to Government Communication and Information System (GCIS) (2012), South Africa has the world's largest reported reserves of manganese ore (80%), platinum group metals (PGMs) (87.7%), gold (12.7%), diamonds (12%), and chrome ore (72.4%), and also has enormous reserves of zirconium (25%), vanadium (32%), vermiculite (40%), and titanium (65%) (Department of Mineral Resources, 2011).

Apart from its large reserves of various minerals, South Africa is the world's largest producer of PGMs, chrome, manganese, and vanadium. It supplies 8% of the world's diamonds, and is also a significant exporter of coal and other, lesser minerals and metals (Department of Mineral Resources, 2011). However, large reserves of PGMs, coal, gold, chromium, and diamonds are found several kilometres underground, thus posing a major challenge for the mining industry. According to Chamber of Mines of South Africa (2016b), large deposits of these resources remain untapped. Nevertheless, South African mines are at the forefront of extractive techniques and technological innovations (Chamber of Mines of South Africa, 2016a). The country's role in the global mining industry is quite significant, as illustrated in figure 1.1.

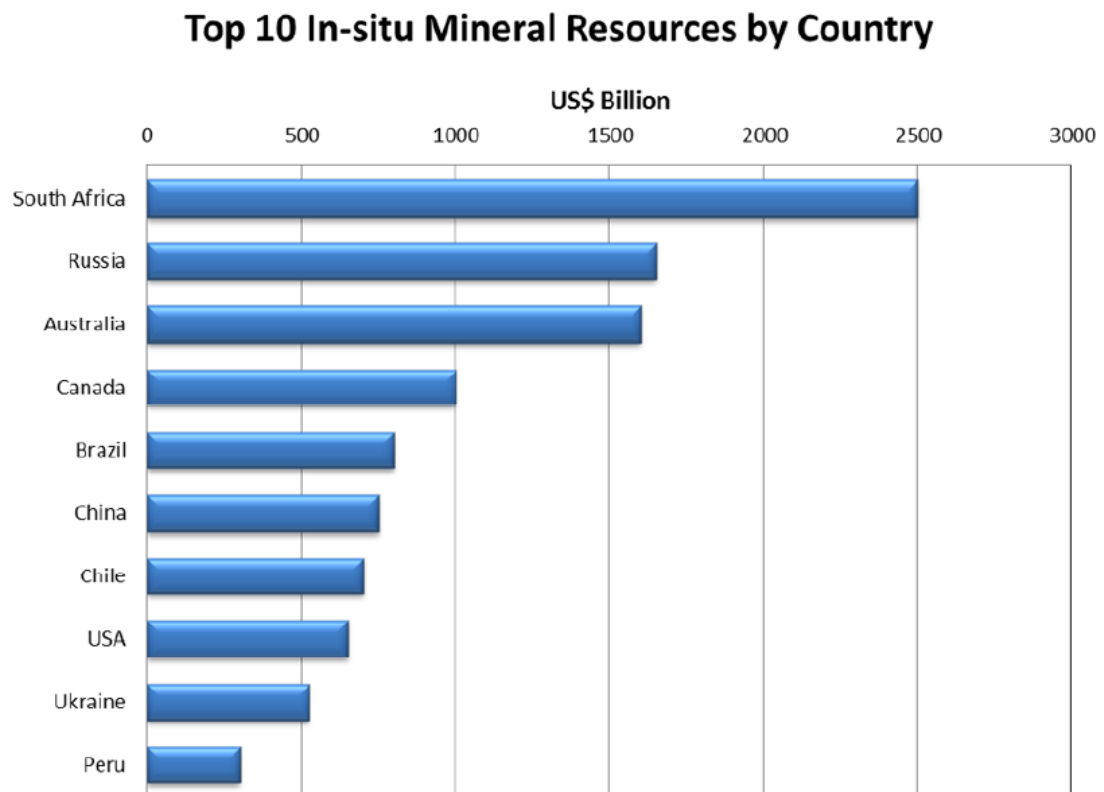


Figure 1.1: Top ten in-situ mineral resources by country

Source: Citibank in Baxter (2011)

Table 1.1: South Africa's contribution to world's mineral reserves, production, and world rankings

Commodity	Unit of measurement	South Africa's reserves	World		Location of major reserves		
			Rank	%			
Aluminium	kt	*	*	*	*	*	*
Aluminosilicates (ore)	Mt	51	1	*	*	*	*
Antimony (metal)	kt	27	5	1.5	China	Russia	Bolivia
Chromium	Mt	3,100	1	85.0	South Africa	Kazakhstan	Zimbabwe
Coal	Mt	30,156	8	3.5	United States	Russia	China
Copper	kt	11,000	11	1.6	Chile	Peru	Australia
Ferrochromium	kt	*	*	*	*	*	*
Ferro-Mn/Fe-Si-Mn	kt	*	*	*	*	*	*
Ferrosilicon	kt	*	*	*	*	*	*
Fluorspar (contained CaF ₂)	kt	41,000	3	17.1	*	*	*
Gold (metal)	t	6,000	2	11.8	Australia	South Africa	Russia
Iron Ore	Mt	650	12	0.8	Australia	Brazil	Russia
Lead (Metal)	kt	300	6	2.1	China	Australia	United States
Manganese (metal)	Mt	150	1	24.0	South Africa	Ukraine	Brazil
Nickel	Mt	3,700	7	4.9	Australia	New Caledonia	Brazil
Platinum group metals	t	63,000	1	95.5	South Africa	North America	Russia
Phosphate rock (contained concentrates)	kt	1,500,000	*	2.2	*	*	*
Silicon (metal)	kt	*	*	*	*	*	*
Silver (metal)	t	*	*	*	Peru	Poland	Chile
Titanium minerals (metals)	Mt	71	4	10.2	China	Australia	India
Uranium (metal, up to US\$ 80/kg)	t	279,100	6	5.2	Australia	Kazakhstan	Canada
Vanadium (metal)	kt	3,500	3	25.0	China	Russia	South Africa
Vermiculite	kt	14,000	1	*	*	*	*
Zinc (metal)	kt	14,000	8	3.3	China	United States	Australia
Zirconium minerals (metals)	kt	14,000	2	29.0	Australia	South Africa	Ukraine

Source: Adapted from *Chamber of Mines of South Africa (2016b)*

Figure 1.1 shows South Africa's position as a leading in-situ mineral resource nation. Russia and Australia occupy second and third positions respectively. The table clearly indicates that South Africa is exceptionally rich in mineral resources. However, understanding the role these resources play in the global economy and the national economy is vital.

Table 1.1 shows South Africa's mineral reserves, production, and world ranking. It confirms South Africa's position in terms of reserve of the world's different minerals. Worthy of note is that the lifespan of most of the minerals in the table exceed 100 years except for a few minerals: gold, iron ore, lead, titanium, and zirconium. Here is a clear indication that the country remains a key player in the global supply of mineral resources for many more years to come. The key question is how the exploitation of

these resources contributes to growth of the economy, or to the gross domestic product (GDP) of the country.

While the role played by mining varies within different economies, the mining industry in many economies remains a key player in national growth. South Africa is no exception. The presence of these mineral resources in South Africa provides enormous potential for sustained economic growth and development. Generally, areas of major contributions of mining to the economy include: foreign direct investment (FDI), revenue generation in the form of taxes and royalty, contribution to the GDP, formal and informal employment, and sales revenue from export.

However, most definitions of resource-rich nations focus on resource reliance measures rather than the stock of wealth (Elbra, 2013). According to Davis (1995), a mineral-based economy is one in which mineral resource exports account for 8% to 10% of the total GDP, and contributes to more than 40% of total exports revenue. Alternatively, the International Monetary Fund (IMF) (2007) defines mineral resource dependency as one in which mining's share of exports exceeds 25% of the respective totals, averaged over the past five years. South Africa on average records an 8.3% mining contribution to GDP and receives more than 40% of total export revenue from the mining sector. Thus, South Africa can be considered a resource-reliance economy (Elbra, 2013) in terms of the IMF definition.

Analyses of the impact of abundant reserves of mineral resources on economic performance have been undertaken for some time now (Hlavova, 2015). Early works focus on the impact of mineral resource abundance on productivity and economic growth (Sachs and Warner, 1999). Stocks of mineral wealth attract FDI in developing nations, especially in Sub-Saharan African countries. Thus, countries endowed with abundant natural resources (including South Africa) can easily diversify and grow economically faster than resource-poor countries (Mahonye and Mandishara, 2015; Wajiha, 2016).

Atkinson and Hamilton (2003) argue that mineral resources provide two main advantages to growth and development. Firstly, exploitation of natural resources can cause the economic growth rates of a country to increase in the short term. Secondly, it creates an opportunity for a sustained level of income that can be utilised in the future to accelerate economic growth and development. Doing so is achievable through many growth channels in the economy. For instance, through forward and backward linkages, mineral resources present great potentials to sustainable economic growth and development (Mahonye and Mandishara, 2015). Given the above, one would therefore expect resource-rich nations including South Africa to exploit their resources for higher growth rates, technological transfer, and poverty alleviation, as well as to increase the level of per capita welfare.

However, not all mineral resource-rich countries enjoy fast economic and developmental growth rates (Gylfason, 2001; Wajiha, 2016). Studies conducted in this area have proven that resource-poor countries have sometimes outperformed resource-rich developing nations in terms of economic growth and development, in what for the latter is generally known as the resource “curse” (Sachs and Warner, 1999; Mahonye and Mandishara, 2015; Leite and Weidmann, 1999). In contrast, some non-mineral resource-rich European nations and the Asian “Tigers” enjoy fast economic growth rates owing to their manufacturing and service sectors (Kronenberg, 2004). Moreover, rising export revenue from mineral resources can have a negative impact on other exports sectors in the economy, especially on manufacturing (Hlavova, 2015).

As such, the resource curse is the paradoxical outcome in which natural resource endowment is seen as a disadvantage to a nation (Auty, 1997; Sachs and Warner, 1995). The concept is widely applicable to Sub-Saharan African countries such as Nigeria, Chad, Angola, and the Democratic Republic of Congo. However, other middle-income and upper-income countries endowed with natural resources appear to be free from resource curse because their mineral wealth provides good infrastructure and economic growth for many in the society (Elbra, 2013).

1.2 A Brief History of South Africa's Mining Industry

South Africa's mining history dates back to the 19th century, when the first diamonds were discovered in Kimberley in the 1860s (Curtis, 2009). Two decades later came the discovery of huge gold reserve on a Transvaal farm called Langlaagte on the Witwatersrand in 1886, precipitating a gold rush into the area by foreigners (Sperotto, 2015). In the early days, ownership of diamond and gold mines were concentrated in the hands of a few entrepreneurs called "Randlords" (Curtis, 2009). The two common types of mining techniques used for mineral extraction in South Africa were (and continue to be) underground and surface mining (open cast mining). The choice of technique depends on the deposit's geology. About 75% of South Africa's mining operations use underground mining technique due to the deep nature of the deposits (Curtis, 2009).

The mining industry dominated by the gold and diamond sectors expanded throughout the 20th century. Revenues raised were used for economic diversification. South Africa's manufacturing base, educational institutions, roads, and railway networks were developed. The birth of the University of the Witwatersrand and the University of Pretoria in 1922 and 1930 respectively owe their origin to the South African School of Mines which was founded in Kimberly in 1896, thanks to the discovery of diamonds in that area (Sperotto, 2015). With high mineral prices in the 1970s and early 1980s, South Africa continued to be viewed by Western powers such as the United States of America and the United Kingdom as important for its commerce, post-war economic development, and militaries (Curtis, 2009). As such, London and Washington backed the apartheid government by protecting them from full international sanctions and censure (Curtis, 2009).

In 1994, the year that marked the end of the apartheid rule, mining activity was still concentrated in the hands of a small group of companies, controlled by whites. For instance, Anglo American controlled a significant 43% of the Johannesburg Stock Exchange (JSE) (Elbra, 2013). Through a complex web of cross holdings, the top five group of companies controlled 84% of the JSE (Elbra, 2013). However, the desire to

re-direct the benefits from the mining sector to the broader population precipitated the need for major developmental and policy changes in the mining sector, leading to the release of a White Paper in 1998 titled A Minerals and Mining Policy for South Africa. The paper earmarked the basis for major mining legislation, the Mineral and Petroleum Resources Development Act (MPRDA), which was passed in October 2002 and came into effect in 2004. The Act recognises state's ownership over all minerals in the nation, and is the main piece of legislation governing all stages of mining and petroleum production processes in South Africa (Department of Mineral Resources, 2011). While promoting economic and social development through mineral resource exploitation, the Department of Mineral Resources ensures sustainability of mineral and petroleum resources within a framework of national environmental policy, norms, and standards.

The introduction of the MPRDA brought significant changes into the mining industry, and benefits from the mining sector were re-directed to the broader population. Such changes included the implementation of a Broad-Based Black Economic Empowerment (BBBEE) Act, and its associated schemes (Sorensen, 2011). This Act saw the creation of a scorecard in 2003, which is aimed at compelling large companies and encouraging medium- and small-sized business to include more black South Africans in management positions. The Act called for a 26% ownership of mining assets and 51% ownership of mining projects by “historically disadvantaged South Africans” (HDSAs) by the year 2014 (Curtis, 2009). The Act also stipulates that, by the year 2009, 40% of mining managers should be HDSA and 10% women. The BBBEE scorecard has produced mixed results. Over the last three decades, there exists no simple way of describing government policies in the mining sector (Cawood & Oshokoya, 2013b). However, efforts put in place to increase the role of HDSAs in the mining sector are yielding positive results. According to the South African Chamber of Mines report (2017c), the percentage of HDSAs occupying management positions in the mining sector in 2016 stood at 49.3% at the top management level, 48.3% at senior management level, 49.8% at the middle management level, and 58% at the junior

management level. In that same year, 39% of the mining industry was owned by HDSAs which was far above the 2010 mining charter's target of 26%.

Despite South Africa's industrialised state, the economy still relies heavily on its mining sector for growth (Ebra, 2013). Yet the question as to whether the riches from this sector translate to the majority of the population remains vital, especially as South Africa continues to experience outcomes similar to symptoms of the resource curse. For instance, South Africa recorded an average growth rate of 3.26% compared to the 4.72% in Sub-Saharan African states and 4.18% in middle-income countries (World Bank, 2013; Elbra, 2013). The question thus remains: what major challenges affect the country's ability to optimise benefit from this sector?

1.2.1 Challenges Facing the South African Mining Sector

Although South Africa enjoys a comparative advantage in mineral resource abundance, the mining industry faces numerous challenges (technical, social, and operational) that may hinder the smooth translation of this comparative advantage into a competitive advantage (Neingo and Tholana, 2016). The growing concern from the government, investors, and the mining communities for safety, environmental protection, and corporate social responsibility have impacted negatively on productivity and profitability. For instance, the Department of Mineral Resources have, in terms of Section 54 of the Mine Health and Safety Act, No. 29 of 1996, imposed many safety-related measures that negatively affect mining productivity (Department of Mineral Resources, 2007). Particularly, the desire to reduce the impact of mining activities on the environment places pressure on mines to develop technologies capable of maximising water and energy efficiency, thereby ensuring environmental integrity.

Other major challenges faced by the mining industry include commodity price volatility, labour unrest, weak institutional framework, increase in electricity and labour costs, the 2007/2008 global financial crisis, the shooting of some 34 mineworkers in Marikana by police officers in 2012, and a persistent call for mine nationalisation by politicians as a solution to the high rates of inequality, unemployment, and poverty (Cawood and Oshokoya, 2013a). Moreover, high

commodity price volatility, especially during low commodity prices, compels South African mining companies to seek new, advanced, and more technically cost-effective ways of improving output that often compromise health and safety measures.

Although mining remains important to the South African economy, the pace of mineral exploitation has declined significantly over the years. The mineral base has become depleted. Deep mines are technically complex to exploit, and their economic value diminishes as the depth increases because of safety considerations. Gold, which used to be a key driver of the economy, has witnessed a consistent decline. According to the Chamber of Mines of South Africa (2016a), many of South Africa's resources are characterised by deep-level aging underground mines, with travel times to the face reaching above one hour. For instance, some 160Mt of high grade ore is reported to be locked in underground support pillars (Chamber of Mines of South Africa, 2016b). The report further stipulates that about 400Mt of South Africa's gold ore resource is endowed with a low grade. These factors negatively affect productivity, accelerate production costs, create health and safety risks, and could cause premature mine closure. According to Curtis (2009), gold production in 2006 was at its lowest level of 275t since 1922. Exploration and extraction of these resources to benefit the economy require advanced technology, highly skilled labour, and sound institutional framework.

South Africa also faces serious competition in terms of attracting FDI in the minerals sector. Frequent changes in mining legislation for mine operating licences and the introduction of stricter health and safety measures are limiting factors in attracting investment in the mining industry. Moreover, most of South Africa's minerals are exported as raw ores, or partially processed, due to low level of beneficiation. There seems to be significant loss in export revenue and employment creation due to low-level beneficiation activity. Thus, there is an urgent need for policy makers to engage in proper analysis and make informed decisions.

1.3 Problem Statement

Although the mining industry has made major contributions to the South African economy for over a century, the pace of mineral resource exploitation has declined

significantly over the past few years. The minerals base of South Africa is said to have depleted (Curtis, 2009). This is evident in the fact that two decades ago, mining contributed to 12% of South Africa's GDP, but has dropped to a low of 7.3% in 2016 (Chamber of Mines of South Africa, 2016b). Moreover, gold, which traditionally has been a great contributor to the economy, has contracted from its production peak of 1000t in 1970 to 275t in 2006 (Curtis, 2009; Chamber of Mines of South Africa, 2016b). South Africa's annual growth rate in the mining sector between 2007 and 2011 was just 0.47% (Chamber of Mines of South Africa, 2016b; KPMG, 2013; Trading Economics, 2016), while employment in the mining sector has dropped to 17% between 1997 and 2009, and more since then owing to rising costs of production and automation.

Although KPMG (2013) states that the mining sector has been the locomotive of South Africa's economic growth for nearly 150 years, both absolute and relative contributions of this sector to economic growth have witnessed significant downturn over the past decades. This decrease may have a significant impact on economic growth in South Africa. Coupled with the above challenges facing the mining sector, and given the central role mining plays in contributing to economic growth in South Africa, a study examining mining's contributions to the economy is significant.

1.4 Significance of the Study

Apart from South Africa's significant role in the global mining industry, the mining sector has also played a key role in the national economy. For many years, mining is believed to have been the backbone of South Africa's economy despite the country's industrialised nature. Mining precipitated the establishment of the first stock exchange market in Africa in 1881 (Kane-Berman, 2017), and the discovery of diamonds led to the establishment of two South African state universities: Witwatersrand and Pretoria universities (Sperotto, 2015). Throughout the colonial, apartheid, and post-apartheid eras, the economy has relied heavily on the mining industry for growth and development (Elbra, 2013). In turn, mining has impacted greatly on the social, political, and economic landscape of South Africa.

There exist many active mines in the country, most with long lifespans. According to Curtis (2009), South Africa has produced over 53 different minerals from 1212 mines and quarries: 47 mines produced gold, 89 produced coal, 33 produced PGMs and 240 produced diamonds. In fact, South Africa's mining sector is ranked fifth in terms of its global contributions to the economy (Antin, 2013; Brand South Africa, 2012; GCIS, 2012). Through forward and backward linkages, mineral resource exploitation presents great potential in contributing to sustainable economic growth and development, poverty reduction, job creation, foreign exchange earnings, and income to the government in the form of taxes and royalties (Mahonye and Mandishara, 2015; Chamber of Mines of South Africa, 2016a). The mining sector has also played a vital role in attracting FDI and creating leading global enterprises in the country. In fact, FDI in the mining sector has developed into a major source of development finance, thus accelerating economic growth (Olawumi, 2016). The different industries that make use of mining products include manufacturing, energy, engineering, water, chemical, financial, and construction services.

The mining sector is thus one of the most critically observed economic sectors in South Africa. As stipulated in Brand South Africa's report (2012), mining contributes 8.6% directly and 10% indirectly to South Africa's GDP, 20% of total investment in the economy, and over 50% of foreign exchange earnings. Trading Economics (2016) holds that mining and quarrying contributed to around 8.3% of South Africa's GDP in 2016. In a statement emphasising the importance of mining in the South African economy in terms of job creation issued by the Chamber of Mines Chief Economist, Langenhoven writes,

“The urgency of needing to do everything possible to secure the recovery of the sector is apparent. About 460,000 people are directly dependent on employment in the sector. However, when the indirect and induced employment in supplier sectors as well as the dependency ratios are taken into account, nearly 10

million people are in some way or the other influenced by the success or failure of the sector.” (Chamber of Mines of South Africa, 2017b:p3)

This study therefore contributes to our broad understanding of the role of mining in the South African economy.

Although many studies have been carried out on the role of mining in developing economies, none of these studies deals specifically with the experience of South Africa (Elbra, 2013). Moreover, South Africa does not even appear in the studies of countries that have escaped the resource curse, such as Botswana. Though South Africa’s GDP per capita is comparable with other middle-income countries, it has experienced slower growth in the past decades (Elbra, 2013). The negative social, economic, and political effects of resource abundance identified in the literature such as corruption, a loss of natural capital, dissatisfaction in the mining community, mine-related violence, and high unemployment are prevalent in South Africa (Elbra, 2013).

In terms of relevant academic work, there is limited research work on South Africa available in the public domain with respect to this topic. Although many studies have been conducted to analyse the impact of mineral resource endowment on economic growth in developing countries, there seem to be limited studies that examine the contributions of South Africa’s mining sector to economic growth over the period 1993 to 2015. This study will therefore contribute enormously to the broad understanding of the contributions of South Africa’s mining sector to economic growth over time. The outcome of the study will assist policy-makers in formulating robust growth, trade, and investment policies in South Africa.

1.5 Research Objective

Given the abovementioned challenges facing South Africa’s mining industry, and because of significance of the mining sector to the national economy, this study seeks to examine the contribution trends of the South African mining sector to GDP and employment generation over the period 1993 to 2015.

Other objectives of this study include:

- to examine contributions of the mining sector to GDP growth and employment creation in South Africa over the period under review;
- to identify the major cause(s) of the decline in mining's contributions to the GDP and employment creation in South Africa over the period under review;
- to look at South Africa's developmental initiatives in the mining sector; and
- To suggest ways to improve mining's contributions to the South African economy.

1.6. Research Questions

To achieve the abovementioned objectives of this study, the following research questions must be answered:

- What role does the South African mining sector play in terms of its contributions to GDP growth and employment creation over the period 1993 to 2015?
- What are the major causes of the decline in mining's contributions to GDP and employment creation in South Africa over the period under review?
- What are South Africa's developmental initiatives in the mining sector?
- What measures can be put in place to enhance mining's contributions to growth and development in South Africa?

1.6 Limitations of the Study

Because data was accessed from many different sources, there may be a loss in consistency. Moreover, although aggregate data was readily available on the South African mining industry, more detailed data for certain principal sectors was difficult to obtain. For instance, data on the informal mining sector's contribution to employment was not available. This lack of information meant that our analysis would focus on formal employment in the economy only, which may not give a complete picture of mining's contributions to employment generation, as the informal mining sector also contributes.

Time constraints meant limited time allocated for further literature review and data analysis. As such, the study only focused on examining mining's contributions to GDP and employment creation in the economy. The mining sector's contributions to revenue generation through taxes, royalties, foreign earnings, FDI, and environmental effects have not been examined in this report, even though these are significant areas in the economy.

1.7 Structure of the Research

Chapter two covers reviewed literature on the role of the mining industry in general and in the South African economy in particular. Chapter three deals with policy and developmental measures in the mining sector. We examine South Africa's minerals policy, the Mining Charter, and discuss developmental initiatives in the mining sector such as the adoption of the National Development Plan (NDP), which is in line with the new developmental growth strategy called the New Growth Path (NGP) that puts mining as key to achieving its objective, the Mining Phakisa initiative, Mining Vision 2030 development goals, and African Mining Vision (AMV). In chapter four, we examine data on mining sector's contributions trends to value added towards GDP and employment generation in the South African economy over the period 1993 to 2015. Chapter five presents the findings and suggests possible measures to improve on mining's contributions to the South African economy. We then end with chapter six, which offers our conclusions and recommendations.

