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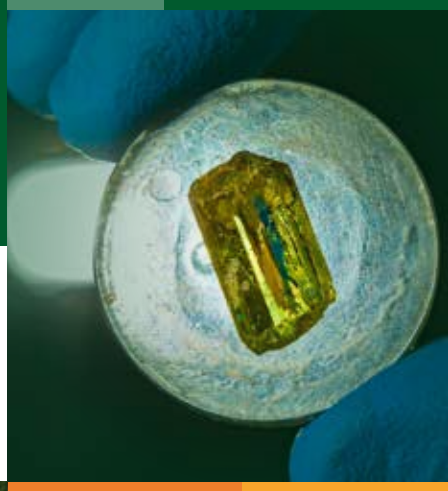
Mineral and Petroleum Resources
REPUBLIC OF SOUTH AFRICA

CRITICAL MINERALS AND METALS STRATEGY

SOUTH AFRICA



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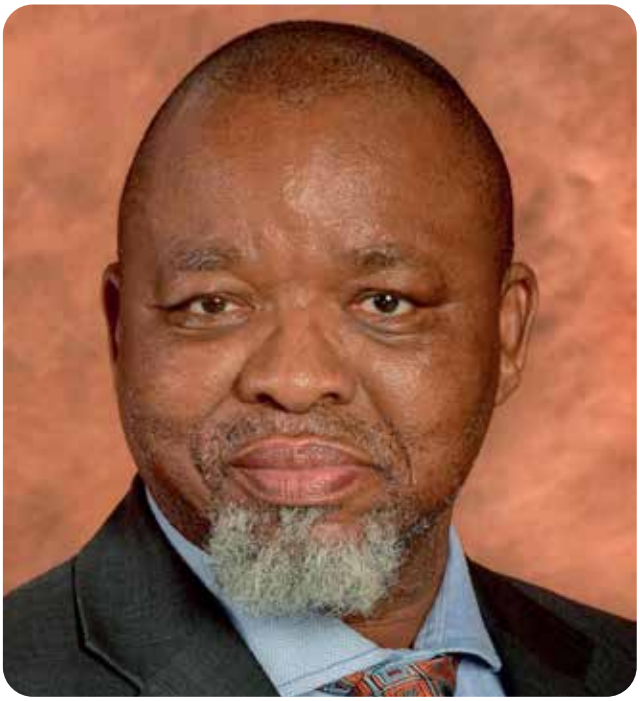
FOREWORD BY THE MINISTER OF MINERAL AND PETROLEUM RESOURCES



It is with great pride and a deep sense of responsibility that I present South Africa's Critical Minerals and Metals Strategy, approved by Cabinet as a cornerstone of our national development agenda and a vital contribution to global efforts to achieve a just and sustainable energy transition.

The 21st century is being shaped by the global shift towards green industrialisation, decarbonisation, and digital transformation. At the heart of this shift lies a growing demand for critical minerals such as manganese, platinum group metals, vanadium, rare earth elements, and lithium. South Africa and the rest of the continent are abundantly endowed with most of these. This endowment positions our country as a strategic global partner in building resilient value chains for technologies of the future such as aerospace components, defence application materials, electric vehicles, battery storage, renewable energy, and green hydrogen, among others.

The Critical Minerals and Metals Strategy outlines a clear and coordinated roadmap to leverage these natural resources in a manner that promotes inclusive growth, industrial development, job creation, and economic transformation. It prioritises exploration, beneficiation at source, research and development, regional integration, financial instruments and energy security, guided by our constitutional commitment to environmental sustainability, social justice, and economic equity.

This strategy is not just a policy framework, it recognises that the future of our country is inextricably linked to how we develop and manage our mineral wealth. By strengthening our industrial base and increasing our capacity for value addition, we can unlock significant employment opportunities, stimulate innovation, and advance our economic growth priorities.

It is also a call to action urging the public and private sectors, development partners, investors, and communities to work together to unlock the full potential of our critical minerals. It underscores the importance of infrastructure development, skills enhancement, research and innovation, and international partnerships to ensure that our mineral wealth becomes a catalyst for long-term prosperity.

I commend the Department of Mineral and Petroleum Resources, our sister departments, state-owned entities, industry stakeholders, and social partners, and Mintek for their work in coordinating the development of this strategy. Let us now move decisively from policy to implementation for the growth and prosperity of our country and the global village within which we exist.

Mr. Samson Gwede Mantashe
Minister of Mineral and Petroleum Resources | Republic of South Africa

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EXECUTIVE SUMMARY

Many countries are ensuring security of access to critical minerals to aid their own development and energy transition efforts. The World Bank confirms that minerals will be needed at scales significantly beyond current production levels and estimates a surge in demand for critical minerals of up to 500 per cent by 2050 (WBG, 2018). This driver for a scramble for critical minerals presents opportunities for innovation, industrial expansion, orderly global trade and diplomacy and most importantly, employment creation and economic growth. Estimates suggest that local processing and beneficiation of critical minerals could create 2.3 million jobs and increase the African continent's GDP by 12% . For this opportunity to be realised, broader challenges pertaining to mining – including energy security and logistics constraints need to be resolved speedily.

To secure long-term economic growth and maximise value from critical mineral resources, South Africa must prioritise investment in:

1. **Exploration**
2. **Research & Development (R&D)**
3. **Local processing and beneficiation**
4. **Infrastructure**
5. **Strategic partnerships to establish advanced mineral processing capabilities**

By implementing this strategy, South Africa can create a self-sustaining industrial base that generates high-value products, supports downstream industries, and fosters higher rates of job creation:

Advanced processing capabilities will position the country as a global player in critical mineral value chains, particularly in emerging sectors such as ***renewable energy technologies, electric vehicles, green hydrogen and advanced