2 THE ROLE OF MINING

2.1 The Role of Mining in National Economies

Mining has greatly contributed to economic growth and development of many countries' economies. Mineral resource exploitation is believed to have transformed many agriculturally based economies into industrialised nations. According to the Inter-Governmental Forum's (IGF) report (2010) on minerals, metals, mining, and sustainable development, economies that launched the industrial age were major mining economies. Some of these economies, such as Canada, the United States of America, and China, still play a key role in the global mining industry today. In fact, mining generates the much-needed revenue and raw materials required for industrial development (International Council on Mining and Metals (ICMM), 2014). Figure 2.1 summarises mining's contributions at the macro level to national economies.

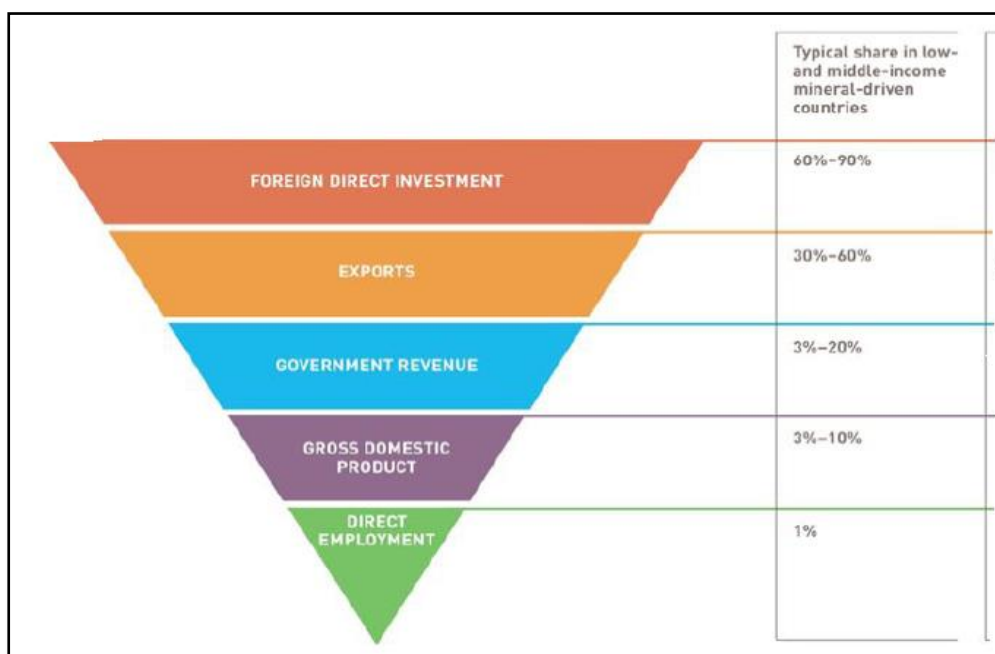


Figure 2.1: Macro-level contributions of mining in each major area in national economies

Source: Adapted from the ICMM (2014) report

Figure 2.1 depicts macro-level contributions of mining in each key area in national economies. The percentages signify the range of stand-alone contributions in each area. The different areas in which the mining sector contributes to national economies include: FDI, mineral exports, government revenue, GDP, and employment. The figure indicates that mining's share in FDI, particularly in low- and medium-income economies, ranges between 60% and 90%. Although ICMM (2017) argues that countries can always attract mining investment even if FDI into other sectors is unattractive, FDI in mining is highly sensitive to changes in the institutional and economic environment. Three quarters of low- and middle-income countries, as demonstrated above, receive between 30% and 60% of their merchandise export from the mining sector. Mining's contribution to government revenue across countries varies between 3% and 20%.

Royalty and tax payment represent the most important contributions to the government. Mining's contribution to GDP is in both direct and indirect forms. However, figure 2.1 shows that mining's direct contributions to the GDP only ranges between 3% and 10% of the national totals. Mining's contribution to direct employment levels is also often small, between 1% and 5%, which might be because of the modern-day capital intensive method in almost all mining counties.

However, mining's contribution to the global economy has grown significantly. Growth in mineral production value has outstripped growth in world's gross domestic production, as illustrated in figure 2.2.

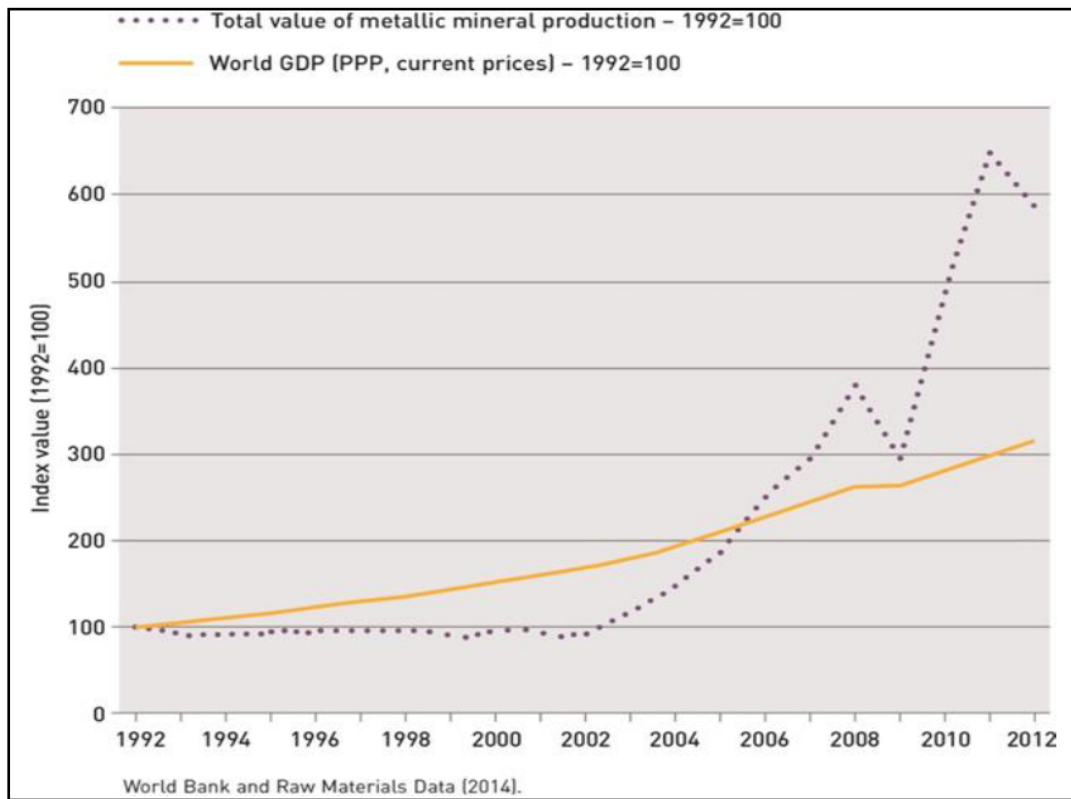


Figure 2.2: Shows the gross value of metallic mineral production and the world's gross domestic production from 1992-2012

Source: Adapted from the ICMM (2014) report

As shown in figure 2.2, growth in mineral production value outweighs growth in the world's gross domestic production, indicating the growing relative significance of mining in the global economy. This growth owes to the unprecedented increase in demand for metals and minerals in emerging economies such as China and India (ICMM, 2014).

As indicated above, many low- and middle-income economies heavily depend on the mining sector for growth and development. Mining generates the much-required capital to develop other key sectors of the economy, thus helping to address the problems of unemployment, poverty, and inequality. This dependence has consistently increased over the years despite the great turmoil in the international commodity market (ICMM, 2012). There is thus urgent need for the governments to put in place workable

frameworks that will protect their economies from vulnerability to the commodity cycle.

Moreover, although mining serves as an instrument for sustained economic growth and development, there exists no universal standard through which mining activities can be held accountable. The contribution of mining activities to national economies to a great extent is dependent on the aspirations and capabilities of different stakeholders in the various economies. As such, mining's contribution to government revenues in low- and middle-income economies is often volatile and varies significantly. Contributions range between 2% to 20% of total revenue, and is often considered to be neither well documented nor fully understood (Fernandes, 2014). The need to underscore the strategic role of mining to economic growth is therefore significant.

2.2 What is Economic Growth?

The term “economic growth” is defined by different scholars in different ways. For instance, Business Dictionary (n.d.) defines economic growth as the “increase in a country's productive capacity, as measured by comparing gross national product in a year with the gross national product in the previous year”. Economic growth is considered as one of the most watched economic indicators in an economy. Increase in economic growth is triggered by an increase in capital stock and improvements in technology and the quality of the literacy levels in a country (Business Dictionary, n.d). However, the best way to measure economic growth is by the use of the GDP.

According to Mohr et al. (2008), GDP measures the total value of all final goods and services produced within the national boundaries of a nation in a particular period, usually one year. The GDP of a country is regarded as one of the most important tools used in the measurement of the performance of the economy. An increase in real GDP implies economic growth in the economy. As one of the strategic sectors in the South African economy, the mining sector significantly contributes to value added towards the GDP. Therefore, a change in mining's contribution to GDP affects the level of economic growth in the economy as a whole.

2.3 Related Studies on Mining's Contributions to Growth

Studies on the role of natural resources on economic growth have dominated the field of mineral economics. The role played by the mining industry in most economies by setting up broad-based economic growth and development cannot be seen in isolation. In an attempt to explore the relationship between mineral resource endowment and economic growth, researchers have carried out many studies to establish the link between the two concepts (Auty, 1997; Sachs and Warner, 1995; Gylfason, 2001). However, these analyses have taken several routes (Raymond, 1997; Hlavova, 2015), with different theoretical approaches.

According to Rosser (2006), countries rich in mineral and oil resources are more likely to experience poor economic, social, and political outcomes. Rosser (2006) further asserts that countries rich in minerals or oil are likely to experience some or all of the associated outcomes of resource curse. However, Davis (1995) argues that the resource curse phenomenon may be an exception rather than a rule. In a subsequent study by Eggert (2001), it is argued that the resource curse is not deterministic. The study further holds that this phenomenon largely depends on how resources are managed in every country. Because the resource curse is associated with poor quality institutions, if robust institutions are put in place, then the phenomenon ceases to exist (Butkiewicz and Yanikkaya, 2010; Eggert, 2001).

Wajiha (2016) analysed the correlation between mineral resource abundance and economic growth in Pakistan using time series data and a semi-log linear model as the estimation technique. Findings show a negative relationship between mineral resource abundance and economic growth. A similar study was carried out in Ghana by Adu (2011), in which nine variables were used as proxy for resource abundance. The study found that the resource curse is not applicable in Ghana.

Looking at the relationship between mineral resource abundance and economic growth, Sachs and Warner (2001) carried out a study on 95 developing economies with annual growth data from 1970 to 1990. A cross-sectional growth regression model found that a higher share of primary exports negatively affects growth. According to Ploeg (2011),

the negative relationship between these variables is severe in a situation in which the country suffers from low quality institutions, high income inequality, high levels of corruption, and weak law enforcement.

However, the issue of the resource curse cannot be generalised. For instance, countries such as Indonesia with abundant resources have been successful due to sound policies and robust institutions (Rosser, 2004). Resource-rich developing countries with good policy frameworks may enjoy fast economic growth rates (Asanuma, 2008; Shaxson, 2005). Konte (2013) in his study pointed out that democracy plays a pivotal role in determining the effect of natural resources on economic growth. He further holds that a certain level of democracy is required in the economy for mineral resources to enhance economic growth. A subsequent study by Saylor (2014b) seconded the view that quality political institutions play significant role, but the author went further to say that the relationship between the ruling elites and exporters and the ability of exporters to gain access to credit play significant role.

However, despite the major contributions of mining to economic growth and development, mining activities may often pose serious consequences to the environment and its people. Kane-Berman (2017) argues that mining is believed to be one of the most hazardous peace time occupations. His report further confirms that more than 1549 miners perished in China's coal mine in 1942 as a result of an accidental fire. South Africa experienced its worst mining disaster when 437 miners perished in 1960 at the Coalbrook colliery in a massive ground collapse (Kane-Berman, 2017). Moreover, the use of arable land for mining deprives the people of this necessary resource. Mining also often leads to negative social and environmental effects, such as soil, air, and water pollution; conflicts; rent-seeking behaviours; corruption; and the fact that the community may be compelled to vacate their arable land to be used for mining activities.

2.4 Role of Mining in the South African Economy

South Africa remains one of the world's most significant mining destinations in terms of quantity and variety of mineral products produced (Technology Innovation Agency

(TIA), 2012). It harbours the world's largest reserves of PGMs, gold, and coal, and is ranked first in the production of PGMs, manganese, vanadium, and chrome (Statistics South Africa, 2015a). South Africa's rich endowment of mineral resources has played a vital role in the evolution of the economy. According to the TIA report (2012), economic growth in South Africa will continue to be closely linked to the proceeds from the mining sector. However, as indicated above, there has been a noticeable decline in mining's contributions to the country's GDP over the years. To repeat, according to KPMG (2013), both absolute and relative contributions of the mining sector to South Africa's economic growth have witnessed significant decline over the past decades. For instance, mining's contribution to GDP growth over the years has dropped from 21% in 1970 to 7.3% in 2016 (Chamber of Mines of South Africa, 2016b).

Nonetheless, according to Statistics South Africa (2015b), the mining sector remains a key contributor to growth and development in the economy. Areas of significant contribution include GDP, foreign exchange earnings, taxes and royalties, employment or human resource development, and research and development. As such, efforts to enhance mining's contributions to the South African economy have been put in place. The Mining, Industry, Growth, Development, and Employment Task Team that was established at the peak of the global financial crises in 2008 was committed to achieving two vital goals: 1) to save jobs and help the mining sector manage the negative effects of the global economic crisis, and 2) to put the mining sector at the forefront of growth and transformation in the medium and long term. Other policies aimed at targeting growth in the industry include: the Industrial Policy Action Plan (IPAP) and the National Industrial Policy Framework (NIPF). The remainder of this section explores the contributions of South Africa's mining sector to the national economy.

2.4.1 Mining's Contribution to Real National Output (GDP)

As stipulated by the ICMM (2014), the GDP contribution of the mining sector is the total net income generated by the sector. For many decades, the South African mining

industry has traditionally played a key role in the generation of real output to the economy. However, mining's contribution to GDP has experienced a significant downturn over the years. For instance, contribution of the mining sector to the private sector's GDP has declined from a high of 21.3% in 1970 down to 9.9% in 1998 (Johannes and Farah, 2000). According to Statistics South Africa (2015a), the South African mining sector was the second-most influential industry after manufacturing in 1980, with a contribution of 21% to the GDP. It has dropped to sixth place with a contribution of just 7.3% to GDP in 2016 (Chamber of Mines of South Africa, 2016b). The agricultural sector also experienced a decline from seventh position to tenth place during the same period, contributing just 2% to the GDP in 2016 (Statistics South Africa, 2015c). At the same time, there has been a rise of other potential sectors of the economy, such as the secondary and the tertiary sectors.

Mining's contribution to the GDP depends on the gross value added by the principal mining sectors in South Africa – PGMs, gold, coal, iron ore and other lesser minerals (Statistics South Africa, 2015a). According to Statistics South Africa (2015c), the major cause of this decline in mining contribution to GDP can be attributed to lack of investment and the impact of the cut in production capacity during the economic crises in 2007/2008. The effects of safety stoppages are equally responsible for this decline. However, iron ore production has showed an increase, as seen in the Sishen expansion project (Statistics South Africa, 2015a). Despite significant interest in coal production, its production has remained stable over the years.

2.4.2 Output of Principal Mining Sectors in South Africa

2.4.2.1 Gold production

South Africa is currently losing its position in the global gold mining industry (Neingo and Tholana, 2016). For instance, in January 1980, the gold production index was 359.0. By January 2015, it had dropped to 48.4 (Statistics South Africa, 2015c), which implies that South Africa produced 87% less gold in January 2015 compared to the same month in 1980. The gold sector has thus lost the prominent position it once had in the South African economy (Neingo and Tholana, 2016; Statistics South Africa,

2015c). Figure 2.3 shows gold production in metric tons and the number of employees in the gold sector from 2007 to 2016.

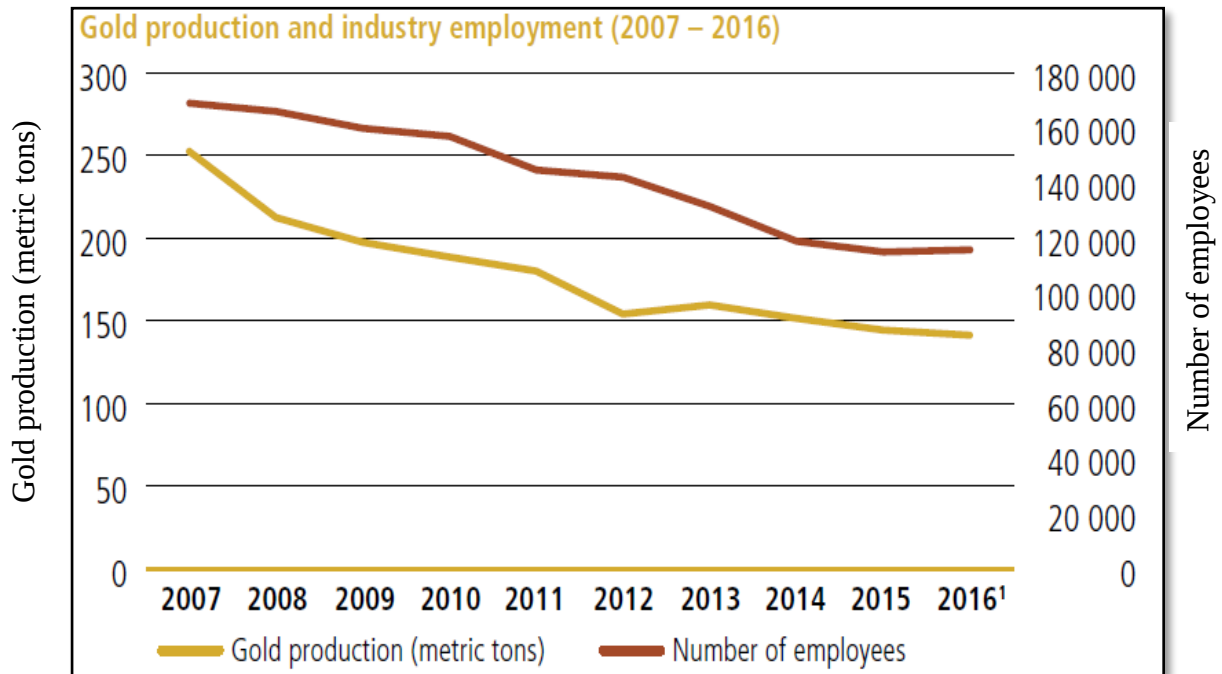


Figure 2.3: Gold production in metric tons and the number of employees in the gold sector from 2007 to 2016

Source: Adapted from Chamber of Mines of South Africa (2016b)

The decrease in gold production over the years as demonstrated in figure 2.3 has negatively impacted on gold’s contributions to output and employment in the South African economy. For instance, gold’s contribution to South Africa’s GDP was 3.8% in 1993 and dropped to 1.7% in 2013 (Statistics South Africa, 2015b). Gold’s contributions to all minerals sales in South Africa decreased from 67% in 1980 to 12.5% in 2014 (Statistics South Africa, 2015a). This decline in gold’s contribution to mining’s share of the GDP has slowed down growth in the economy, and may be attributed to the fact that this sector has been faced with major challenges ranging from technical, social and economic, to operational challenges. Some of these issues are unique to the country.

2.4.2.2 Platinum production

The first platinum nuggets were discovered in the Bushveld igneous complex in 1924 (Chamber of Mines of South Africa, 2016a). South Africa is a host of more than half of the world's PGMs and other related minerals such as chromium, nickel, vanadium, and refractory minerals. In fact, about 87.7% of the world's known platinum reserve is found in South Africa (Department of Mineral Resources, 2011). As such, PGMs have contributed significantly to the economy. According to the Chamber of Mines of South Africa (2016b), a total of 275.5Mt of platinum was produced in 2016, which accounted for 88% of metals exported, with total sales of R94.14 billion. In 2016, 172,369 people were directly employed in this sector, and+ R0.72 billion was paid as royalties. Figure 2.4 shows platinum production in metric tons and the number of employees in the platinum sector from 2004 to 2015.

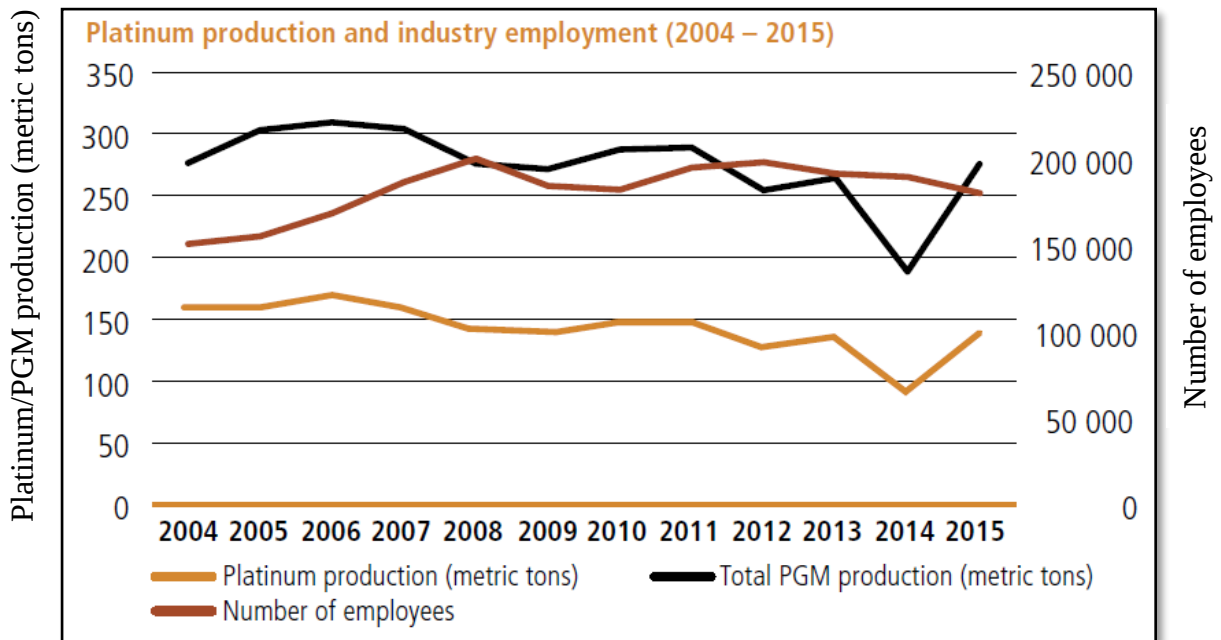


Figure 2.4: Platinum production in metric tons and the number of employees in the platinum sector from 2004 to 2015

Source: Adapted from Chamber of Mines of South Africa (2016b)

Figure 2.4 shows that PGMs and platinum production were at their highest level of production in 2006, and employment numbers were at their highest levels in 2008 and 2012. Platinum production and total PGMs production were at their lowest levels in the year 2014. The years after 2014 showed sharp increase in both platinum and PGMs production while employment numbers in this industry showed a downward trend. These factors have significant effects on the GDP and employment generation in the economy.

2.4.2.3. Coal production

According to the Department of Mineral Resources (2011), the country has about 7.4% of the world's coal reserves, and supplies a total of 3.5% of the world's annual total output (Chamber of Mines of South Africa, 2016b). Coal is one of the minerals mined solely for domestic use, and most of South Africa's coal is used for industrial purposes, principally for electricity generation. Coal plays a key role in South Africa's energy sector, with 81% of ESKOM's energy generated from coal (Chamber of Mines of South Africa, 2016a). Figure 2.5 shows coal production in metric tons and number of employees from 2004 to 2016.

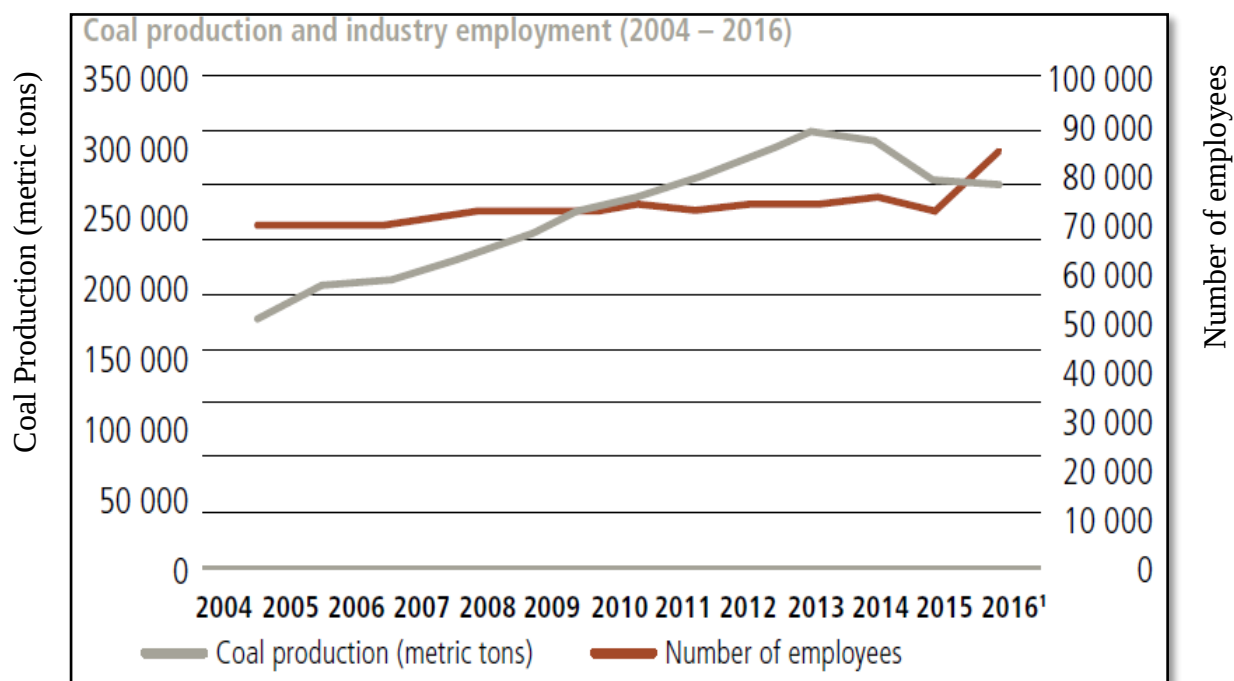


Figure 2.5: Coal production in metric tons and number of employees from 2004 to 2016

Source: Chamber of Mines of South Africa (2016b)

Figure 2.5 depicts that both the production of coal and the number of employees in this sector over the years from 2004 to 2016. Coal production peaked production in 2013 and employment was relatively stable. Production began to fall after 2013, while employment numbers showed a sharp increase after 2015. According to the Chamber of Mines of South Africa (2016a), the coal sector's contributions to global export stands at 6%, thus ranking South Africa as the sixth-highest coal-exporting country in the world.

2.4.2.3 Diamond production

Diamond production has taken place for over 50 years in South Africa. The main sources are the kimberlites in ancient volcanic pipes. As stipulated in the Chamber of Mines of South Africa's report (2016b), a total of 8.2m carats of diamond was produced, with a total of 40.3% recorded as export in 2016. The report further holds that the sales record in that year stood at R14.4 billion. In addition, 17,885 people were

directly employed in the sector, with total earnings of R4.7 billion. Royalties paid amounted to R0.61billion. Figure 2.6 shows diamond production in carats and the number of employees in the industry from 2004 to 2015.



Figure 2.6: Diamond production in carats and the number of employees in the industry from 2004 to 2015

Source: Chamber of Mines of South Africa (2016b)

According to figure 2.6, production and employment numbers in the diamond sector were at peak levels in 2005. After 2005, production and employment numbers began to fall, reaching their lowest levels in 2009. Both then gradually improved after 2009, and may have been a result of the 2007/2008 global financial crisis, which affected the mining sector.

2.4.2.4 Other minerals

Other minerals include chrome, iron ore, manganese, and other lesser minerals. According to the Chamber of Mines of South Africa's report (2016b), South Africa has around 80% of the world's manganese resources. The report further states that 70% of

global chrome resources is found in South Africa, with South Africa being the largest producer of these resources.

Exploitation of such resources has greatly contributed to the national output of the economy. For instance, in 2016, 15,459 people were employed in the chrome production sector, 17,081 people in iron ore production and 7,200 people in manganese. The following figures were recorded for output; chrome 163t, iron ore 73.2t, and 15.0t of manganese (Chamber of Mines of South Africa, 2016b).

2.4.3 Mining's Contribution to Revenue Generation

Although South Africa's mining relative contribution to the GDP has shrunk, it remains the backbone of the economy. One of the most important contributions of South Africa's mining industry is in the area of revenue generation. Mineral exploitation generates enormous revenue in South Africa's economy in the form of tax, royalty, and licence fees contribution to the government, and export earnings from mineral sales. Such revenues generated from the mining sector can be used for economic diversification.

2.4.3.1 Government revenue

Existing literature suggests that the contribution of mining to government's revenues in low- and middle-income countries varies significantly, ranging between 2% and 20%, with some outliers (ICMM, 2012). Contributions are in the form of royalties, personal income tax, value added tax (VAT), and other taxes. According to ICMM (2017), payment of taxes and royalties to the government represents one of the biggest contributions of the mining sector. The key role of tax revenues to translating mining's contribution to long-term development is important. However, according to Kane-Berman (2017), the taxable income of mining companies in South Africa is said to have decreased. Only a total of 437 companies were assessed, amounting to R13.0 billion as income tax in the 2012 tax year. In total, mining companies account for just 0.3% of corporate tax payers, and 9.7% of all tax assessed. This figure dropped to 6.8% in 2014. Commodity price fluctuation contributes significantly to the decreased in tax revenue.

The outcome of the 2012 strike action also affected tax revenue collected. This revenue is used by the state to carry out developmental projects in other sectors of the economy, including infrastructural development, job creation, and provision of public goods and services (schools, hospitals, street lightening, and defence). Also, revenues generated from the sales of minerals raises funds for economic diversification. Through various linkages, other areas such as the transportation network, railway construction, public housing, and the agricultural and manufacturing sectors are equally enhanced. Ports facilities are also constructed and levy fees from these facilities go a long way towards raising further revenue.

2.4.4 Mineral Exports (Sales)

Mineral sales represent a large export share in many economies, and South Africa is no exception. Through international trade in minerals, mining brings in huge foreign earnings from mineral sales and FDI into the South African economy. As stipulated in Statistic South Africa's report (2017b), revenue realised from both local and foreign mineral sales amounted to R387 billion in 2015. Of this, coal contributed a significant 27%, followed by PGMs with 25%, gold at 16%, iron ore at 10%, and the remainder by other minerals (Kane-Berman, 2017).

Nonetheless, the global economic crisis in 2007/2008 compelled South African mining companies to cut back on supply and close down uneconomic production, which led to a decrease in sales value of South Africa's minerals by 20% – that is, from R302.633 billion in 2008 down to R241.345 billion in 2009. As stipulated in the Chamber of Mines of South Africa's report (2010), the decline in mineral sales was triggered solely by a fall in the sales of major minerals: coal by 10%, PGM by 37%, and manganese by 68%. Total primary mineral export sales fell by 21% – from R221.926 billion to R176.39 billion in 2009 (Chamber of Mines of South Africa, 2010). This situation impacted negatively on mining's contributions to growth in the South African economy.

Commodities with highest sales revenue contribution include PGMs, coal, and gold. These three key minerals contributed 71% of the total mineral sales recorded in 2009,

with a sum of R171.876 billion (Statistics South Africa, 2017a). These minerals culminated in a 63% total contribution to minerals' GDP in that same year.

Owing to the small domestic demand for most of South Africa's mineral commodities, the mining industry is largely export-oriented. In fact, South Africa is noted as a leading world supplier of a range of quality mineral products. Mining exports contributed to between 40% and 50% of South Africa's total export between 2001 and 2015, and are a major source of foreign exchange earnings in the country (Statistics South Africa, 2015b). However, mining's contribution to commodity exports has varied significantly over the years. It ranges from a high of 44% in both 2016 and 2010, to 31% in 2003, and again to an increase of 34% in 2015 (Kane-Berman, 2017). According to Statistics South Africa (2015b), such fluctuations occur because of commodity price fluctuation.

Nevertheless, mining export remains a major earner of foreign exchange in South Africa. As stipulated in the Chamber of Mines report (2016b), mining exports amounted to R320 billion in 2015. Nearly a third (27%) of the said amount was accounted for by PGMs, 21% gold, coal and iron ore accounted for 16% each, 10% was oil product, about 5% each for chromium and manganese ores and concentrates, and the balance by a few others. Moreover, if mining beneficiated products are taken into account, then 60% of export revenue will emanate from this broader category, as shown in figure 2.7 (Kane-Berman, 2017).

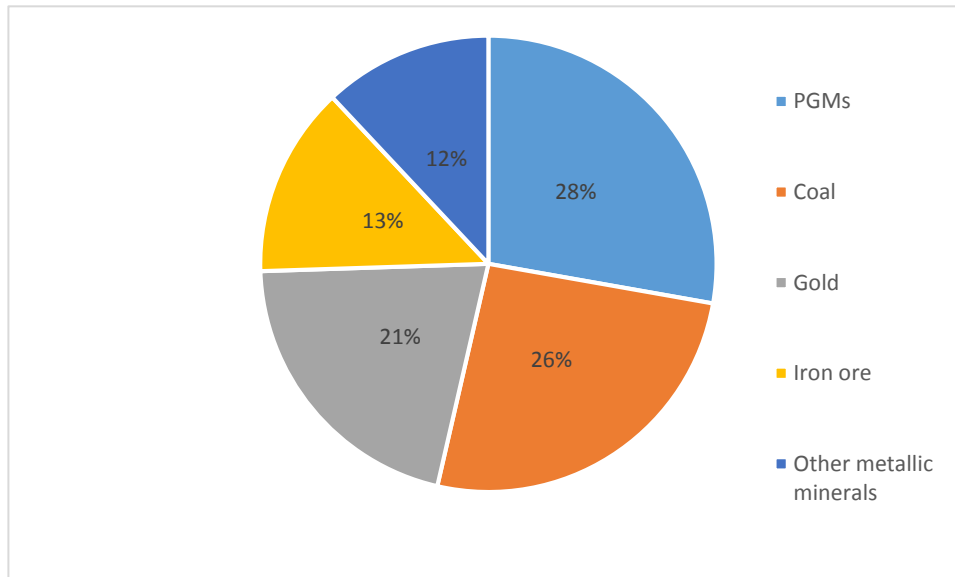


Figure 2.7: Percentage of mining revenue per commodity

Source: PWC (2010)

As shown above, PGMs are the highest revenue-generating commodities. Coal and gold occupy the second and third positions respectively. PGMs and coal overtook gold as larger revenue-generating commodities in 2005 (PWC, 2010). Revenue from PGMs was the backbone to the mining sector in 2007, contributing up to 39%. The decline in PGM revenue in 2009 was offset by the price-driven growth in coal production and the production-driven growth in iron ore. Total mining revenue declined in 2010 for the first time since 2004. The decline, which was largely caused by a fall in mineral prices, was felt across the economy (Statistics South Africa, 2017b).

2.4.5 Mining's Contribution to Employment in South Africa

The Chamber of Mines of South Africa (n.d) argues that, for any direct mining job, two indirect jobs are created through downstream and support industries. However, similar to manufacturing, the mining industry has witnessed significant decline in the number of people employed in the sector. For instance, the mining sector in 1986 employed more than 832,000 people. However, this number dropped significantly to 485,000 in

2016, representing barely 3% of total employment in the economy (Chamber of Mines of South Africa, 2016b). All total, mining contributes for 1.5 million jobs and renders direct and indirect supports to about 15 million people (Chamber of Mines of South Africa, 2016a). The report further adds that one mining worker has about ten dependants to feed.

Although mining has lost some of its gains in the area of job creation, its role here remains significant. Employment in the mining sector has grown from the late 1990s, owing to the expansion of the platinum and the coal offsetting job losses in the gold mining sector (Trade and Industrial Policy Strategies, 2015a). Mining contributed to an estimated workforce of 490,146 individuals in 2015 (Statistic South Africa, 2015b), then decreased its employment number from the year 2013 after the sharp decline in mineral commodity prices. However, from 1994 to 2014, wages more than doubled in real terms in the mining sector (Trade and Industrial Policy Strategies, 2015b). The median monthly wage in the mining sector was R7, 000, an amount close to double that in the rest of the formal sector in the economy. Fluctuations in employment numbers in the mining sector are illustrated in figure 2.8.

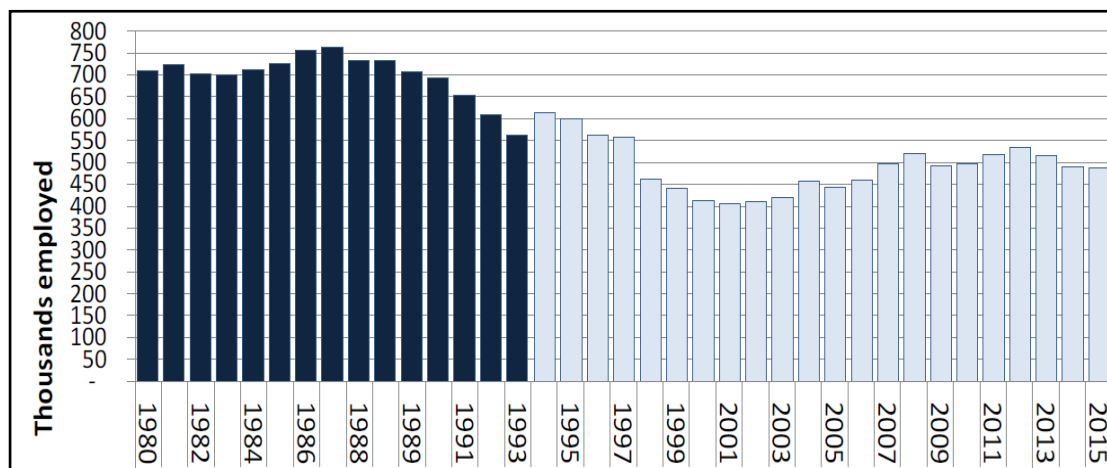


Figure 2.8: Total employment number in the mining sector from 1980 to 2015; figures are in thousands

Source: Adapted from Trade and Industrial Policy Strategies (2015b)

As shown in figure 2.8, total mining employment reached its peak in 1986, with 750,000 workers employed. This number later fell to 400,000 in 2001, then climbed again to over 530,000 from 2001 to 2012. With the fall in commodity prices after 2011, employment number in the sector decreased again to below 490,000 in 2015.

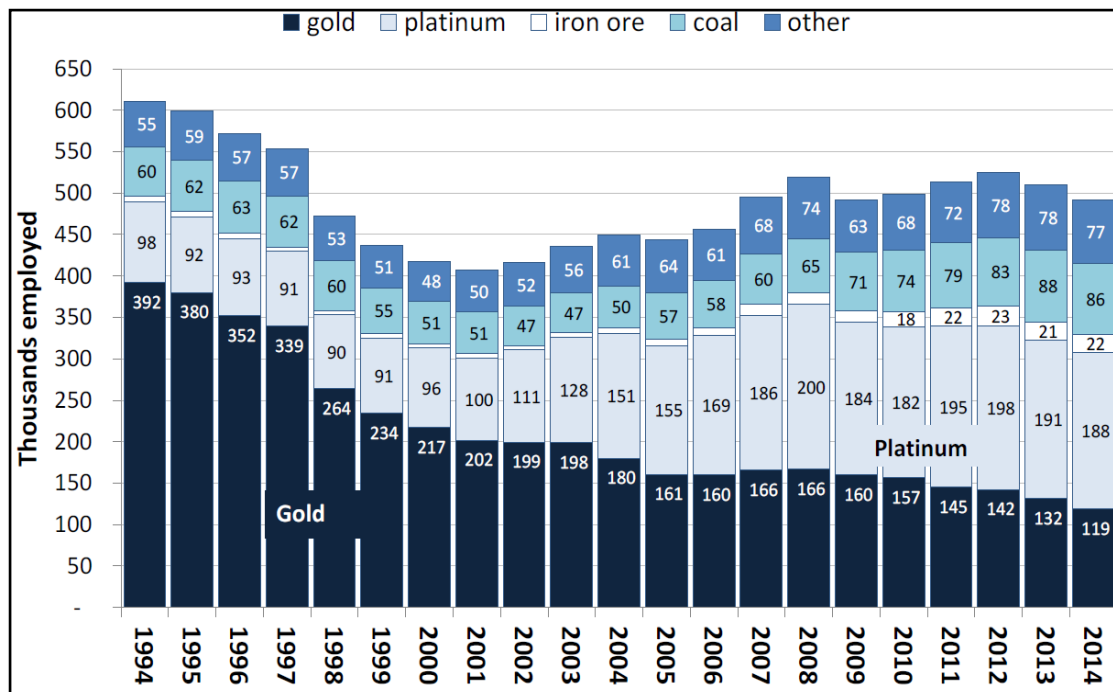


Figure 2.9: Employment numbers by commodity from 1994 to 2014; figures are in thousands

Source: Adapted from *Trade and Industrial Policy Strategies (2015b)*.

As shown in figure 2.9, great changes were experienced in employment numbers in commodities over the years. For instance, from 1994 to 2013, employment in the gold sector fell by 160,000 workers. In the platinum sector, employment numbers increased by around 100,000 workers from a low of 98,000 workers in 1994 to a high of 198,000 in the year 2012, though decreased again to 191,000 in 2013. Employment numbers in the coal mining sector fell from 60,000 in 1994 to 47,000 in 2002, and rose again to 88,000 in the year 2013.

Mining sector's contribution to the national economy goes beyond direct employment (Chamber of Mines of South Africa, 2010). Expenditure by other sectors on resources produced creates and retains thousands of jobs in these sectors, include the agricultural, manufacturing, finance and banking, and construction sectors. The mining industry is estimated to have spent approximately R211.8 billion on various goods and services in 2015 (Trade and Industrial Policy Strategies, 2015c). The mining industry has also played a significant role in indirect job creation in the economy. According to the Chamber of Mines' report (2016b), mining indirectly accounted for 954,089 jobs in 2015. Three-quarters of this number were in the tertiary sector and the rest in the secondary sector, with only a small number in the agricultural sector. In all, PGMs is the highest contributor to the industry's workforce, followed by gold and coal. Gold was once the top employer in the mining industry but was overtaken by PGMs in 2006 (Kane-Berman, 2017).

2.4.6 Indirect Contribution of the Mining Sector to the South African Economy

The South African manufacturing industry, which is now a major contributor to national income, owes its origin to the needs of the mining industry. Shortly after the establishment of the Union of South Africa in 1910, private manufacturing accounted for just 6.5% of GDP (Kane-Berman, 2017). By the early 1960s, private manufacturing accounted for 27% of the GDP. In contrast, mining's relative contribution dropped from 27% to just 13% in the same period.

Mining drew many people out of the agricultural sector into commerce. It also facilitated the establishment and expansion of towns, thus creating new and easier markets for agricultural products, construction of railways and roads, and so forth. The higher concentration of people in such areas together with an improved transport system facilitated the establishment of various factories, banks, banking facilities, schools, libraries, hospitals, theatres, and many other services. Mining therefore stimulates the agricultural, manufacturing, and even tertiary sectors.

Coal also supplies fuel not only to power stations, also to railways and other industries. It provides feedstock for the production of liquid fuel by Sasol, which is a multinational

corporation operating in 33 countries across the world and is listed in the JSE as well as the New York Stock exchange market (Kane-Berman, 2017).

Another important company is the formally state-owned Iron and Steel Corporation of South Africa (Iskor), which was established in 1928. It has since been privatised and now trades as ArcelorMittal South Africa, the largest steel manufacturing company in the economy. Other companies include African Explosives and Chemical Industries (AECI), Imperial Chemical Industries (ICI), and Haggie Rand, which has supplied the industry with steel wire ropes since the 1920s. These mining-linked companies are great milestones in South Africa's industrial development. The spill-over effect of mining thus stimulated not only the agricultural sector, but also the secondary and tertiary sectors of the economy.

2.5 Conclusion

To sum up the above literature, one could conclude that mining is a very generic term, and the role it plays varies according to different economies. Nevertheless, the mining industry of every economy remains a key player towards national growth, and impacts upon economic growth and development. South Africa is no exception. Contributions from this sector are in both direct and indirect forms, and vary significantly. Principal areas of contribution include FDI, mineral exports, government revenue, GDP, and employment creation. However, not all mineral resource-rich economies enjoy fast economic and developmental growth rates. Studies conducted in this area have demonstrated that resource-poor developed nations have sometimes outperformed resource-rich developing nations in terms of their contributions to economic growth and development. For instance, the European nations and the Asian "Tigers" enjoy fast economic growth rates owing to their manufacturing and service sectors. Moreover, despite the great contributions of mining to economic growth and development, mining activities often pose serious consequences to the environment and its people. It is believed to be one of the most hazardous peace time occupations, and often leads to negative social and environmental effects such as land, air, and water pollution;

conflicts; rent-seeking behaviours; and corruption, and the community may be compelled to vacate their arable land for mining activities.

3 DEVELOPMENTAL MEASURES/INITIATIVES IN THE MINING SECTOR

The mining sector propelled South Africa's growth in the 20th century. During this period, large, diversified mining houses were integrated vertically and horizontally along the mining value chain. The integration of those companies facilitated mining-related research, economic infrastructural development, downstream beneficiation, and industrial capabilities for capital goods. However, the relaxation of exchange controls allowed South African companies to buy and invest capital in mines outside South Africa. Moreover, previously South African focussed mining companies are now multinational mining companies. These factors have made some mining companies to shift their primary listing from South Africa. This action fragmented the mining sector. Greenfield exploration declined far below the global percentage share of exploration expenditure from its high of 5% (Chamber of Mines of South Africa, 2017a). The industry today continues to face major challenges, such as lack of requisite infrastructure, policy and regulation incoherence, and poor investment in research and development, especially in extraction, downstream beneficiation technologies, and linkages with other sectors of the economy (Elbra, 2013).

Inadequate investment in innovation and technological advancement by both the private and the public sectors have put the sustainability of the industry under serious threat. With high commodity price volatility, the industry is often in crisis during periods of low commodity prices, which results in mine closure and high retrenchment rates of mine workers. Policy uncertainty and a contradictory regulatory environment as well as poorly managed, unstable relationships between the mining companies, their employees, and the communities around the mines have impacted negatively on the mining sector.

However, the mining sector remains a key strategic sector to growth and development in the South African economy. Areas of contribution span the social, economic, and

political domains. For instance, 524,632 people were directly employed in the mining sector in 2012 (Chamber of Mines of South Africa, 2013). In the same year, mining contributed R221.99 billion to real GDP, and 11.8% in real terms to fixed investment. Mining's contribution to associated industries is remarkable in terms of revenue generation, FDI, and export earnings.

In an effort to address challenges in South Africa's mining sector, such as low level of investment in new technologies, limited infrastructural development, little investment in research and development, and policy and regulatory incoherence, in order to attract investors into the mining sector and optimise benefits that flow from mineral resource exploitation, many key players have been involved. Table 3.1 provides a summary of the key role players in the mining and minerals sector's system of innovation in South Africa.

Table 3.1: Summary of the key role players in the mining and minerals sector

	Exploration	Mining	Mineral processing	Mineral and metal beneficiation
Research and education system actors	Council for Geoscience, Universities	Council for Scientific and Industrial Research (CSIR), Mine Health and Safety Council (MHSC), Universities	Mintek, Universities	Mintek, CSIR, Nuclear Energy Corporation of South Africa (Necsa) and Universities
Sector value chain actors	Consulting companies, geophysical service companies and mining companies	Mining consulting companies, equipment manufacturers, mining companies	Process consulting firms, equipment manufacturers, chemicals suppliers	Mintek, CSIR, Necsa and Universities
Enabling agencies	National Research Foundation (NRF), TIA, Industrial Development Corporation (IDC), Provincial economic developing agencies, Department of Mineral Resources (DMR), Department of Science and Technology (DST), Department of Water and Environmental Affairs (DWEA), Dept. of Land Affairs, the Department of Trade and Industry (dti) and Non-governmental Organisations (NGOs)			
Sector R&D Funding Agencies	<i>Safety in Mines Research Advisory Committee (SIMRAC), Coaltech Research Association, South African Minerals to Metals Research Institute (SAMMRI)</i>			
Key activities	Research and development, technology development and exploration services	Mine health and safety, energy and water efficiency, mine design, technology development, environment and mine of the future	R&D in process technology, process efficiency, water and energy efficiency, health and safety, and environment protection.	Advanced Manufacturing Technology Strategy (AMTS), Advanced metals initiative, project AuTek, PGM beneficiation, Minerals beneficiation strategy

Source: Adapted from TIA (2017)

Many developmental measures both at national and continental levels have been put in place by key mining players along the mining and minerals value chain. Both the government and private sectors have also initiated several developmental measures and/or initiatives in the mining industry, amongst which include: adoption of the NDP, in line with the NGP, which identifies mining as key to achieving its objective; the Mining Phakisa initiative; Mining Vision 2030 development goals; the South African minerals policy; the Mining Charter, and the Africa Mining Vision (AMV). This section sets out to explore the impact of these measures/initiatives on mining's contribution to the national economy.

3.1 Africa Mining Vision (AMV)

The African continent comprises countries rich in mineral resources, of which South Africa is an outstanding example (World Trade Organisation, 2010). Unfortunately, the level of value addition in the continent is relatively low, thus most of its mineral resources are exported as ores, concentrates, or metals (African Union (AU), 2009). Moreover, the absence of systematic geological mapping of mineral resources in most African countries have reduced their resource base. In fact, the African continent in general and South Africa in particular have not fully benefitted from these abundant resources as have their counterparts in the developed world (Elbra, 2013).

The formulation, implementation, and monitoring of a workable resource-based industrialisation strategy based on Africa's unique strength is thus vital. The key to attaining the millennium development goals (MDGs) through transformation of mineral resources into an industrialised and modernised continent calls for the need of a shared mining vision. In line with this, the AMV was developed in August 2008, by a technical taskforce established and co-ordinated by the African Union (AU) and the United Nations Economic Commission for Africa (ECA) (AU, 2009). The taskforce comprised representatives from the African Development Bank, an African mining partnership made up of an intergovernmental forum of African ministers dealing with

mining, delegates to the United Nations Conference on Trade and Development, and the United Nations Industrial Development Organisation (AU, 2009).

The main goal of the AMV is centred on “Transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth and socio-economic development” (AU, 2009). In line with this vision, it is therefore important to consider South Africa’s minerals policy and development strategies within the broader African context. The shared vision of the AMV is aimed at achieving the MDGs, and is broadly classified into seven key strategic areas as summarised below:

- a knowledge-based African mining industry that ensures broad-based growth and development, fully integrated through different ways (downstream linkages, upstream linkages, side-stream linkages, mutually beneficial partnership between key players, and a comprehensive knowledge of its mineral endowment);
- a sustained and well-governed mining industry that effectively collects and deploys resource rents in a safe, healthy, gender and ethically inclusive, socially responsible, and environmentally friendly manner by surrounding communities;
- a mining sector that enhances diversification, and a vibrant, globally competitive industrial African economy;
- a mining industry that fosters a competitive African infrastructure through enlargement of its local and regional economic linkages;
- a mining environment that makes optimum use of Africa’s finite mineral resource endowments, with diversification incorporating both lower-value industrial minerals and higher-value metals at commercial and small-scale levels;
- a mining sector that builds on potential of artisanal and small-scale mining to grow local/national entrepreneurship, improve livelihoods, and advance integrated rural and socio-economic developments; and

- A mining sector that serves as major player in vibrant and competitive national, continental, and international capital and commodity markets.

The AMV objectives serve as point of reference for African nations for their mineral resource policy reforms and resource-based development and industrialisation strategies. It ensures that Africa's resource-based economies make good use of their resources for sustained growth and development, achieved through a knowledge-based African mining industry that ensures broad-based growth and development. It is integrated through different ways of increasing and strengthening local and regional economic linkages – downstream linkages, upstream linkages, and side-stream – mutually beneficial partnership between key players; the usage of resource rents in a safe, healthy, gender and ethically inclusive, socially responsible, environmentally friendly way by surrounding communities; enhancing diversification, and a vibrant, globally competitive industrial African economy; and recognising the potential of artisanal and small-scale mining to grow local/national entrepreneurship.

The AMV serves as a reference point for Africa's resource-based economies, thus ensuring that Africa's resources are optimally used for growth and development. South Africa is no exception. In order to achieve these objectives, the taskforce developed a schematic African resource-based industrialisation model with four main phases, as illustrated in figure 3.1.

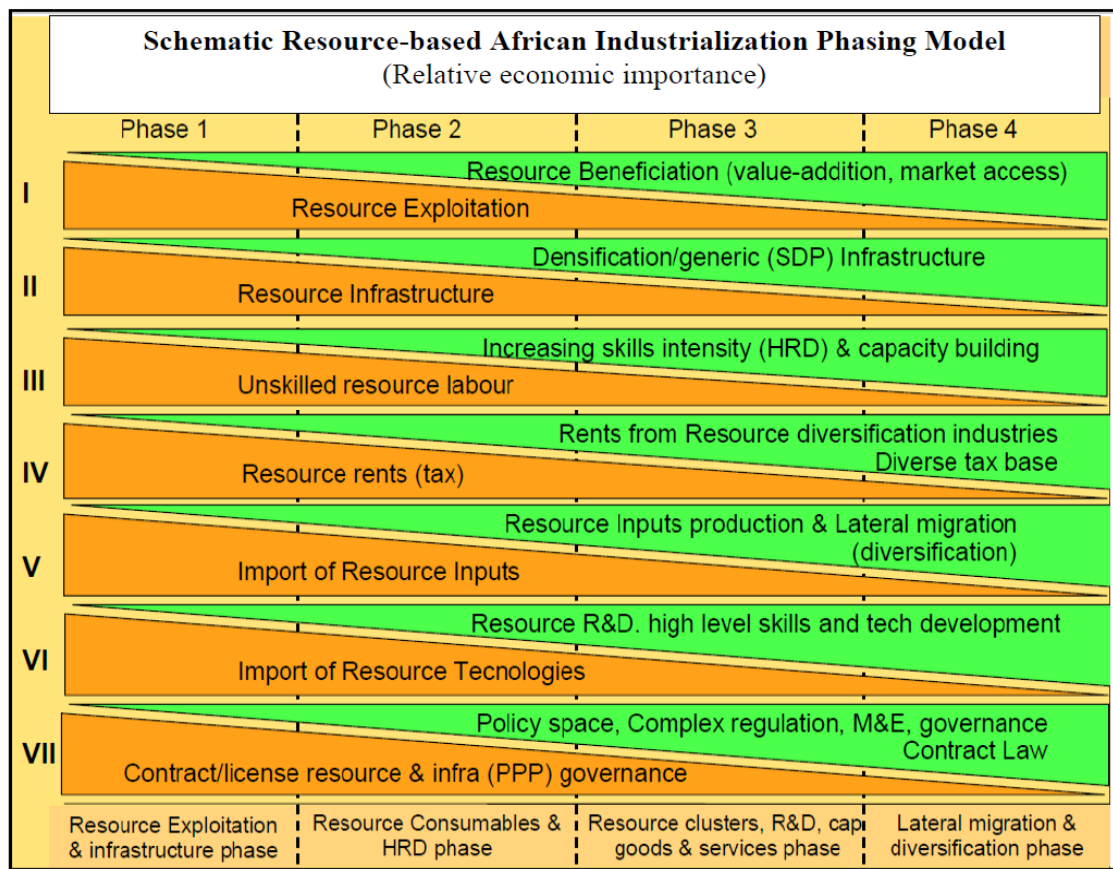


Figure 3.1: Schematic resource-based African industrialisation phasing model

Source: Adapted from AU (2009)

Taking into consideration the long gestation period of mining projects, and coupled with the local context and developmental trajectory, the African mining vision is a multi-phased approach, comprising resource exploitation and infrastructure; resource consumables and human resource development; resource clusters, research and development, capital goods, and services; and lateral migration and diversification. These phases are not mutually exclusive and can be implemented concurrently. The multi-phased approach such as the one above provides resource-based industrial growth and development strategies aimed at uplifting African countries – including South Africa – to the level of their counterparts in the developed countries.

Phase one through phase four show increasing economic importance with each progressive phase of industrialisation. Resource-based industrialisation is a positive option for Africa's modernisation, and South Africa is pursuing this route. However, the success of this strategy is based on favourable internal and external factors within an economy, which include the presence of natural resource endowments and the active role of key stakeholders, in order to:

- facilitate research and development in human resources and skills development;
- provide the necessary infrastructural development required for growth and development, such as energy and water, roads, railways, ports, and telecom;
- galvanise the potentials of public-private partnerships;
- obtain adequate, share-efficient utilisation of minerals revenue;
- establish a strong bond of collaboration among all the stakeholders; and
- Encourage value addition and local beneficiation.

By establishing a shared mining vision for the continent, the AMV gives hope that the legacy of mining in Africa in general and South Africa in particular can be enhanced. Nevertheless, more is required to be done in order for complete success to be achieved. There is the need for robust policy, legal, and regulatory frameworks to ensure equitable participation, and for instruments to improve revenue generation locally by all stakeholders in the mining sector. Mechanism for transparency and efficiency in handling revenue flow from the mining sector by the government is also required. Although these systems exist in South Africa, their applicability is often questionable.

There is the need for more effort to be put in place to strengthen institutional capacities at all levels, including government. Proper management and intelligent spending, efficient long-term planning, and savings and investment of mineral wealth should be priority. AMV is developed to provide a blueprint that addresses challenges identified above. It employs an integrated development approach to mineral resource exploitation, built on the foundation of a strong political will, visionary leadership, and efficient administration, maximising the benefits of regional integration and

establishing strong partnership for change. These objectives can only be achieved with the aid of a robust national minerals policy.

3.2 South Africa's Minerals Policy

The quest to enhance growth and development of South Africa's mining industry led to the approval of the White Paper on Minerals and Mining Policy for South Africa by Cabinet on the 23 September 1998; a policy document that provides guidance for attaining desired objectives in the mining sector (Department of Minerals and Energy, 1998). The policy document was developed due to the significant contributions of the mining sector to socio-economic development in the South African economy. Although the document was developed prior to the establishment of the AMV, both are geared towards achieving broad-based industrialised growth and development. As stipulated by the AU,

“The African Mining Vision is informed by broader outcomes of several initiatives and efforts made at sub-regional, continental, and global levels to formulate policy and regulatory frameworks to maximize the development outcomes of minerals exploitation at a continental level.” AU (2009:p1)

This statement implies that the AMV establishes a broad-based developmental framework in Africa within which individual African nations, including South Africa, may develop and reform their mineral policies and legal and regulatory frameworks in line with a harmonised developmental strategy with the rest of Africa. According to Fernandes (2014), AMV enhances favourable trade relations, cooperation, peace, and security amongst trading partners. The objectives of the minerals policy take into account the global nature of the mining industry in order to ensure continuous prosperity of the sector (Otto and Cordes, 2002).

3.2.1 Objectives of South Africa's Minerals Policy

South Africa's minerals policy is aimed at facilitating mining's contribution towards the attainment of broad-based growth and development in the national economy (Buck and Elver, 1970). Areas of contribution range across different spheres, including the economic, social, and environmental sectors. In order to increase mining's share of economic growth and development, there is need to ensure fair distribution of proceeds from the mining sector to all through infrastructural development; promote economic diversification and improved social wellbeing and standards of living; eradicate poverty; and preserve the environment. However, the goals and objectives of South Africa's minerals policy can only be achieved in a favourable and attractive investment environment.

As such, the investment environment greatly impacts mining investment (Mtegha et al., 2006). It can help to attract investors to the mining sector or repel investors from the sector. A wide range of key factors in the South African minerals policy are evaluated, including: mineral development and the business climate; participation in ownership and management; environmental management; regional co-operation; governance; and general people's issues (Department of Minerals and Energy, 1998).

3.2.1.1 Mineral development and business climate

Theoretically, South Africa's minerals policy provides a robust framework that maintains and promotes stable legal and fiscal structures in the mining sector. Doing so could help the mining industry make significant contributions to the local, provincial, and national economy. However, more effort is needed to enhance macro-environmental stability, in order to attract foreign and local investors to the mining industry. Government's macroeconomic strategies in this regard include economic liberalisation through bureaucratic deregulation and fiscal and tariff reforms – steps necessary to enhance the country's competitiveness and investment portfolio. The policy makes provision for structures that compel the government to facilitate access to resources and business opportunities through the provision of infrastructural developments required to make the industry more competitive. To further encourage

minerals development, the policy provides a wide range of tax considerations to investors, including the redemption of capex in mining, ring-fencing, capital allowances for gold mining, and extension of the gold mining tax formula to other mining sectors (Oshokoyo, 2017).

3.2.1.2 Participation in ownership and management

The South African minerals policy makes provision for systems to promote small-scale mining in the country. Such endeavours are popular in the gold, diamond, and coal sectors. Efforts to facilitate the sustainability of small-scale mining to achieve optimal exploitation of small mineral deposits that contribute positively towards growth of the national economy are undertaken. Such efforts include the provision of required information on the availability of mineral deposits and rights, and access to investment finance and technology. It also makes provision for the Department of Minerals and Energy in collaboration with organised labour unions, tertiary institutions, research organisations, foreign aid agencies, and the private industry to provide training facilities to small-scale miners. All these approaches culminate in increasing mining's contribution to value added to the GDP.

The nature and content of mineral rights are founded in a dual system in which some mineral rights are owned by the state and others by private holders. The policy compels the government to institute changes in the mining sector that will lead to equity of opportunity in terms of ownership and management in the mining sector. Efforts in that regards include the use of Labour Relations Acts (LRA) to eliminate racially discriminatory practices at all levels within the mining industry, apprenticeship, and other training programs (Department of Minerals and Energy, 1998). Doing so is achieved through Employee Share Ownership Participation Scheme, which enhances efforts to deracialise the mining sector by promoting black ownership. Previously disadvantaged individuals are then equipped with necessary skills and training to enable them to be highly productive and competitive.

Yet although efforts are put in place to increase the number of black investors and women participation in the mining industry, ownership of the main mining companies

is still in the hands of whites (Elbra, 2013), and located within a few mining houses. Blacks still find it difficult to raise the huge capital needed to own companies in this sector. The problem is compounded by the fact that the current deed registry system fails to reliably provide overall figures of the different percentages of mineral rights owned by the state and private holders. Workplace discrimination is also still common, making it impossible for blacks to occupy middle and senior management positions in the industry (Elbra, 2013).

In addition, the policy does not provide a coherent structure that assists small-scale mining developments, lacking good marketing, management and technical skills in dealing with complex metallurgical problems. Many still view the current mineral rights ownership system as major barrier to small-scale mining development (Cawood, 2011).

3.2.1.3 Research and Human Resource Development

The present minerals policy recognises and enhances the role of government to undertake and promote research and development in the mining industry. This goal could be achieved through development and transfer of new technology to stimulate optimal development of the nation's resources and competitiveness of the mining sector, and facilitation of human resource development. Such can be attained through the provision of academic and vocational education system, educational subsidies, and on-mine training programs with emphasis placed on adult basic education and training and health and safety at all levels. All qualifications should be registered within the National Qualification Framework.

However, in South Africa, research and development in general and in the mining sector in particular has not received due attention. The policy framework has achieved very little in this domain, and spending on research and development is insufficient. For instance, South Africa spends just 1% of its GDP on research and development whereas countries such as Sweden and Finland spend up to 4% (Cawood, 2011). Moreover, the South African mining sector suffers from a shortage of skilled labour. The mining sector is believed to be a knowledge-intensive industry, thus, in order to

remain competitive in the ever-changing and highly competitive global market, it needs to develop and use technologies to cut the increasing costs. Funding of research and development in the economy in general and the mining sector in particular must be a priority to both the public and private sectors.

3.2.1.4 General people's issues, housing and living conditions

In accordance with the National Health policies, the Mine Health and Safety Act states that the employer is responsible for the protection of health and safety of employees. This Act requires government to ensure good health and safety conditions in all mines. Regulations governing mine safety should be realistic and practically enforceable, and health and safety of employees should be prioritised in major training programs in mines. In consultation with the Mine Health and Safety Council, the minerals policy encourages the government to propose measures with regards to housing standards and nutrition of employees who are accommodated at the mines, along with strict monitoring and ensuring compliance. Investigation of housing conditions of mine workers and their relatives is recommended.

Although these requirements have been well articulated in the policy document, their application remains to be seen. Mine workers are believed to work and live under deplorable conditions, which precipitated the 2012 strike actions. These strike actions impacted negatively on productivity, thus decreasing mining's contribution to value added towards the GDP. However, in order to improve mining productivity, stakeholders need to adhere to good health and safety conditions of all mine workers and create a better working environment.

3.2.1.5 Promotion of value addition (beneficiation)

Embedded in the minerals policy document is the need to promote beneficiation of mineral raw materials into semi-finished and finished products. The enhancement of downstream industries based on value addition is viable though greater local participation in the provision of manufactured goods. This objective corroborates with the AMV (AMV, 2009). Beneficiation is to be enhanced through greater co-operation between the Departments of Minerals and Energy, and Trade and Industry. Efforts

include: efficient supply-side measures such as tax incentives for beneficiated projects that encourage local downstream beneficiation; provision of stable, low-cost electricity and transport; and the provision of joint venture research and training programs with universities and private sectors to produce the necessary skills and technology for beneficiation advancement (Eunomix, 2015).

However, the lack of co-ordination between the different governmental departments is a major setback to successful beneficiation. Moreover, the low level of research and development, insufficient infrastructural developments, skill shortages, policies and regulation issues, and lack of implementation of key policies remain major setbacks. In order to maximise benefits from the mining sector, key stakeholders must invest in research and development and skills development through training, as this would promote value addition in the mining sector.

3.2.1.6 Environmental management

Many developing economies including South Africa have paid little or no attention to environmental issues in the past (Fernandes, 2014). Mineral exploitation is amongst the major contributors to environmental degradation in South Africa. However, trends have recently changed, with such developing economies beginning to pay more attention to mining's related environmental issues (Fernandes, 2014). In addressing these concerns, the state has to take full responsibility as custodian of the nation's natural resources, and endeavour to ensure that exploitation takes place within the framework of sustainable development and in line with national environmental policy, standards, and norms. In so doing, the state would acknowledge the effect of mining activities on the environment and, as such, implement legislation and policies to regulate the mining environment. Key areas of concern include: the environmental impact of exploration; environmental effect over life of mine such as mine closure and financial assurances for rehabilitation; and maintaining rehabilitation measures where mining activity ceases to exist. Thus, a balance needs to be achieved between a competitive and cost-effective mining industry and protecting the environment.

3.2.1.7 Regional cooperation

Enshrined in the minerals policy is the need for the South African government to enhance co-operation on minerals and mining matters within the southern African Development Community (SADC) on basis of mutual benefits, facilitated by the integration of economies of the southern African states through the trade and investment protocol (Fernandes, 2014). The SADC region is richly endowed with mineral wealth and supplies vast amounts of diamonds, coal, platinum, gold, asbestos, nickel, iron, chrome, as well as other lesser minerals (Olawumi, 2016). Owning these resources, the mining industry plays a central role in the region, and serves as foundation for renewed growth. Regional blocks such as the SADC also offer advantages for large market with the free flow of goods and services and coordinated policies.

South Africa stands to benefit from increased regional, international, and continental co-operation. The region provides huge demands for South African equipment suppliers, technologies, consultancy, and expertise. However, for benefits to be optimised, there is a need to remove all forms of barriers to free trade and movement of capital, labour, and commodities without destabilising the economy of a member state. The policy therefore encourages the South African government to co-ordinate policies so that the SADC region can benefit from its mineral wealth. Such efforts include:

- removal of barriers that prohibit movement of capital, labour, goods, and services in a phased manner in order to avoid destabilisation of the economies involved;
- harmonisation of minerals-related legislation within the block;
- promotion of value addition among member states;
- encouragement of regional co-operation in the development of technology and human resources; and
- Dissemination of exploration and investment information among member states.

3.2.1.8 Governance

The policy document compels the Department of Minerals and Energy as agent for the government to carry out regulatory and promotional activities in a transparent and more efficient manner. Moreover, it regulates the mining industry to attain national objectives and maximise benefits to the nation. It further compels the Department to consider the interest of mining communities, thereby function as a regulatory body.

For these objectives to be achieved, the Department needs to be staffed with adequate, skilled personnel. They must be involved in a promotional rather than regulatory role in order to facilitate relations between the industry, other regulatory agencies, and the government. Although efforts are in place to enhance governance in the mining industry, the Department of Minerals and Energy needs to increase the number of trained staff to implement, coordinate, and monitor activities.

Despite the above articulated views enshrined in the policy document, government's inability to effectively implement and administer the regulatory framework is a key weakness (Cawood, 2011). This issue might impact negatively on the mining sector's ability to attract FDI and meaningfully contribute towards broad-based industrialised economic growth and development in the economy.

3.3 Mining Phakisa

The South African mining industry is noted for its significant contributions towards the growth of the national economy. However, such contributions to economic growth has witnessed significant downturn over the past decades. The mining sector faces numerous challenges ranging from the low level of research and development, lack of innovations, inadequate geoscientific information in the public domain to attract investors, a shortage of skilled labour, and other structural challenges. The pace of mineral resource exploration has declined over the years, as has employment numbers due to rising production costs.

In line with these challenges facing South Africa's mining industry, and given the need for a concerted effort to establish a firm foundation for future investment in the mining

industry, developmental measures have been established. The Department of Planning, Monitoring and Evaluation under the mandate of the presidency convened a Mining Phakisa in collaboration with the Department of Trade and Industry, Department of Mineral Resources, and the Economic Development Department (Chamber of Mines of South Africa, 2016a).

The Phakisa initiative was launched in 2014 to bring about the much-needed changes in the mining sector and achieve the goals of the NDP, in which mining is identified as being a key player (Creamer Media, 2017). This initiative is a developmental strategy aimed at unlocking the economic potentials through a joined collaboration process, convened by the government with representatives from other sectors of the economy, including the civil society, industry, and academia. It facilitates planning, monitoring, and implementation of initiatives that positively impact the economy (Biznisafrica, 2015).

Mining Phakisa employs a methodology initiated by Malaysia under its “Big Fat Result” initiative. According to Creamer Media (n.d), the Mining Phakisa initiative is aimed at achieving the following objectives in South Africa’s mining sector:

- fast-track upstream linkages between the mines and domestic capital equipment sectors;
- facilitate beneficiation of both precious metals and bulk resources, thus exploring a win-win resolution;
- enhance social and community development with a key interest on housing;
- increase exploration activities through the provision of a detailed geoscientific information to explorers; and
- Support research, development, and innovation within the mining cluster, ensuring proper planning and implementation of a holistic mining modernisation.

As stated in Daniel et al (2015), “The broad aim of the Mining Phakisa is to galvanise growth, investment and employment creation along the mining value chain, in relevant input sectors and in the mining related communities”.

The role of Mining Phakisa as a collaborative process that brings all key stakeholders together to effectively study how to attain agreed upon objectives through productive problem-solving mechanisms is much-needed today in the mining industry. In practice, the Phakisa initiative has three broad phases: the pre-laboratory preparation phase (which entails research and extensive stakeholders’ consultations to develop a lucid scope for the laboratory); the laboratory phase (which involves an extended multi-stakeholder workshop that ranges from four to six weeks to set up a detailed and robust implementation plan); and post laboratory phase (which involves the implementation, modification, monitoring, reporting and evaluation of the plans).

A significant objective of Mining Phakisa is its efforts to extend the life of platinum and gold mines beyond 2025 and establish global leadership role in narrow-reef, hard-rock mining systems in South Africa (Chamber of Mines of South Africa, 2017a). These are to be achieved through partnerships in research and development; enhancing competitive local manufacturing capability for next generation mining system through the setting up of a mining manufacturing equipment cluster and a mining research and development hub; the South African Mining Extraction Research, Development and Innovation (SAMERDI); and development of mechanised mining solution for platinum and gold mines that will focus on current and future mining operations.

3.3.1 Mining Research and Development Hub

To achieve the said objectives, the mining hub co-ordinates research activities in order to revitalise South Africa’s mining operations through the advancement of next-generation mining systems. Figure 3.2 shows how the mining cluster can be advanced through research and development, and enhancing mining manufacturing equipment capability. Focus is on the short-, medium- and long-term objectives.

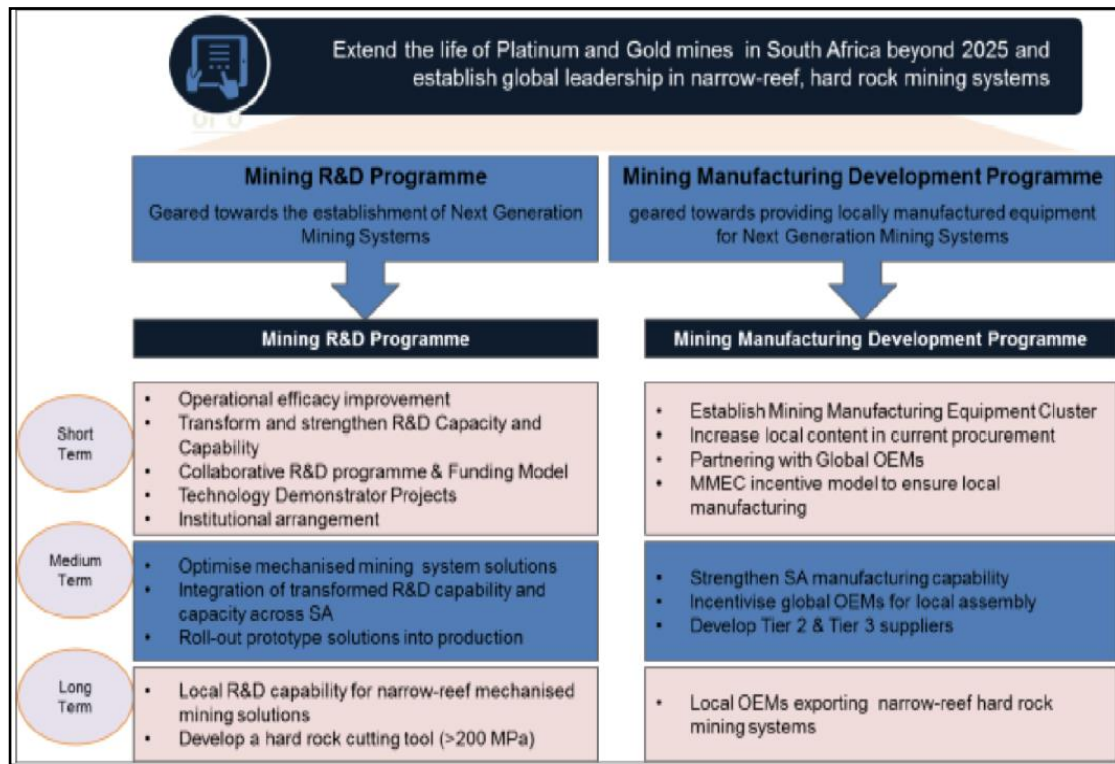


Figure 3.2: Summarised view on the lives of platinum and gold mines in South Africa

Source: Adapted from Singh (2016)

Figure 3.2 gives a summarised view of how the lives of platinum and gold mines in South Africa could be extended beyond 2025, and how global leadership role in narrow-reef, hard-rock mining systems can be established in South Africa. These objectives are to be met in different time periods (in the short, medium and long term) through mining research and development programs and mining manufacturing development programs (Chamber of Mines of South Africa, 2017b)

3.3.2 South African Mining Extraction Research, Development and Innovation (SAMERDI)

SAMERDI serves as an input document in Mining Phakisa. Stakeholders in the mining industry have recognised and agreed that the SAMERDI strategy is to be used as a consolidated strategy for mining extraction (Singh, 2016). The SAMERDI document, which is aimed at facilitating mining extraction research and innovations, was

developed by CSIR with input from the draft document of the Departments of Science and Technology and Mineral Resources. Although under the banner of the Mining Phakisa initiative, SAMERDI is centred on productivity-related aspects of mining. It aims to ensure that mineral resources are efficiently and safely converted into mineable reserves, with minimal environmental impact. Its main objectives are as follows:

- To enhance competitiveness of South Africa's mining sector, and create new opportunities for mining-based companies to operate along the entire mining value chain and benefit from innovations stemming from research and development; and
- Rebuild and reposition South Africa as world leader in mining research, development, and innovation by developing skills in human resources and great capacities and capabilities across the industry, science councils, and academia in order to ensure sustainability.

With these well-articulated objectives of the Mining Phakisa initiative, one would therefore be tempted to say that all the challenges in the mining sector will be resolved. However, the timeframe required for these measures to be effectively materialised is also important, as mining's contribution to South Africa's GDP continues to show a downward trend despite such efforts.

3.4 The Mining Charter

An initiative to bring transformation in the mining industry saw the development of a Mining Charter. The exclusionary policies of the apartheid regime facilitated a systematic marginalisation of a majority of South Africans. This was achieved through the prevention of Historically Disadvantaged South Africans (HDSAs) from owning production means and meaningfully participating in mainstream economy (Cox Yeats, 2017). To redress this, in line with section 9 of the Republic of South Africa's constitution, Act 108 of 1996, the Mineral and Petroleum Resources Development Act (MPRDA) No. 28 of 2002 was enacted. The MPRDA is aimed at facilitating a meaningful participation of HDSAs in the mining and minerals sector (Government Gazette, 2017). Section 100(2) (a) of the MPRDA calls for the development of a

Mining Charter as a tool for transformation with specific targets in the mining industry. Enshrined in the 2002 Mining Charter is a provision to review progress and determine further steps to attain its objectives (Government Gazette, 2017).

In line with the above mentioned provisions, the Mining Charter was first published in 2002. An evaluation of the charter in 2009 by the department of Mineral resources found some shortcomings in the charter's ability to attain its objectives. In 2010, an amended mining charter was published to address the shortcomings. A further assessment of the mining charter in 2014 revealed that the objectives of the 2010 charter were not achieved. Another review process was undertaken in 2015 with an objective of "the need to integrate Government policies to remove ambiguities in respect of interpreting and creating a regulatory certainty" (Cox Yeats, 2017:p2). A draft reviewed mining charter was then published in April 2016 for public comment. It received industry wide outcry. As a result, the then Minister of Mineral Resources, Mr. Mosebenzi J. Zwane undertook to consult with key role players. On the 15th of June 2017, the new mining charter was published.

3.4.1 Objectives of the Mining Charter

As stipulated in the Government Gazette (2017), the Mining Charter is aimed at achieving the following key objectives:

- Recognises the internationally acceptable right of the state to have full sovereignty over mineral resources within the country;
- Redressing the imbalances of the past injustices by deracialising ownership of the mining and minerals industry;
- Creating and expanding opportunities for Black persons to enter the mining and minerals industry and fully benefit from the state's mineral resources;
- Using and expanding existing skills base to empower Black persons;
- Creating employment opportunities and diversifying the workforce in order to attain competitiveness and productivity of the mining and minerals industry;

- Achieving social cohesion through the enhancement of social and economic welfare of the mine communities and major labour areas;
- Promotes sustainability in growth and development of the mining and minerals industry;
- Accelerating growth and development of the local mining inputs sector by leveraging procurement spending of the mining and minerals industry; and
- Promoting beneficiation of mineral commodities by South African Based companies.

In order to achieve the above mentioned objectives, key elements have been developed. The table below gives a vivid summary of the key elements of the 2017 mining Charter (CDH, 2017).

Elements of the Mining Charter	Key Points
Ownership	• A minimum of 30% BEE for all mining rights. To be broken down as follows: 8% employees, 8% mine communities, and 14% Black entrepreneurs. • Right holders at 30% are not required to apportion and those at 26% must increase within 12months but do not need to apportion. • 30% BEE shareholding to be held in entities or persons separate from the right holdings. • A minimum of 50% plus 1 Black person shareholding must include voting right for all new prospecting rights. • The solvency and liquidity provisions of companies Act 71, Of 2008 will be applicable. 1% of annual turnover of

	Right holder to be paid to the 30% BEE prior to any distribution to shareholders. Equity not vested in a HDSA must vest in no more than ten years and no less than 3% annually.
Employment Equity	- At the board level, 50% must be black, out of which 25% must be black women. - At top management level: 50% black; 25% to be Black women. - At Senior management level: 60% black; 30% to be black women. - At middle management level: 75% black; 38% to be black women. - At junior management level: 88% black; 44% to be black women.
Procurement	80% of all mining services to be from BEE entities. 70% of mining goods must come from BEE entities on a staggered basis. - SA-based firms to analyse 100% of mineral samples. 1% annual turnover of foreign suppliers to be paid to Mining Transformation Development Agency. - Holders to poses a 3 year transitional period within which procurement targets must be achieved.
Beneficiation	11% maximum offset against BEE shareholding. However, must meet the following criteria: Beneficiation must be in accordance with the meaning of beneficiation as stipulated in the MPRDA, and such must be approved by the Department of Mineral resources.

	• The 11% offset will not be applicable to beneficiation that commenced after 2004 but has since ceased to exist. • The 11% offset is only claimed if beneficiation process is still ongoing.
Housing and Living Condition	Must be in accordance with the principles as set out in the Housing and living conditions Standard for mining and minerals industry developed in terms of section 100(1) of the MPRDA: • Decent housing standard. • Superb nutrition requirement and standard. • Employees to be involved in housing administration system. • Provision for physical, social and economic integrated human settlements. • Standards are subject to revision over time.
Human Resources Development	A leviable investment amount of 5% on skill development, broken down as follows: • 2% apportioned for mining transformation and development agency. • 2% of skills development activities: bursaries artisanal training, literacy and numeracy skills development for employees and community members.

The revised Mining Charter has been surrounded with mixed feelings among key role players in the mining industry. The decision to come up with the current charter has come under serious scrutiny both from within the governing party and the Chamber of Mines (Sowetan, 2017). The African National Congress (ANC) Economic Transformation Committee raised concerns for the publication of the charter without further engagement with the mining industry (Leon and Leyden, 2017). The committee

emphasized on the effect of the new charter on employment. The Chamber of Mines complained over the lack of proper consultation and states that “the new charter could kill the goose that lays the golden egg” as quoted by Daily Maverick in the Sowetan (2017). There is uncertainty regarding the targets and the idea of ‘once empowered, always empowered’ with the government and the industry having different interpretations. This is quite critical from a mining investment perspective.

3.5 The National Development Plan (NDP)

The South African government adopted the NDP as a blueprint for the advancement of socioeconomic development in the nation. Strategically, the NDP provides a long-term vision plan for the nation and aims to achieve a decent standard of living for all South Africans through the elimination of inequality and poverty. The South African mining sector as a key economic sector will contribute greatly towards the attainment of these goals. The NDP incorporates the IPAP, established by the Department of Trade and Industry, and the NGP, established by the Ministry of Economic Development. These initiatives are incorporated into the National Planning Framework (Zarenda, 2013).

The NGP places the economy on a production-led growth trajectory, aimed at tackling unemployment, poverty, and inequality (Department of Mineral Resources, 2011). The NGP recognises mining as key to job creation within the mining value chain and downstream and upstream industries across the economy. According to the Department of Economic Development (2012), the main objective of the government’s NGP is to create five million jobs by the year 2020, with the mining sector set to create 140,000 more jobs by the year 2020, and 200,000 jobs by the year 2030. The NGP shows strong emphasis on mining’s role in achieving its objectives.

However, the main issue with the attainment of the above-mentioned objectives rests with the processes of implementation and monitoring, and the willingness and capabilities of key players.

3.6 Mining Vision 2030

The establishment of Mining Vision 2030 for South Africa is aimed at contributing positively towards achieving the goals of the NDP of ensuring a decent standard of living for all South Africans through the elimination of inequality and poverty. Because South Africa is greatly endowed with mineral resources, it has the potential to contribute significantly towards achieving these objectives.

However, the mining sector is believed to have failed to match global growth trend in mineral exports (Creamer Media, 2012). As stated in the Chamber of Mines report,

“The South African mining sector has, for more than 100 years, been considered a labour-intensive industry using physically demanding manual drilling methods with blasting and cleaning on a stop-start basis, predominantly in narrow reef, hard-rock mining for gold, platinum and chrome.” Chamber of Mines report (2017a: p2)

With the increasing depth of these aging mines, working conditions are becoming harsher and characterised by abrasive rock with steep gradients and seismicity. The temperature in gold mines with virgin rocks is as high as 40 degrees Celsius, even reaching 70 degrees at times. Travel times to the face are sometimes longer than an hour. These factors negatively affect productivity, thus leading to increase in production cost. The need to revitalise the methodology of mining is vital in South Africa. South Africa’s Mining Vision 2030 is suited for this purpose.

The Mining Vision 2030 is based on mine modernisation and mechanisation as a strategy to achieve the NDP objectives of eliminating inequality and eradicating poverty by the year 2030. The term “mine modernisation” is often confused with the term “mine mechanisation”. According to the Chamber of Mines of South Africa (2017a:p1), mine modernisation is defined as the “process of transition and

transformation of the mining industry of yesteryear and today to that of tomorrow”, whereas mine mechanisation implies the use of more machines in production.

Modernising the mining industry is not limited to mechanisation or implementation of new technology (Chamber of Mines of South Africa, 2017a). Mine modernisation also involves the acknowledgment of people’s contribution in the sector through the improvement of skills, health, fulfilment of employees, and quality of life, accounting for the nation’s resources in the safest, most efficient, healthy, cost-effective and sustainable manner, ensuring general transformation and growth. Its contribution also extends to increase in skills development, employment creation, exports and revenue generation (Chamber of Mines of South Africa, 2017a).

Without a change in South Africa’s mining method, the industry will fail to profitably extract deep-level complex orebodies, leading to mine closure and a high rate of retrenchments. Research holds that 200,000 jobs will be lost by 2025 if the South African mining sector is not modernised (Chamber of Mines of South Africa, 2017a). Thus, in order to facilitate the modernisation process, a mining hub has been set up to co-ordinate research and development initiatives, encourage skill development in the mining sector, and promote the manufacturing of mines equipment. Figure 3.3 shows the summarised objectives of mining innovation hub.

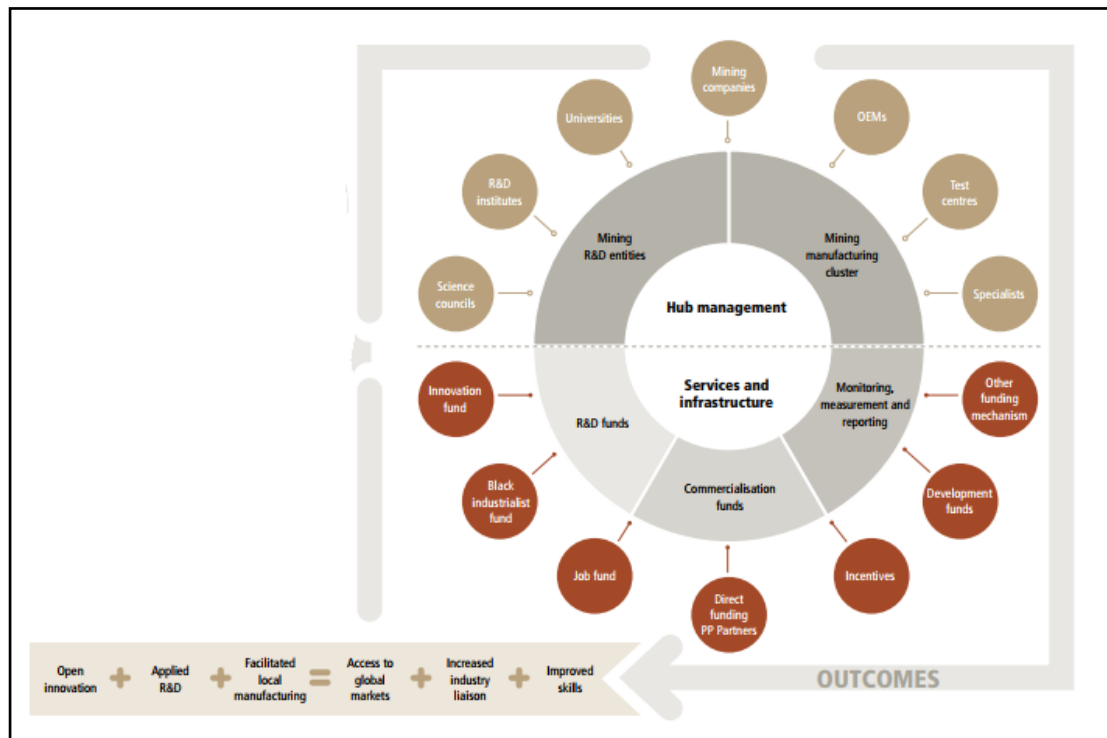


Figure 3.3: Summarised objectives of the mining innovation hub

Source: Adapted from Chamber of Mines (2017a)

The mining innovation hub is regarded as a joint public-private partnership founded on the need for open innovation. The primary objective of the mining hub is to advance the mining cluster through partnership.

The innovation hub acts as a management structure that oversees and coordinates activities. The organisation is a centre for excellence, coordinating research and development purposefully for future underground narrow-reef and hard-rock mining systems. The hub also aids in the development of South Africa's mining manufacturing, promoting the country's narrow-reef, hard-rock mines. It encourages exportation of locally manufactured mine equipment, and promotes skills development for future narrow-reef hard-rock mining systems.

Owing to the mining hub, major milestones have been achieved as a result of mechanisation. Remotely controlled equipment has been developed and critical

research areas have been identified to meet the needs in the mining sector. As such, mine life has been extended, employment preserved, and safety and health improved. Mines are also now capable of mining lower-grade orebodies and deeper resources. It is on record that full scale mechanisation and 24/7 operations could extend the mine life as much as 25 years (Chamber of Mines of South Africa, 2017a). At the centre of these developmental objectives is the intention to use the sector to achieve the 2030 NDGs of improving the life of South Africans to the level of their counterparts in the developed world. The attainment of these goals is a collective effort by all the major economic sectors in the economy.

3.7 Conclusion

The South African minerals policy, the mining charter, and other developmental initiatives play a key role in setting up guide lines on how activities are carried out in the mining sector, while ensuring that gains from the industry are optimised and benefits flow to all South Africans. They also provide frameworks on how the sector's objectives fit within the national, regional, and global mining objectives by identifying key areas within the mining sector. These initiatives have achieved significant strides in transforming the mining sector, towards achieving the desired objectives in the social, economic, political, and environmental domains in South Africa, and thus striving towards the long-term development plan. However, every indication shows that the country has not fully benefited from its mining sector despite these measures and initiatives that have been put in place, reflected through several human development indicators such as low per capita income, wide spread poverty, high unemployment rates, and high income inequality. These indicators signify that, despite all these initiatives put in place to optimise gains from the mining sector, benefits are yet to be fully realised.

4 EXAMINING MINING SECTOR'S CONTRIBUTION TO VALUE ADDED TOWARDS GROSS DOMESTIC PRODUCT AND EMPLOYMENT CREATION IN THE SOUTH AFRICAN ECONOMY

Historically, South Africa's mining sector has made huge contributions to the national economy in terms of revenue generation (in the form of taxes, royalties, and export earnings); FDI; infrastructural development; job creation; research, development, and innovation; and contributions to the national output. In fact, South Africa is estimated to have the world's fifth largest mining sector in terms of its contributions to GDP (Brand South Africa, 2012; GCIS, 2012).

The South African mining sector is commended for its strategic role in the economy. However, concerns have been raised that mining's contributions to value added towards GDP and employment creation in South Africa do not meet expectations given the abundance of resources in the country (Elbra, 2013). Critics hold that a large proportion of mineral wealth generated only benefits foreign-owned companies or investors who contribute very little towards local development. Much of the proceeds from the country's mineral wealth is repatriated (Elbra, 2013). However, there is growing pressure from different segments of the South African society to re-distribute proceeds from mineral wealth to benefit all citizens. This call continues to be a driving force behind the initiation of developmental measures to tackle issues of local participation and shareholding within the mining industry.

Studies have also shown mining's declining contribution both in absolute and relative terms to the South African economy over the years (Johannes and Farah, 2000). The decline is especially felt in terms of job loss, where unemployment stood at 27.7% in 2017, as well as high income inequality (Statistics South Africa, 2017). While South Africa's economy has been under a period of transformation over the past two decades (Johannes and Farah, 2000), transformation in the mineral sector could be viewed as a

natural process. In fact, South Africa's economy has been on a developmental trajectory, which fosters economic diversification over time. Many developmental measures have been initiated to optimise benefits from the mining sector to the national economy. This section therefore seeks to examine mining's contributions to value added to the GDP and employment creation in the South African economy over the period 1993 to 2015.

This section will therefore focus on examining two key areas:

- i. Trends in mining's contributions to South Africa's GDP from 1993 to 2015.
- ii. Trends in mining's contributions to employment creation in the South African economy from 1993 to 2015.

Although the mining sector makes large contributions to the South African economy (as discussed in chapter two) through revenue generation (in the form of taxes, royalties, and export earnings); FDI; infrastructural development; job creation; and research, development, and innovation, as well as its contribution to the national output, we will limit our analysis of mining's contributions to real value added to GDP and employment trends over the period 1993 to 2015.

The decision to limit our examination/analysis on mining's contributions to real value added to GDP and employment creation over the period under review is significant. These two contributing factors (real value added, or GDP, and employment creation) amongst others have the most immediate and direct welfare effect on the South African economy (Johannes and Farah, 2000). Any change in mining's contributions to GDP and employment levels will affect the other contributing factors. Moreover, the decision has been motivated by data availability.

4.1 Examining Mining Sector's Contributions to South Africa's Gross Domestic Product from 1993 to 2015

The South African mining sector has traditionally played a central role in contributing to real value added to the national economy. However, mining's overall contributions to South Africa's GDP has shown great variation over the years. These variations are

caused by many factors, ranging from socioeconomic to structural. For instance, adverse market factors that operate at either local or international levels negatively impact on the sector's ability to contribute significantly to the national economy. A good example of an international factor impacting negatively on the overall economy and the mining sector in particular is the global economic crisis of 2007/2008. The mining industry suffered from this crisis owing to the sharp decline in mineral commodity prices.

In order to obtain an in-depth understanding of mining's declining contributions to GDP over the years, this section will be structured in two main parts. Firstly, it examines mining's relative contributions to value added towards South Africa's GDP vis-à-vis other major economic sectors of the economy (such as agriculture, forestry, and fisheries; manufacturing; electricity, gas and water; services; and building, construction and other sectors). In the second part of the analysis, it pays attention to analysing the trends of the principal mining sectors' (PGMs, gold, coal, other metals ore, and other mining and quarrying) contributions to the mining share of South Africa's GDP over the period under review (1993 to 2015). Details of the decline in mining's contribution to the overall GDP will be underscored and possible reasons for such changes identified.

4.1.1 Major Economic Sectors' Contribution to GDP

Key economic sectors that contribute to the GDP of every economy include the agricultural, forestry, and fisheries sector; manufacturing sector; electricity, gas and water sector; services sector; and building, construction and other sectors. A change in the gross value added of any of these sectors affects the value of the overall GDP of the economy. In order to understand mining's relative contribution to the national economy, one needs to analyse its contribution vis-à-vis other major economic sectors of the national economy. Table 4.1 provides value added data per economic sector for all the major economic sectors that contributed towards the GDP of South Africa from 1993 to 2015.

Table 4.1: Contribution of major economic sectors (real gross value added) to South Africa's GDP from 1993 to 2015. Figures are in Rand billions constant 2010 prices

year	Agric, Forest & Fish	Total Mining	Total manufacturi ng	Elec, Gas & Water	services	Building , & others	GDP
1993	45.29	231.84	220.79	45.59	863.42	193.49	1600424.00
1994	49.04	233.76	227.52	48.41	890.19	203.26	1652184.00
1995	39.48	227.76	243.64	49.65	931.42	211.71	1703660.00
1996	49.26	227.30	248.56	55.35	975.50	221.06	1777032.00
1997	49.80	231.67	255.91	57.64	1001.42	227.64	1824067.00
1998	47.22	231.68	255.65	54.08	1021.70	223.16	1833504.00
1999	50.30	229.21	257.94	53.99	1063.41	221.90	1876740.00
2000	52.95	227.80	280.30	55.97	1110.32	227.37	1954710.00
2001	51.41	228.40	290.21	54.12	1151.70	232.34	2008181.00
2002	54.93	231.25	299.21	56.17	1200.07	240.21	2081837.00
2003	55.26	238.89	294.45	57.78	1247.99	248.87	2143232.00
2004	55.82	242.89	309.37	61.80	1307.25	263.71	2240847.00
2005	57.50	245.83	329.16	65.22	1380.69	280.69	2359099.00
2006	54.54	245.22	351.57	67.69	1470.95	301.32	2491295.00
2007	56.17	243.66	370.39	70.00	1561.30	323.32	2624840.00
2008	67.07	230.66	378.96	67.52	1627.71	336.67	2708600.00
2009	65.80	218.83	338.69	66.34	1639.63	337.65	2666939.00
2010	65.60	230.35	358.70	67.94	1676.81	348.61	2748008.00
2011	66.91	228.65	369.58	68.98	1744.99	359.14	2838258.00
2012	68.09	221.99	377.33	68.73	1798.10	366.83	2901076.00
2013	70.58	230.77	380.43	68.31	1842.75	380.45	2973292.00
2014	75.42	227.52	380.84	67.45	1884.20	388.40	3023826.00
2015	70.99	234.71	379.52	66.76	1915.20	395.91	3063101.00

Source: Chamber of Mines of South Africa, 2016b; Quantec, 2016; World Bank, 2017

From the above data set in table 4.1, table 4.2 is then derived by calculating the percentage contributions of the major economic sectors to South Africa's GDP from 1993 to 2015.

Table 4.2: Percentage contributions of major economic sectors to South Africa's GDP. Figures are in percentages and may not add up to 100% due to rounding

Year	Agric, Forest & Fish	Mining & Quarrying	Manu- facturing	Elec,Gas & Water	services	Building, & others
1993	2.83	14.49	13.80	2.85	53.95	12.09
1994	2.97	14.15	13.77	2.93	53.88	12.30
1995	2.32	13.37	14.30	2.91	54.67	12.43
1996	2.77	12.79	13.99	3.11	54.89	12.44
1997	2.73	12.70	14.03	3.16	54.90	12.48
1998	2.58	12.64	13.94	2.95	55.72	12.17
1999	2.68	12.21	13.74	2.88	56.66	11.82
2000	2.71	11.65	14.34	2.86	56.80	11.63
2001	2.56	11.37	14.45	2.69	57.35	11.57
2002	2.64	11.11	14.37	2.70	57.64	11.54
2003	2.58	11.15	13.74	2.70	58.23	11.61
2004	2.49	10.84	13.81	2.76	58.34	11.77
2005	2.44	10.42	13.95	2.76	58.53	11.90
2006	2.19	9.84	14.11	2.72	59.04	12.09
2007	2.14	9.28	14.11	2.67	59.48	12.32
2008	2.48	8.52	13.99	2.49	60.09	12.43
2009	2.47	8.21	12.70	2.49	61.48	12.66
2010	2.39	8.38	13.05	2.47	61.02	12.69
2011	2.36	8.06	13.02	2.43	61.48	12.65
2012	2.35	7.65	13.01	2.37	61.98	12.64
2013	2.37	7.76	12.80	2.30	61.98	12.80
2014	2.49	7.52	12.59	2.23	62.31	12.84
2015	2.32	7.66	12.39	2.18	62.53	12.93

Table 4.2 shows the percentage contributions of the major economic sectors to South Africa's GDP from 1993 to 2015. Values are calculated from the data in table 4.1 using the following formula:

$$\frac{\text{Real gross value of major economic sector per year}}{\text{Real GDP per year}} \times 100$$

For an in-depth description, we further derived different curves, as shown in figure 4.1, to clearly illustrate the trends in contributions of all the major economic sectors to GDP from 1993 to 2015.

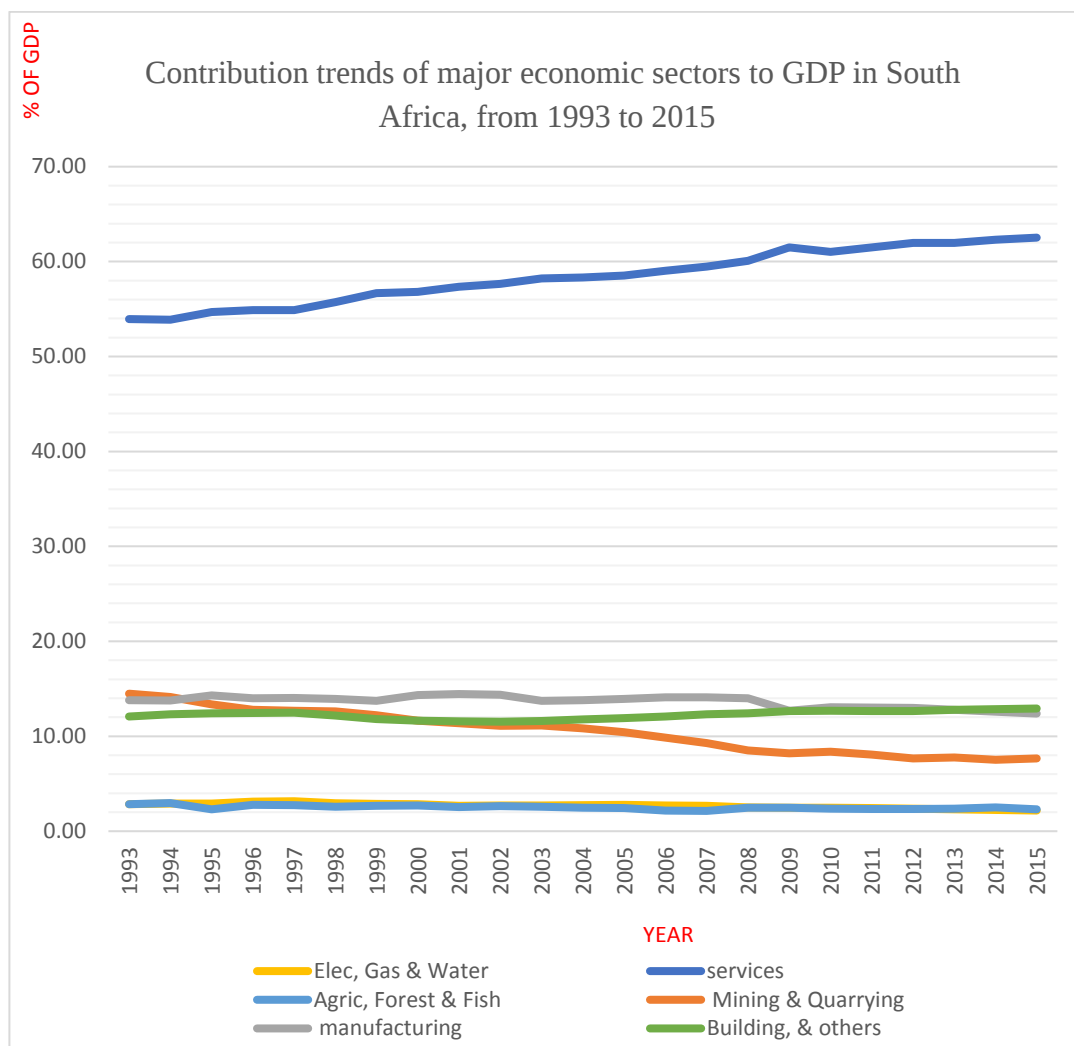


Figure 4.1: Contribution trends of major economic sectors to South Africa's GDP from 1993 to 2015

As shown in table 4.2, the service sector contributed the highest percentage of real gross value added to the overall GDP over the period under review. The agriculture, forestry and fisheries; electricity; gas and water; and building and other sectors showed a relatively stable contribution to the GDP over the period of this study. Mining and manufacturing, in contrast, showed declining contributions to GDP over the same period.

Over the period 1993 to 2015, the proportional contributions of the service sector to GDP increased significantly from a low of 53.95% in 1993 to a high of 62.53% in 2015,

thus providing a percentage increase of 15.90% to real GDP over the period under review. This increase is illustrated in figure 4.1 by the upward sloping “service” curve. However, growth in the service sector was achieved at the expense of mining and the manufacturing sectors. For instance, over the period 1993 to 2015, mining sector’s proportional contribution to South Africa’s GDP almost halved from 14.49% in 1993 to 7.52% in 2014, thus recording a percentage decrease of 48.10% to the GDP. This decline is due to the continual fall in value added of the gold mining sector to private sector GDP, which negatively affected mining’s overall contribution to the GDP. The strongest decrease in mining’s contribution to GDP was experienced during the period 2012 to 2015, which corresponded with the fall in commodity prices. The downward sloping “mining and quarrying” curve in figure 4.1 above clearly depicts this phenomenon.

In contrast, this period saw high investment spending in the mining sector compared to any other sectors of the economy. According to the Trade and Industrial Policy Strategies report (2015a), mining investment increased from around 7% of total investment in South Africa in 1994 to about 12% in 2015. In fact, annual investment growth in the mining sector between 1994 and 2014 averaged 7.2% compared to a decline of 4% in the previous decades (Trade and Industrial Policy Strategies, 2015a). The increase in investment growth in the mining sector owed to the falling commodity prices, which compelled mines to increase their annual production throughputs so as to cover the loss in revenue (Trade and Industrial Policy Strategies, 2015a). The investment spending was increased to ensure that mines remained operational during the global economic crisis.

The sharp decline in mining’s contribution during this period could equally be attributed to the strike action that affected the mining sector more than any other sector of the economy (Trade and Industrial Policy Strategies, 2015c). Moreover, the end of the commodity boom in 2011 that witnessed sharp fall in mineral commodity prices also contributed to the decline in mining’s contribution to value added towards the GDP.

The agriculture, forestry, and fisheries sector contributed the least to the GDP with the sector's lowest contribution of 2.14% in 2007 and highest of 2.97% in 1994. However, it showed quite stable values as shown by the flat curve in figure 4.1. In contrast, mining, manufacturing and the service sectors showed great changes over the period under review.

In all, the mining sector showed a sharp decline in its contributions to GDP from 1993 to 2015. In order to further break down and gain an in-depth understanding of the decline in value added contributions of the mining sector to South Africa's GDP over the period of this study, the study further examined the value added by the principal mining sectors (PGMs, gold, coal, other metals ore, and other mining and quarrying) to mining's share of the GDP. The next section therefore explores value added contributions of principal mining sectors to mining's share of GDP from 1993 to 2015.

4.1.2 Contribution of Principal Mining Sectors to Mining's Share of the GDP

In order to get an in-depth understanding of the declining relative and absolute contributions of the mining sector to South Africa's GDP, one needs to further examine the contributions of the principal mining sectors (PGMs, gold, coal, other metals ore, and other mining and quarrying) to mining's contributions to the overall GDP. Data on value added of the principal mining sectors' contributions to private sector GDP is provided in table 4.3.

Table 4.3: Data for principal mining sectors contribution to private sector GDP from 1993 to 2015. Figures are in Rand billions, 2010 constant prices

Year	Coal	Gold	PGMs	Other metal ores	Other mining	Total Mining
1993	36.73	115.08	35.28	35.74	30.14	231.84
1994	39.15	109.10	36.56	37.63	31.61	233.76
1995	40.83	100.15	36.04	40.15	29.85	227.76
1996	41.12	96.45	37.05	40.63	30.08	227.30
1997	43.67	94.61	38.50	41.69	30.21	231.67
1998	44.46	89.13	39.15	43.48	30.36	231.68
1999	44.06	86.27	42.40	39.87	28.65	229.21
2000	44.50	82.13	40.49	41.59	29.81	227.80
2001	44.10	75.64	44.79	40.84	29.49	228.40
2002	43.39	75.95	46.35	41.13	29.76	231.25
2003	46.77	71.64	51.99	41.83	31.31	238.89
2004	47.96	65.75	54.14	42.10	36.95	242.89
2005	48.32	57.17	59.35	43.66	39.10	245.83
2006	48.27	52.84	60.60	44.70	38.81	245.22
2007	49.01	49.07	59.55	46.60	39.43	243.66
2008	49.96	41.36	54.02	50.05	35.28	230.66
2009	49.41	38.46	53.16	50.12	27.69	218.83
2010	50.81	36.76	56.28	56.87	29.63	230.35
2011	49.66	35.13	56.58	59.49	27.79	228.65
2012	51.39	30.25	49.82	63.49	27.02	221.99
2013	51.00	31.14	51.75	68.14	28.87	230.77
2014	52.49	30.33	77.51	58.69	28.46	227.52
2015	50.04	28.08	94.14	39.47	28.62	234.71

Source: *Trade and Industrial Policy Strategies (2015a) Briefing Document*

Table 4.4 is then derived from the data set in table 4.3 by calculating the percentage contributions of all the principal mining sectors to mining's share of South Africa's gross domestic product from 1993 to 2015.

Table 4.4: Percentage of principal mining sectors' contribution to private sector GDP from 1993 to 2015. Figures are in percentages and may not add up to 100% due to rounding

Year	Coal	Gold	PGMs	Other metal ores	Other mining
1993	15.84	49.64	15.22	15.41	13.00
1994	16.75	46.67	15.64	16.10	13.52
1995	17.93	43.97	15.82	17.63	13.11
1996	18.09	42.43	16.30	17.88	13.23
1997	18.85	40.84	16.62	18.00	13.04
1998	19.19	38.47	16.90	18.77	13.10
1999	19.22	37.64	18.50	17.40	12.50
2000	19.53	36.05	17.78	18.26	13.08
2001	19.31	33.12	19.61	17.88	12.91
2002	18.76	32.84	20.04	17.78	12.87
2003	19.58	29.99	21.76	17.51	13.11
2004	19.74	27.07	22.29	17.33	15.21
2005	19.66	23.26	24.14	17.76	15.91
2006	19.69	21.55	24.71	18.23	15.83
2007	20.11	20.14	24.44	19.12	16.18
2008	21.66	17.93	23.42	21.70	15.30
2009	22.58	17.58	24.29	22.90	12.65
2010	22.06	15.96	24.43	24.69	12.86
2011	21.72	15.36	24.75	26.02	12.16
2012	23.15	13.63	22.44	28.60	12.17
2013	22.10	13.49	22.42	29.53	12.51
2014	23.07	13.33	22.30	28.79	12.51
2015	24.32	12.60	21.11	28.81	13.20

Table 4.4 shows the percentage contributions of the principal mining sectors to mining's share of the GDP from 1993 to 2015. The values are derived from table 4.3 using the following formula:

$$\frac{\text{Real gross value of principal sector per year}}{\text{Real gross mining's share of GDP per year}} \times 100$$

We further derived different curves in figure 4.2 below to clearly illustrate the trends in contributions of the principal mining sectors to mining's share of the overall GDP over the periods 1993 to 2015.

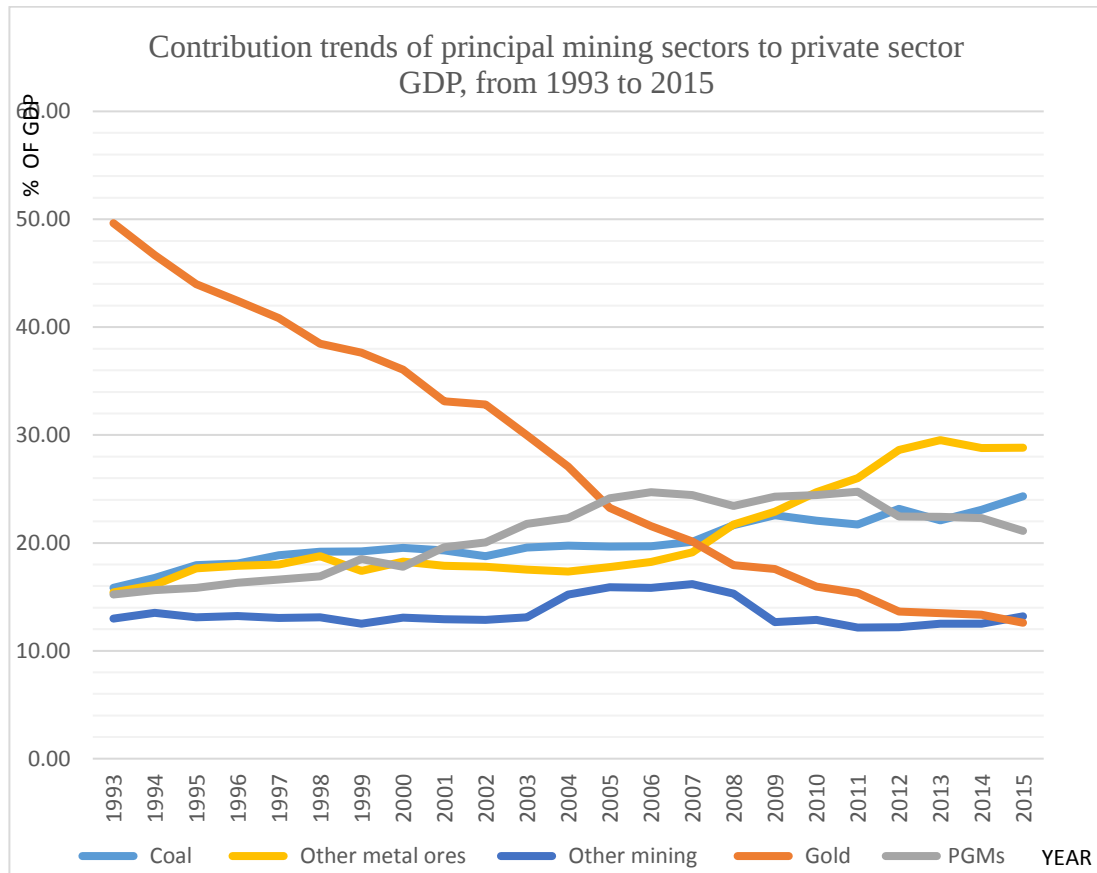


Figure 4.2: Contribution trends of the principal mining sectors to private sector GDP from 1993 to 2015

In order to obtain an in-depth understanding of the diminishing relative importance of the mining sector to the South African economy, we compiled table 4.4, which shows the proportional contributions of the principal mining sectors to mining's share of the GDP.

As shown in table 4.4, coal, PGMs, other metal ores (diamonds and iron ore), and other mining and quarrying sectors showed an increase in their percentage contributions to mining's share of South Africa's GDP over the period under review. During this period, contributions growth averaged 34.9% from coal sector, 31.7% from PGMs, 46.5%

from other metals ore (diamonds and iron ore), and 7% from other mining and quarrying. These findings are corroborated in figure 4.2 with the coal, PGMs, other metals ore, and other mining and quarrying curves sloping slightly upward.

PGMs showed a steady increase in its real value added to mining's share of the GDP. As shown in table 4.4, PGMs contribution to private sector GDP was 15.22% in 1993 and steadily increased to 21.11% in 2015, thus recording a percentage increase of 38.69% between the two years, illustrated by the upward sloping PGMs curve in figure 4.2. Over the period 1993 to 2011, PGMs' contributions to mining's share of the GDP as shown in table 4.3 increased significantly from R35.28 billion in 1993 (a percentage contribution of 15.22%) to R56.58 billion (a percentage contribution of 24.75%) in 2011, showing an increase in value added of R21.30 billion (percentage increase of 60.37%) to mining's share of the GDP over the period. However, PGMs' contributions to mining's share of the GDP dropped after the year 2011, from 24.75% in 2011 to 22.44% in 2012, to a low of 21.11% in 2015. This decline could be attributed to the strike actions in the country that particularly affected the platinum and the gold sectors. The decline could also be attributed to the fall in commodity prices after 2011.

Other metals ores, which include iron ore and diamonds, showed increasing contributions to mining's share of the GDP, from 15.41% in 1993 to 28.81% in 2015, giving a percentage increase of about 86.95%, due to the greater contributions of value added of iron ore over the years. The high demand for the minerals in emerging economies such as China and India led to an increase in the price of iron ore, and ultimately an increase in its value.

Other mining and quarrying recorded fluctuating contributions to mining's share of the GDP over the period of this study. It showed a stable contribution of around 13% in 1993 up to 1998, then dropped to 12.5% in 1999. The decline in contribution of this sector to the share of mining's contributions to GDP could be attributed to the decline in commodity prices, which affected output and possibly the sector's contribution to GDP. However, the sector showed its highest contributions to private sector GDP of 15.91% in the year 2005 and thereafter decreased to 15.3% by 2008. The periods from

2009 to 2015 recorded the lowest contribution value, of 12.2% on average, over the period to the share of mining's contribution towards GDP. This period corresponded with the 2007/2008 global economic crisis.

Another significant contribution was recorded in the coal mining sector: coal mining showed a tremendous increase in its value addition to private sector GDP over the period of this study. Standing at R36.73 billion in 1993 (a percentage contribution of 15.84%) it improved to R50.04 billion (a percentage contribution of 24.32%) in 2015. As shown in tables 4.3 and 4.4, coal surpassed gold mining as the second-highest contributor to private sector GDP in the year 2008. It contributed 21.66% as shown in table 4.4, while gold's contribution to value added dropped to 17.93%, as shown in table 4.4. Furthermore, coal overtook both the PGMs and gold mining sectors to become the biggest contributor to value added to mining's share of the GDP in 2014, recording a percentage contribution of 23.07%, while PGMs followed with 22.3%, and gold at third position with 13.33%, as shown in table 4.4.

The gold sector, which was the biggest contributor to the mining sector's share of GDP, with a total value of R115.08 billion (49.64%) in 1993, as shown in table 4.4, witnessed a steady decline in its contribution over the years to 12.6% by the year 2015. This drop could be attributed to structural factors such as the increasing depth of the gold mines, which affected productivity negatively. Yet despite the sharp decline of gold's contribution to private sector GDP, its contributions to mining's share of the GDP was the highest up until 2005, when the PGMs sector took as the highest commodity contributor to private sector GDP. Thereafter, gold mining showed a steady decline in its contributions to value added to private sector GDP, to a low of 12.6% by 2015.

In line with the above analysis, our finding shows that the overall decline in mining's proportional contributions to value added towards GDP in the South African economy during the period 1993 to 2015 is chiefly linked with the decline in gold sector's contribution to mining's share of the GDP. The analysis also identifies a profound shift in mining's structure during the period of the study, with gold giving way to other commodities such as PGMs, coal, and iron ore in terms of their share of contributions

to value added to the GDP. The other principal mining sectors marginally increased their share of contribution to GDP over the period of this study. Though gold's contributions to private sector GDP recorded a significant decline over the period, it still remains a significant contributor to mining's share of GDP in South Africa. The overall decline in mining's share of value added contribution to GDP impacts greatly on mining's contribution in other key areas such as employment creation over the same period. The next section therefore examines mining's contributions to the labour market in South Africa from 1993 to 2015.

4.2 Employment Trends in the South African Mining Sector

This section sets out to examine trends in mining's contribution to formal employment in the South African economy from 1993 to 2015. In order to obtain an in-depth understanding of mining sector's contributions to the labour market in South Africa, the section will be broken down into two main parts. Firstly, it briefly looks at mining's contribution to formal employment vis-à-vis other major economic sectors in the South African economy, including agriculture, forestry, and fisheries; manufacturing; electricity, gas and water; services; and building, construction and other sectors. The second part of the section addresses the principal mining sectors' (including PGMs, gold, coal, other metal ores, and other mining and quarrying) contribution to total formal employment in the overall mining sector. One then concludes by proposing possible reasons for the changes in mining employment levels during the period under review.

4.3 Employment in Major Economic Sectors

This section sets out to examine formal employment levels in the mining sector vis-à-vis other key economic sectors described above in the South African economy from 1993 to 2015. Any major change in employment creation in any of these sectors affects the level of unemployment rates in the economy. Key factors that generally affect a sector's contribution to the level of employment in the economy include, amongst others: remuneration, skill levels, and demand for the commodities, union action, and strike action. The primary and manufacturing sectors were affected more than the other

sectors of the economy by the global economic crises and the strike action in 2012. In order to understand mining's relative contribution to employment creation in the national economy, one needs to analyse its contributions vis-à-vis other major economic sectors of the economy. Table 4.5 provides the necessary data in that regard.

Table 4.5: Formal employment by major economic sectors in South Africa from 1993 to 2015

Year	Agric., Forest & Fish	Total Mining	Total manufacturing	Elec., Gas & Water	Services	Building & Others	Total
1993	1,370,372	620,999	1,516,312	51,052	6,184,143	2,871,284	12,614,162
1994	1,368,149	611,014	1,499,010	47,977	6,193,452	2,931,801	12,651,403
1995	1,364,940	598,846	1,516,776	47,574	6,236,717	2,999,195	12,764,048
1996	1,358,951	572,063	1,561,389	48,002	6,394,339	2,979,399	12,914,143
1997	1,347,991	553,545	1,493,190	47,490	6,497,351	2,984,321	12,923,888
1998	1,333,563	471,824	1,423,797	49,838	6,580,390	2,901,199	12,760,611
1999	1,316,887	436,471	1,381,864	50,958	6,729,259	2,773,617	12,689,056
2000	1,296,955	417,568	1,346,849	47,665	6,754,678	2,697,318	12,561,033
2001	1,275,112	406,977	1,317,791	47,127	6,731,752	2,291,257	12,070,016
2002	1,502,676	415,972	1,322,278	46,484	6,906,878	1,759,976	11,954,264
2003	1,305,724	435,628	1,319,476	43,381	7,070,449	2,042,536	12,217,194
2004	1,217,419	448,907	1,336,693	44,442	7,243,895	2,246,064	12,537,420
2005	1,085,242	444,136	1,353,155	46,472	7,283,964	2,631,010	12,843,979
2006	1,246,465	456,336	1,367,296	47,464	7,484,884	2,796,364	13,398,809
2007	1,100,188	495,147	1,355,828	49,883	7,739,657	3,060,295	13,800,998
2008	818,618	518,731	1,333,591	53,091	7,965,737	3,888,926	14,578,694
2009	714,655	491,788	1,243,058	53,464	7,837,262	3,846,447	14,186,674
2010	665,295	498,889	1,199,415	56,153	7,775,713	3,587,274	13,782,739
2011	644,143	512,882	1,183,810	58,178	7,916,436	3,748,306	14,063,755
2012	696,254	524,641	1,179,322	60,308	8,026,864	3,932,571	14,419,960
2013	739,961	510,105	1,179,830	60,647	8,116,449	4,253,954	14,860,946
2014	701,510	495,580	1,159,632	59,886	8,186,591	4,537,698	15,140,897
2015	879,560	481,992	1,153,419	59,666	8,232,301	4,928,449	15,735,387

Source: Chamber of Mines, 2016b; Quantec, 2017

Again, to get an in-depth understanding, Table 4.6 is derived to illustrate changes in percentage contributions of the major economic sectors to employment generation in South Africa over the period under review.

Table 4.6: Major economic sector's formal employment calculated as percentage of total formal employment from 1993 to 2015. Figures are in percentages and may not add up to 100% due to rounding up

Years	Agric., Forest & Fish	Mining & Quarrying	Manu- facturing	Elec., Gas & Water	Services	Building & Others
1993	10.86	4.92	12.02	0.40	49.03	22.76
1994	10.81	4.83	11.85	0.38	48.95	23.17
1995	10.69	4.69	11.88	0.37	48.86	23.50
1996	10.52	4.43	12.09	0.37	49.51	23.07
1997	10.43	4.28	11.55	0.37	50.27	23.09
1998	10.45	3.70	11.16	0.39	51.57	22.74
1999	10.38	3.44	10.89	0.40	53.03	21.86
2000	10.33	3.32	10.72	0.38	53.77	21.47
2001	10.56	3.37	10.92	0.39	55.77	18.98
2002	12.57	3.48	11.06	0.39	57.78	14.72
2003	10.69	3.57	10.80	0.36	57.87	16.72
2004	9.71	3.58	10.66	0.35	57.78	17.91
2005	8.45	3.46	10.54	0.36	56.71	20.48
2006	9.30	3.41	10.20	0.35	55.86	20.87
2007	7.97	3.59	9.82	0.36	56.08	22.17
2008	5.62	3.56	9.15	0.36	54.64	26.68
2009	5.04	3.47	8.76	0.38	55.24	27.11
2010	4.83	3.62	8.70	0.41	56.42	26.03
2011	4.58	3.65	8.42	0.41	56.29	26.65
2012	4.83	3.64	8.18	0.42	55.66	27.27
2013	4.98	3.43	7.94	0.41	54.62	28.63
2014	4.63	3.27	7.66	0.40	54.07	29.97
2015	5.59	3.06	7.33	0.38	52.32	31.32

Table 4.6 shows percentage share of major economic sectors to total formal employment number in the South African economy from 1993 to 2015. The values are derived from table 4.5 through the following formula:

$$\frac{\text{Total formal employment per sector a year}}{\text{Total formal employment in South Africa per year}} \times 100$$

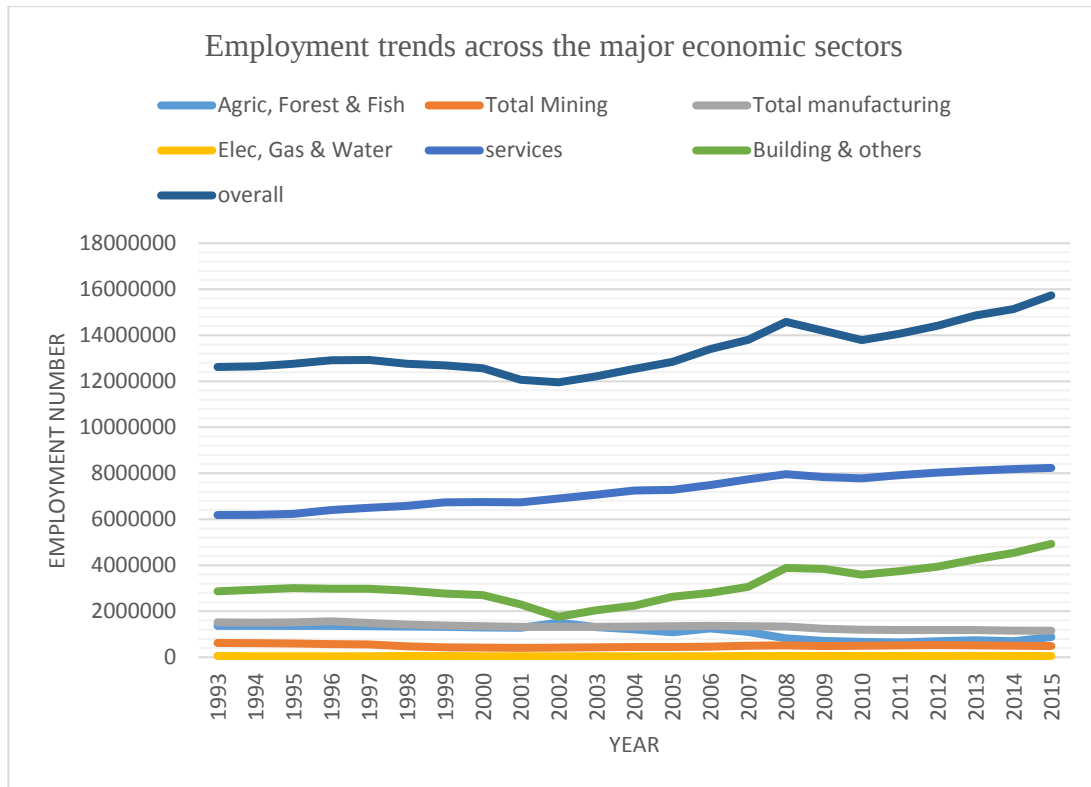


Figure 4.3: Formal employment trends of major economic sectors from 1993 to 2015

As shown in tables 4.5 and 4.6, it is clear that the agriculture, fisheries and forestry, manufacturing, and mining sectors all showed declining contributions to formal employment generation in the South African economy over the period of this study. Electricity, gas, and water recorded a stable contribution to labour usage, while the services, building and other sectors made major strides in their contributions to formal labour employment in the South African labour market. For instance, the service sector contributed 49.3% of total formal employment in 1993 and gradually increased its share to 54.62% by 2013, thus showing a percentage increase of 10.79% over the years. This increase is illustrated by the upward sloping “service” curve in figure 4.2 above.

However, improvement in the service sector's contributions to employment creation is at the expense of the mining and manufacturing sectors.

Mining employed 4.92% of formal labour force in 1993. After various fluctuations, it decreased to 3.06% by the year 2015. Over the period 1993 to 1997, formal employment in the mining sector was stable at an average of around 4.6% and later declined to 3.7% from 1998, and to 3.06% in 2015. In order to understand the details of this decline, we now focus our analysis on the principal mining sector's share of formal employment in the South African economy over the period under review.

4.3.1 Principal Mining Sector's Contribution to Formal Employment Numbers in the South African Economy

To unpack reasons for the continual decline in the mining sector's contributions to employment levels in the formal labour market, we further examine contributions of the principal mining sectors (PGMs, gold, coal, other metals ore, and other mining and quarrying) to total mining's share of formal employment in the economy. It is evident that contributions of the principal mining sectors to formal employment level vary significantly during the period under study, as shown in table 4.7.

Table 4.7: Formal employment numbers by principal mining sectors in the labour market from 1993 to 2015

Year	Coal	Gold	PGMs	Other Metal Ores	Other Mining and Quarrying	Overall Mining sector
1993	61,438	395,419	102,809	20,927	39,405	620,999
1994	60,187	392,327	97,643	21,913	36,475	611,014
1995	62,064	380,086	91,528	21,659	41,365	598,846
1996	63,397	352,039	93,304	21,728	40,959	572,063
1997	61,607	339,078	90,876	21,218	39,816	553,545
1998	60,309	263,869	89,781	19,662	37,325	471,824
1999	55,378	234,206	91,269	20,386	34,969	436,471
2000	51,346	216,982	96,273	20,037	32,602	417,568
2001	50,740	201,673	99,575	21,316	33,692	406,977
2002	47,469	199,378	111,419	21,735	35,987	415,972
2003	47,239	198,465	127,672	23,910	38,341	435,628
2004	50,327	179,964	150,630	28,328	39,660	448,907
2005	56,971	160,634	155,034	29,526	41,967	444,136
2006	57,778	159,782	168,530	28,545	41,702	456,336
2007	60,439	166,063	186,411	33,329	48,908	495,147
2008	65,484	166,424	199,948	31,730	55,143	518,731
2009	70,791	159,925	184,163	25,329	51,586	491,788
2010	74,025	157,019	181,969	29,684	56,209	498,889
2011	78,579	144,799	194,745	34,407	60,348	512,882
2012	83,244	142,201	197,752	35,713	65,963	524,641
2013	87,768	131,591	191,261	34,692	64,787	510,105
2014	86,106	119,007	186,864	86,106	21,794	495,580
2015	77,773	115,055	172,444	77,773	20,760	481,992

Source: Chamber of Mines of South Africa, 2016b; Quantec, 2017

From table 4.7 we derived Table 4.8 to show changes in percentage contributions of the principal mining sectors to formal employment generation in South Africa over the period under review.

Table 4.8: Principal mining sector's formal employment calculated as percentage of total formal mining's employment from 1993 to 2015. Figures are in percentages and may not add up to 100% due to rounding up

Year	Coal	Gold	PGMs	Other Metal Ores	Other Mining and Quarrying
1993	9.89	63.67	16.56	3.37	6.35
1994	9.85	64.21	15.98	3.59	5.97
1995	10.36	63.47	15.28	3.62	6.91
1996	11.08	61.54	16.31	3.80	7.16
1997	11.13	61.26	16.42	3.83	7.19
1998	12.78	55.93	19.03	4.17	7.91
1999	12.69	53.66	20.91	4.67	8.01
2000	12.30	51.96	23.06	4.80	7.81
2001	12.47	49.55	24.47	5.24	8.28
2002	11.41	47.93	26.79	5.23	8.65
2003	10.84	45.56	29.31	5.49	8.80
2004	11.21	40.09	33.55	6.31	8.83
2005	12.83	36.17	34.91	6.65	9.45
2006	12.66	35.01	36.93	6.26	9.14
2007	12.21	33.54	37.65	6.73	9.88
2008	12.62	32.08	38.55	6.12	10.63
2009	14.39	32.52	37.45	5.15	10.49
2010	14.84	31.47	36.47	5.95	11.27
2011	15.32	28.23	37.97	6.71	11.77
2012	15.87	27.10	37.69	6.81	12.57
2013	17.21	25.80	37.49	6.80	12.70
2014	17.37	24.01	37.71	7.00	13.90
2015	16.14	23.87	35.78	8.54	15.71

Table 4.8 shows the percentage share of principal mining sectors to total formal employment number in the South African economy from 1993 to 2015. The values are calculated from table 4.7 using the following formula:

$$\frac{\text{formal employment per principal mining sector a year}}{\text{formal employment in the whole mining sector per year}} \times 100$$

To further illustrate the trends in the principal mining sectors' contributions to mining's share of the labour market, we developed different curves to show contribution trends over time:

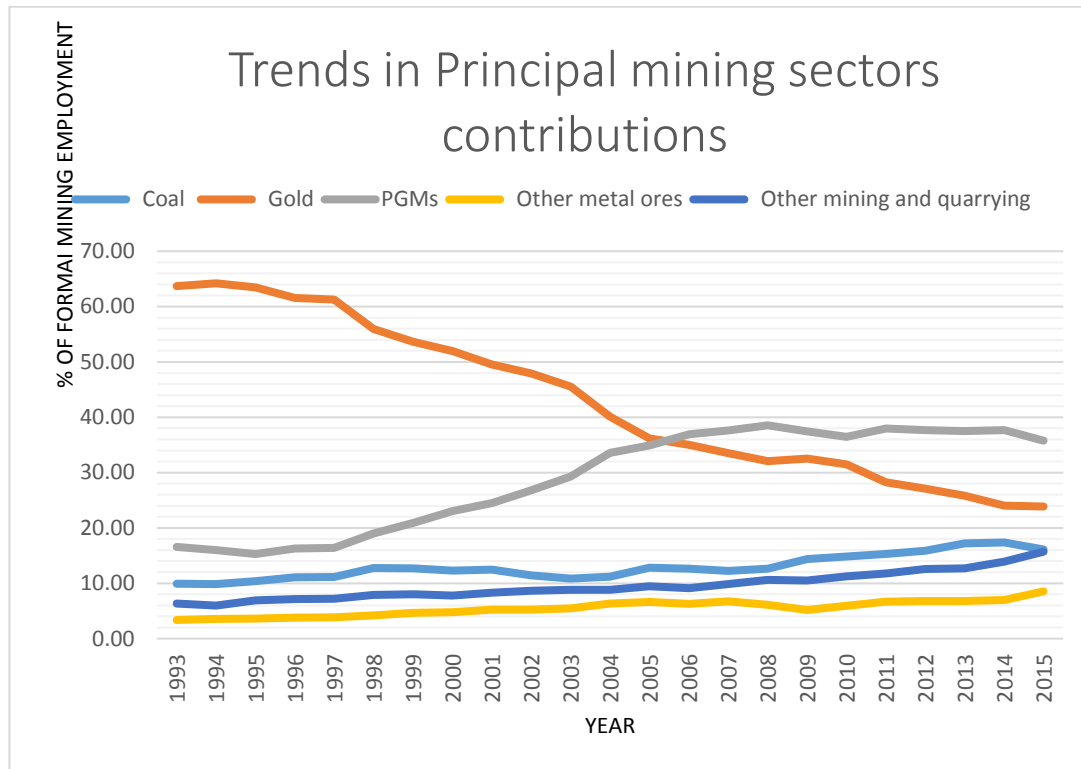


Figure 4.4: Trends in the principal mining sector contribution to total mining sector employment from 1993 to 2015

As shown in tables 4.7 and 4.8, formal employment figures improved in all the principal mining sectors over the period of this study except for the gold mining sector. Gold mining sector showed a steady decline in formal employment generation over the period under review. For instance, formal employment number in the gold mining sector stood at 395,419 in 1993 (representing 63.67% of overall mining sector's formal employment) and declined to 115,055 by 2015 (representing 23.87% of total formal mining employment), thus showing a percentage decrease of 62.51% of formal employment between 1993 and 2015. The highest decline in gold mining's formal

employment was experienced over the period 2011 to 2015, with formal employment numbers at 144,799 and 115,055, respectively.

Despite the steady decline in gold sector's contributions to formal employment numbers in the mining industry, this sector remained top in terms of employee numbers in the mining sector up until 2006, when the PGMs sector took over, employing 36.93% of the total formal workforce in the mining sector. However, the gold mining sector recorded its highest contribution of 64.21% of the total formal employment in the mining industry in 1994. Although employment number in the PGMs sector dropped from 197,752 in 2012 to 172,444 in 2015, PGMs remained the highest employer of formal labour by the year 2015 in the mining industry.

It is worth noting that changes in formal employment creation in the principal mining sectors corroborate with changes in real outputs over the period under review. Coal, PGMs, other metal ores, and other mining and quarrying have all showed improvements in their contributions to employment numbers over the period of this study, owing to changes in real value added in these subsectors.

4.4 Conclusion

This section examined mining's contributions to the South African economy over the period 1993 to 2015. Although mining's contributions to the economy cuts across many areas, this section focuses its attention only on the examination of two important contributing factors: real value added towards GDP and employment creation. The decision to limit the examination/analysis to these factors was based on the fact that these factors, amongst others, have the most immediate and direct welfare effect on the South African economy. The study found a declining trend in mining's contribution both in absolute and relative terms to value added towards GDP and employment creation in South Africa over the period under review. The next chapter summarises the major findings of this analysis and proposes ways through which mining's contribution to the South African economy can be optimised.

5 RESEARCH FINDINGS AND DISCUSSION

This study carried out qualitative research examining mining's contribution to the South African national economy. Key trends in mining's contributions to real value added towards GDP and the employment trends from 1993 to 2015 were assessed, because changes in value added and employment trends in turn have significant impacts on the mining sector's contribution to revenue generation, procurement from local industry by mining producers, infrastructure, and human settlement. These two variables (GDP and employment) were selected owing to their immediate effect on the South African economy. Data for gross value added and employment numbers were obtained from credible sources such as the Chamber of Mines of South Africa's website, Quantec's website, Statistics South Africa's website, and the World Bank's website. The following observations were made.

5.1 Research Findings

To sum up from the above analysis, the following important findings can be established:

- The declining contribution of the mining sector to GDP and employment creation in the South African economy must be sectorally differentiated. The declining importance of mining in the economy is due to a fall in mining's largest sector, the gold mining sector. Declining importance of the gold mining sector is associated with the maturation of the sector. However, gold mining in particular and the mining industry in general remain major contributors to the economy.
- The study found a profound shift in mining's structure in the past 15 to 20 years, with the gold sector giving way to the platinum and coal sectors in terms of their contributions to value added to the GDP.
- Evidence emerges that total mining production in terms of volume remained almost stable from 1994 to 2014. Within total mining production, gold

production fell steadily, while PGMs, coal, iron ore, and other minerals often increased rapidly; however, this growth has shown strong cyclical behaviour over the years.

- The value of total mining production increased owing to the rise in the international commodity prices from 2002 to 2011 when the global commodity boom ended. This phenomenon explains the sharp decline in mining sector's contribution to value added to GDP after 2011.
- The decline in gold's contributions is largely associated with structural factors rather than changes in gold price. It is difficult to conclude that the declining contribution of the gold mining sector to mining's share of the GDP is totally attributed to price changes in the sector. This is because gold price showed both sharp increases and decreases in US dollar terms over the period of this study. Thus, gold price does not provide a convincing argument to the fall in gold sector's contribution to GDP. Moreover, other principal mining sectors marginally increased their relative contribution of private sector GDP over the same period.
- Employment in the mining sector grew owing to the expansion of the coal and platinum sectors that off-set huge job losses in the gold mining sector.
- Commodity prices highly impact upon the mining sector's ability to contribute to the national economy. The sharp fall in prices of mining commodities from 2012 led to decrease in real value added and the loss of many jobs in the mining sector.
- Mining's contribution to real value added and employment creation improved significantly during the boom period, which was marked by high demand for mineral commodities, translating to high commodity prices and thus an increase in output and employment.
- Change in real wages played a key role in determining the level of employment in the mining sector. A study conducted by Trade and Industrial Policy Strategies (2015) revealed that real wages more than doubled between 1994 and 2014 in the gold mining sector, without a corresponding increase in labour

productivity. This situation greatly affected the value added generated from the gold mining sector.

- Apart from the high real wages, the platinum and the gold sectors faced more strike actions than the other sectors of the economy. According to the Department of Labour annual strike statistics, as summarised in Trade and Industrial Policy Strategies (2015c), strike actions in the gold and platinum sectors were more severe than in any other metal sectors and involved a high percentage of workers. Between 2011 and 2013, about half of gold mining workers and approximately a quarter of other metals miners participated in the strike. The strike escalated in the platinum sector, where 34 mine workers were killed. All these actions impacted negatively on the output of these sectors.
- The mining sector declined significantly in terms of its contributions to gross domestic product and as employer in relation to other sectors of the economy. The declining importance of the mining sector as an employer in the economy is mirrored through the decline in its gross output over the period under review, and the output trend in the mining industry partially explains the declining employment trend in the mining industry. Such job losses are believed to have greatly affected unskilled workers in the economy (Johannes and Farah, 2000).
- There is a more dramatic decrease in the share of mining's contribution to the national output than in mining's contribution to total formal employment in the country.
- According to Trade and Industrial Policy Strategies (2015c), real labour cost for all the principal mining sectors showed strong negative correlation with employment numbers in the mining industry. In fact, increases in real labour productivity are not enough to warrant increases in real labour cost experienced in the mining sector, and have equally not been justified by increased skill mix of the mining industry's labour force.

To sum up, it should be recalled that the overall decline in mining's contributions to the real value added towards GDP and employment creation have significant and

indirect negative effects on mining's contribution to tax revenues, foreign earnings, FDI, and so forth. The role of major developmental initiatives in the mining sector need to be enhanced. The next section discusses possible ways in which mining's contributions to the economy could be optimised.

5.2 Discussion

In line with the above findings, this section sets out to discuss possible ways in which mining's contributions to the South African economy can be optimised. Revenue generated from the mining industry can help the economy to attain greater diversification. However, in order to maximise benefits created in the national economy by the mining sector, South Africa has to overcome major obstacles that hinder the development of the mining industry.

Generally, the development of new strategies and technologies enhance the competitiveness of any sector of the economy, and the South African mining sector is no exception. Developmental strategies and technological advancements benefit every component along the mining value chain. This includes exploration, mining, mineral processing, beneficiation or value addition, and environmental and health and safety issues. Collaboration, development, and technology advancement will go a long way towards improving the competitiveness of South Africa's mining sector. In this light, different developmental measures such as mine modernisation through mechanisation, enhancement of economic linkages, beneficiation of mineral raw material, and promotion of research and development along the mining value chain are positive initiatives to overcome these challenges.

5.2.1 Mining Technique

For over 100 years, mining in South Africa has been labour intensive, with the use of manual drilling techniques specifically in gold, platinum, and chrome narrow-reef, hard-rock mining with blasting and cleaning on a stop-start basis (Chamber of Mines of South Africa, 2017a). As a result, output has decreased, and costs have escalated. The use of labour-intensive methods in deep underground mines such as gold mines create safety issues for mine workers and decrease productivity. Although South

Africa's mining companies put measures in place to curb underground accidents (Chamber of Mines of South Africa, 2017a), these measures are often costly and negatively affect productivity. South Africa has fallen to the seventh position after many decades as the world's top producer of gold.

Also affecting output and cost is the fact that most of these deep-level underground mines of about 4km below the surface are old, sometimes with travel time of up to four hours through tunnels to the working face. With increasing mine depth, major challenges exist such as health and safety issues, contraction in the actual drill time at the work face, and the common occurrence of seismic events (Chamber of Mines of South Africa, 2017a). These operational inefficiencies in minerals exploitation affects profit margins, thereby influencing the mine's ability to pay wages to its workers and shortening the life of mines. All these factors negatively affect the mining sector's ability to create new jobs or maintain employees. The need for a more advanced mining technique in South Africa's mines is pressing.

Without a shift from the conventional mining methods characterised by out-dated mining techniques, the South African mining industry in general and the gold, platinum, and chrome sectors in particular will fail to exploit deep-level complex orebodies profitably. Ultimately, this may cause premature mine closures, thus more job losses and sterilisation of resources. With an ever-increasing production cost (around 8% yearly) and the gold price steady at around \$1,250 an ounce for over the past four years (Crowley, 2017), the need for mine modernisation through mechanisation is unquestionable. According to Singh (2016), mine modernisation through mechanisation and automation, and also via fully autonomous operations, will bring about positive results, processes, skill sets, technologies, and social and environmental impacts linked to the current mining practices. Mine modernisation offers a robust solution to the above-mentioned drawbacks in the South African mining industry. As stated by the South African Chamber of Mines,

“A study drawing on South Africa's three principal gold companies- AngloGold Ashanti, Harmony and Sibanye-

indicates that, for one mine, every 1g/t reduction in the cut-off grade would result in 10Mt of additional ore containing 200t of gold to be mined over the operation's extended life."

(Chamber of Mines of South Africa, 2017a:p6)

The above assertion confirms the gains that flow from mine modernisation and a functioning 24/7 mechanised mining technique. Such modernisation across the entire gold mining sector will yield enormous gains. It will also extend the life of mines, and, as a result, South African gold mines will operate profitably beyond 2045. In contrast, conventional mining methods will lead to sharp decline in the gold mining sector. With conventional method, the gold mines can only operate up to 2020, and the overall mining sector will cease its contributions by 2033 (Chamber of Mines of South Africa, 2017a). Figures 5.1 and 5.2 illustrate these scenarios.

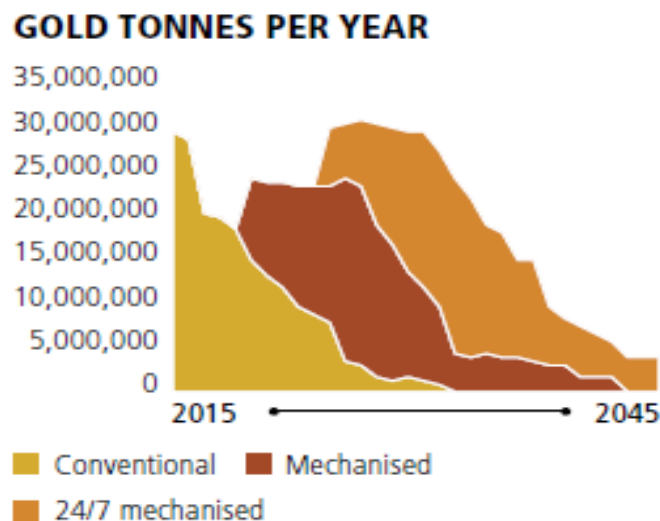


Figure 5.1: Gold in tonnes per year

Source: Adapted from the Chamber of Mines (2017a)

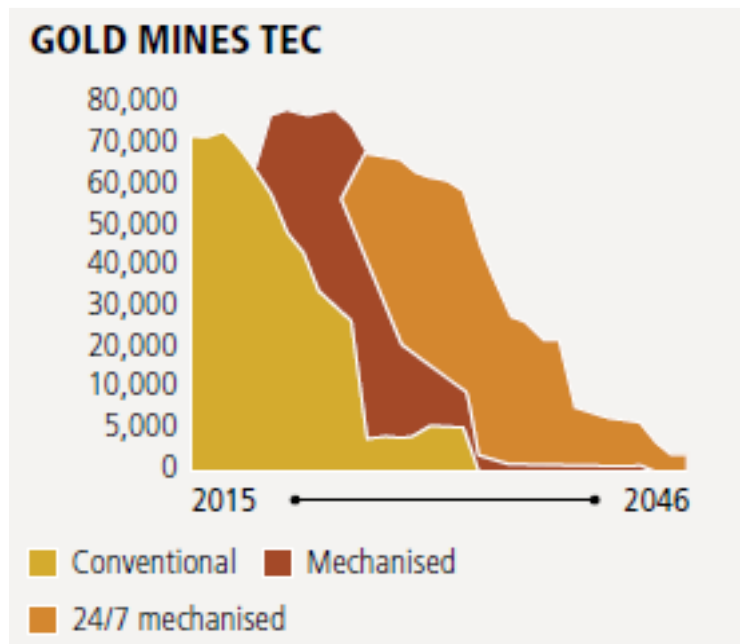


Figure 5.2: Gold mine techniques

Source: Adapted from the Chamber of Mines (2017a)

Figures 5.1 and 5.2 are practical cases that represent the different gold mining techniques and the corresponding gold output produced per tonne per year. Figure 5.1 shows that the use of conventional mining method in gold mining operations will cease in South Africa by 2020. Figure 5.2 confirms a decrease in output per tonne of gold produced with the use of conventional mining techniques. The figures also indicate how mechanisation will increase both outputs per tonne annually and extend the life of mines beyond 2045 in the gold mining sector.

To summarise, mine modernisation will achieve positive results, such as extending the life of mines; enhancing worker's skills and preserving jobs in the mining sector; creating a safer and healthier working environment; creating 24/7 mechanised operations that allows exploitation of ores at lower cut-off grades; and facilitating the mining of lower grades, as well as resources at a deeper depth (Chamber of Mines of South Africa, 2017a). All these results will go a long way towards improving the mines' productivity and the gold sector's contribution to value added to GDP in the South African economy.

Having discussed the advantages that stem from mechanisation, the attainment of this significant improvement in mining methodology requires collective efforts and collaboration from all stakeholders, including researchers and developers, the mining industry, equipment manufacturers, and the government. However, although such gains could be realised from mechanisation, not all mining operations are suitable for mechanisation, thus research is needed to improve existing conventional operations.

Plans are in place towards attaining this goal. Key products, technologies, infrastructures, and people have been identified, with remote-controlled equipment to be in place by 2020 (Chamber of Mines of South Africa, 2017a). A 24/7 mechanised mining system that operates without explosives is projected to be fully operational by 2025. In addition, a strong partnership between the public and private sector to fast-track the modernisation process is currently in place. All major stakeholders are to fully co-operate in the sharing of skills and knowledge for the common good. Towards these ends, mining companies have over the past years spent R0.5 billion on an annual basis and a mining hub has been established to co-ordinate activities that lead to mine modernisation (Chamber of Mines of South Africa, 2017a).

5.2.2 Research and Development

As illustrated above, South Africa's mining sector faces a spectrum of technological challenges, and, as a result, output has declined with relatively higher production cost in the mining sector in general and gold mining in particular. There is also an urgent need for a cutting-edge technology to decrease production cost and improve mines' productivity, thus improving the mining sector's contribution to value added towards GDP and employment creation in the national economy.

The need for mining research and development is undisputed, although key stakeholders put forward different elements of the debate. It is undoubtedly true that the global rate of research and development and mechanisation in the past two decades has gathered momentum since the end of the commodity boom and the global financial crisis. Drivers of enhanced mining research and development in the South African mining sector include the need to:

- achieve zero harm;
- improve productivity;
- reduce operating costs;
- extend life of mines;
- rehabilitate the environment; and
- Address the shortage of skilled personnel, especially at the technician and artisan levels.

In order to realise South Africa's full potential in terms of its mineral wealth, the nation needs to improve its innovation through research and development. That is, there is a need for a shift from a resource-based to a knowledge-based economy. The significance of innovations to enhance the competitiveness of the mining sector is determined by the continuity, level, and quality of such innovation along the mining value chain. However, research and development in the South African economy in general and the mining sector in particular has not received the much-needed attention as required in the past two decades. To remain sustainable, productive, and competitive in this ever-changing and highly global competitive market, the South African mining industry in general and the gold and platinum sectors in particular must innovate and use new and efficient mechanised technologies.

According to a study carried out by Khan (2009), South Africa spends relatively less on research and development than other nations. Khan explains that South Africa spent about R22 billion in the 2011/2012, setting aside 0.76% of the GDP for research. Yet an average of 1.77% is spent by the other BRICS countries (Brazil, Russia, India and China). South Africa needs to increase spending on research and development, especially in the mining sector. In this light, both the government and private sectors have the obligation to:

- provide sufficient funds to research and develop new technologies to solve the ever-increasing structural challenges in the mining industry;

- support and encourage the mining sector to carry out research and development on new technologies;
- support the mining sector in the application of new technologies; and
- Facilitate the development of fundamental and applied knowledge through a collaborative system between private and public research institutions.

Research and development should be needs-driven and linked to developing solutions along the mining value chain, which include:

5.2.2.1 Exploration

There is an urgent need for the geoscientific database to be upgraded, along with that of higher density mapping. The Council for Geoscience thus requires sufficient funds.

5.2.2.2 Extraction of resources

A large number of South Africa's mineral resources cannot be efficiently extracted using the existing level of technologies. Moreover, there has been inadequate investment in research and development by both the state and the private sector in this regard, which has facilitated the exhaustion of mineable reserves, especially in the gold sector. The development of new extraction technologies and investment in new mining systems is urgently required.

5.2.2.3 Processing and beneficiation

The level of beneficiation, given the amount of mineral resources, is said to be very low. The high rate of export of specific mining commodities is under threat as customers seek to divert their sources of supply and develop alternative inputs. Moreover, competition from low-cost suppliers put some commodities under serious threat. An important example is that of low-cost iron ore supply by Australian producers. Thus, there is an urgent need to develop new technologies that will help mining companies to effectively beneficiate their outputs for both national and global markets.

Research and development along the mining value chain are required to provide mining operations with viable solutions that are safer, cost-effective, and more efficient. Doing

so will help translate South Africa's comparative advantage lying in its possession of mineral resources into a more reliable, sustainable, and globally competitive advantages. The mining research and development strategy for South Africa's mining industry should be guided by the vision to

“Maximize the returns of the South Africa's mineral wealth through collaborative, sustainable research, development and innovation of mining technologies in a socially, environmentally and financially acceptable manner that is rooted in the wellbeing of local communities and the national economy.” Singh (2016:p6)

Although innovative measures have been developed by established research institutions and mining houses, they need to conform to the comprehensive science and technology policy that addresses the country's need. Both the government and the private sectors need to undertake and promote research and technological development and transfers that enhance the country's resources in the long term and ensure its competitiveness. However, for research goals to be fully achieved, the state's undertaken research should be user influenced and complement private sector activity. Moreover, coordinated research on applied economic geology should be encouraged in order to attract new exploration companies to South Africa.

5.3 Value Addition (Beneficiation)

Beneficiation is the term used to describe the successive processes of a wide range of activities of adding value to mineral raw materials from the extraction stage through to the sale of finished products to consumer. According to Zonwabele (2015), three broad categories of beneficiation exist: downstream beneficiation (large scale capital intensive operations such as smelting and refinery as well as labour-intensive activities such as craft jewellery); upstream beneficiation (factor inputs into the value chain such as mining capital goods and services, consumables); and side-stream beneficiation

(knowledge, transports, water and energy infrastructure) (Mungoshi, 2011; Department of Minerals and Energy, 1998).

5.3.1 The Level of Beneficiation in South Africa

The concept of beneficiation is not new in the South African context. Historically, South Africa differs from other African nations in that it exports refined metals, not ores (Trade and Industrial Policy Strategies, 2015e). South Africa's platinum is exported in semi-manufactured form as catalytic converters used as inputs into car manufacturing. About 20% of global platinum catalytic converters are produced in South Africa. In addition, more than 70% of South Africa's mined coal is processed locally to generate electricity and chemicals. In fact, around 95% of South Africa's electricity is generated from locally mined coal and more than 30% of South Africa's liquid fuels are made locally (by Sasol) from coal through coal to liquid process (Trade and Industrial Policy Strategies, 2015e). Moreover, South Africa processes about a tenth of its mined iron ore into steel. South Africa is a major supplier of Ferro alloys from chrome and manganese. Gold, however, is exported as metals. Figure 5.3 gives a summary of the main downstream industries in South Africa.

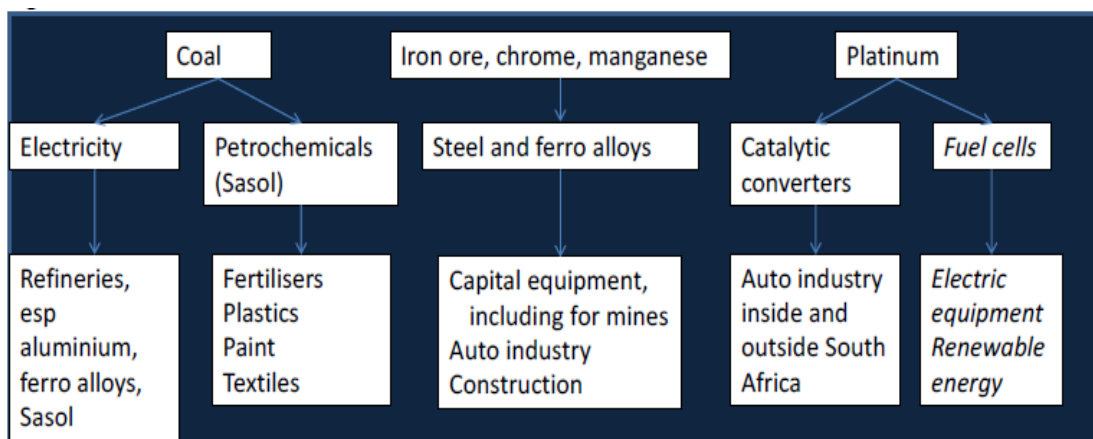


Figure 5.3: Downstream industries in South Africa

Source: Adapted from Trade and Industrial Policy Strategies (2015e)

South Africa has great potential for mining-linked industrialisation. Some examples of downstream products used locally include cement, steel, liquid fuels, electricity, polymers, and plastics. Mining fosters industrialisation through the procurement of capital goods, chemicals, and consumables locally, providing low-cost inputs for manufacturing. However, these linkages need to be established and developed.

Despite South Africa's abundant mineral resources and efforts to promote beneficiation, the level of downstream beneficiation is believed to be low compared to its counterparts in the developed world (Mtegha, 2016). A large portion of South Africa's mined mineral raw materials are exported, with only a small proportion utilised domestically for downstream beneficiation. According to the Department of Mineral Resources (2011), South Africa exports a significant portion of its mineral resources as raw ores or semi-processed products. In a similar study, Zonwabele (2015) argues that major activities in the South African mining industry are characterised by primary production, and export of raw minerals or semi-processed minerals.

South Africa is at a disadvantage when exporting unrefined minerals. The economy continues to lose revenue from high-valued exports that could have been manufactured, and value addition along the mineral value chain could have created meaningful jobs and widen the employment base, develop skills, and advance technology. Thus, while South Africa suffers from a high unemployment rate averaging 25.27% (Trading Economics, 2016), and poverty and income inequality in the country is said to be the greatest amongst world's middle-income economies, the bulk of the country's mineral resources are exported as raw ores or semi-processed, which could have been further beneficiated.

5.3.2 Benefits from Downstream Linkages

Downstream beneficiation could be used as a tool through which the South African resource-based comparative advantage could be transformed into a national competitive advantage (Hweshe, 2012). Promoting beneficiation of mineral resources is important in stimulating new export sectors in developing economies. South Africa is no exception. Value addition plays significant roles in curbing poverty,

unemployment, and inequality in the economy. Downstream beneficiation enhances the development of forward, backward, and lateral linkages, creating skilled employment opportunities and thus assisting in addressing unemployment rates and increasing government revenue from higher value exports.

In an effort to enhance minerals beneficiation in South Africa, the promulgation of Mineral and Petroleum Resources Royalty Act (MPRRA) was established in 2008 for effective implementation in March 2010 (Oshokoya, 2012). The establishment of the MPRRA, is in line with South Africa's Mineral Policy Framework and the Mineral and Petroleum Resources Development Act (MPRDA) of 2002. According to Oshokoya (2012) the MPRRA is aimed at encouraging miners to become refiners by setting a royalty payment system that encourages mineral beneficiation. Mechanism used to achieve this goal is centred on a dual-sliding scale formula for calculating royalty rates for refined and unrefined minerals. As argued by Oshokoya (2012), refined minerals attract lower royalty rates compared to unrefined minerals. She further argues that, the decrease in royalty rate for refined minerals compensates for higher sales value due to higher prices obtained for refined products. However, the question of whether the MPRRA has fully accomplished its objective of advancing minerals beneficiation in South Africa is an area for further research, as South Africa still faces major beneficiation challenges compared to her counterparts in the developed world.

However, there are certain barriers to successful beneficiation in South Africa, among which are limited access to mineral raw materials, a shortage of critical infrastructural development, little research and development, skill shortages, and lack of immediate access to international markets. These barriers imply that, a great number of natural resources do not necessarily translate into downstream beneficiation (Mtegha, 2016). Dedicated interventions are often needed to target possible constraints to value addition in order to create a competitive environment for mineral beneficiating industries (Department of Mineral Resources (2011)).

5.3.3 Opportunities for Downstream Beneficiation in South Africa's Mining Industry

Mining entails a complex process of converting non-renewable resources into reproducible capital. However, fundamental economic theory holds that a non-mineral resource is as gone as good once it is mined (Cawood, 2011). Thus, for optimum benefits to be realised from mining activities, a well-structured government regulatory framework and prudent resource management strategy by companies are required.

In order to create an enabling environment for value addition in South Africa, the government has developed a beneficiation strategy that is deeply rooted in many policy documents addressing key area for potential growth. Such documents include MPRDA and the BBSEE (Broad-based Socio-economic Empowerment Charter for the South African Mining and Minerals industry), the Precious Metals Act (No. 37 of 2005) and the Diamonds Amendment Act (No. 29 of 2005), which enabled the creation of the South African Diamond and Precious Metals Regulator and State Diamond Trader. Moreover, efforts by the Department of Minerals and Energy to create a mineral beneficiation strategy are in line with other government programmes such as the (IPAP2) and the NIPF (TIA, 2016).

Value addition could be enhanced in industries with large supplies of low cost inputs. Better still, however, beneficiation should be undertaken base on mineral commodities in abundant supply, such as iron ore, coal, gold, platinum, chrome, and manganese. South Africa has great opportunities for downstream beneficiation in the following areas:

- PGMs: the bulk of its export is in the form of catalytic converters. However, there is an opportunity for local production of fuel cells as a cleaner energy source, which is important for electric cars and renewable energy.
- Iron, steel and ferrochrome alloys: the bulk of the country's iron ore is exported with minimal processing. However, an opportunity lies in the high demand for steel and ferrochrome products for capital equipment and auto industry, mining, and infrastructural needs.

- Coal: the advantages of downstream beneficiation of coal in South Africa include: low-cost coal supply across southern Africa, especially around Limpopo and Mpumalanga in South Africa and both Eskom and Sasol hold considerable expertise to beneficiate the product. For instance, the Sasol oil-for-coal process produces enormous amounts of bi-products such as propane, ethane, butane, and other hydrocarbons. These petrochemicals foster the manufacturing of medicine, plastics, cosmetics, medical devices, furniture, computers, and televisions. In fact, the presence of cheap coal and Sasol's advanced technology places South Africa as one of the most effective manufacturer of propylene and ethylene.

5.4 Conclusion

Despite the aforementioned constraints, advanced mineral beneficiation can be achieved. Developmental measures such as mechanised mining techniques, advanced beneficiation and improvement in technology through research and development can also be utilised as vehicles through which South Africa's resource-based comparative advantage can be transformed into an international competitive advantage. To do so, emphasis should be placed on advanced research and development, deregulation of the mineral policy to encourage local beneficiation, improvement in infrastructural development, and promote skills development through workshops, vocational and general education (Zikiti, 2015).

6 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

South Africa records an estimated value of US\$2.5 trillion of non-energy in-situ mineral wealth, making it the world's wealthiest mineral resource-rich nation. Apart from owning large reserves of different minerals, South Africa is the world's largest producer of PGMs, chrome, manganese, and vanadium, making it a host to major world mining companies. The presence of these mineral resources in the country creates great potentials for sustained economic growth and development. Generally, areas of major contribution of mining to the economy include: revenue generation (in the form of taxes, royalties, and export earnings), FDI, infrastructural development, job creation, research, and development and innovation, as well as contribution to the national output.

Nonetheless, the South African mining sector faces numerous challenges ranging from lack of innovation as a result of little research and development, inadequate geoscientific information in the public domain to attract investors, shortage of skilled labour, regulation and other structural challenges. These challenges hinder the smooth translation of the comparative advantage of the presence of these abundant resources into a competitive advantage. With these abundant reserves of minerals, and given the prevailing challenges in the mining sector, a study on the examination of mining's contribution to the South African economy was therefore significant.

Common sense knowledge holds that countries endowed with abundant mineral resources could easily diversify and grow economically faster than resource-poor countries, and South Africa is no exception. Mineral resources are believed to have transformed many agriculturally based economies into industrialised nations. Indeed, the mining sector generates the much-needed revenue and raw materials required for industrialisation, as seen in, for example, Canada, the United States of America, and China. However, not all mineral resource-rich countries enjoy fast economic and

developmental growth rates. Studies conducted in this area have shown that some resource-poor countries have outperformed resource-rich developing nations in terms of economic growth and development, as the latter suffer from the resource curse. However, this phenomenon may be an exception rather than a rule.

It is based on the above views that this study was centred on examining the South African mining sector's contributions to value added towards the GDP and employment creation over the period 1993 to 2015. Our decision to limit this examination/analysis on mining's contributions to real value added towards the GDP and employment creation was motivated by the fact that these two contributing factors (real value added or GDP and employment) have, amongst others, the most immediate and direct welfare effect on the South African economy. That is, any change in mining's contributions to GDP and employment levels will equally affect the other contributing factors. This decision was also based on data availability.

Analysis was carried out in two parts. Firstly, the study examined mining's contributions to value added towards South Africa's GDP vis-à-vis other major economic sectors of the economy such as Agriculture, forestry, and fisheries; manufacturing; electricity, gas and water; services; and building, construction and others. In the second part of the analysis, the study focussed attention on examining contribution trends of the principal mining sectors such as PGMs, gold, coal, other metals ore, and other mining and quarrying to mining share of the GDP and employment numbers over the period under review.

Findings revealed that mining sector's contribution to the overall GDP and employment creation in the South African economy witnessed significant downturn over the period of this study, whereas other economic sectors such as the service sector demonstrated significant improvements over the same period. The cause of the decline in mining's contribution to GDP and employment creation was attributed to decline in gold sector's contribution to mining's share of the GDP and employment levels. Reasons for the decline in value added to the GDP and employment generation in the gold sector was largely attributed to structural factors rather than commodity price changes. The study

equally found that the contributions of PGMs, coal, and iron ore to the share of mining GDP and employment numbers increased steadily.

The mining industry in general and the gold sector in particular are major contributors to growth and development in the South African economy. For mining's contributions to be optimised, major adjustments in a range of decision making around policy frameworks, infrastructure and human settlements, research and development, and economic institutions should be made. In that regard, several developmental measures and/or initiatives have been initiated: the minerals policy, mining charter, NGP, AMV, the Mining Phakisa initiative, NDP, and Mining Vision 2030 goals.

To conclude, this study is important in terms of its relevance to academic works, in that there is limited research work in the public domain with respect to this topic. This research therefore adds to our broad understanding of the contribution of South Africa's mining sector to economic growth over time. The results of this study can assist policy-makers in formulating robust growth, investment, and trade policies in South Africa. Based on the findings, one therefore makes certain recommendations.

6.2 Recommendations

In order to optimise South Africa's mineral wealth, the state needs to address key domestic issues that impact negatively on mining investment. The following key recommendations could be made:

i. Become a leader in mining research and development

This could be achieved through the provision of joint venture research and training programs with universities and the public and private sectors to produce the necessary skills and technology required for:

- beneficiation advancement;
- modernising the mining sector in general and mechanisation of the gold, platinum, and chrome sectors in particular;

- developing fuel cell technology to provide an affordable alternative energy sources – production of fuel cells will boost the demand for PGMs, while encouraging the development of renewable energy;
- providing geoscientific information in the public domain to attract investors in the mining industry; and
- Analysing the potential for coal as major feedstock in the South African chemicals and electricity industries.

ii. **Increase stakeholders’ returns on private investments**

This could be achieved through:

- protectionist policies on “infant industry”: this policy may be utilised to protect domestic producers and decrease imports of mineral inputs from other countries, and may be lifted once authorities notice that the domestic industry has gained the necessary competitive edge;
- efficient supply-side measures such as tax incentives for beneficiated projects that encourage local downstream beneficiation, provision of stable, low-cost electricity and transport; and
- Provision of mineral raw materials at a competitive cost to local beneficiating companies. The government can play significant role by subsidising the cost of mineral inputs to companies willing to beneficiate.

iii. **Improve infrastructural development:**

Better access to improved infrastructure such as roads, water, railways, ports, and power supply would serve as a vital engine to accelerate mining investments.

iv. **Create an enabling regulatory environment:**

This can be achieved by:

- developing cut-through regulations and policies that create a business-friendly environment for local mining companies (South Africa's business environment is currently said to be unfriendly, marred with high taxes and strikes);
- reviewing the Mining Charter, incorporating inputs from all key stakeholders in the mining sector; and
- License contracts encouraging local content, research, development, and innovations. There is a need to cut unnecessary bureaucratic procedures in establishing new mining companies. The bargaining process of mining investments should be established on a well-informed platform, which fosters a win-win scenario.

v. Promote co-operative industrial relations

This can be attained by addressing gaps in the regulatory system. For instance, one could develop measures that address persistent conflict in the mining workplace such as:

- providing good housing conditions for mine workers;
- encouraging the mining industry to be involved in the procurement of capital goods, consumables, and chemicals locally;
- nurturing and cultivating a long-term relationship that enhances mutual trust and respect through joint participation in decision-making processes amongst all stakeholders; and
- Building a sustained and cordial relationship between the state, mining communities, and extractive companies.

vi. Limit environmental foot print in the mining sector

This could be achieved by:

- reviewing different environmental measures and laws from all departments to ensure alignment with one another and with economic policy;
- training and having sufficient, qualified staff to enforce implementation of policy framework and monitor compliance;
- providing mining companies with the necessary advice, guidance, and training to improve processes and apply best practice guidelines;
- specifying roles of environmental departments and mineral resources in setting mining standards; and
- Collaborating with all stakeholders to quantify the environmental, economic, and social benefits, and risks and costs of environmental measures for mining.

6.2.1 Area for Further Research

Base on the above analysis, this study suggests that a further research study be carried out on how South Africa's mineral resource abundance can be leveraged to improve on the mining sector's contribution to economic growth and development in the economy.

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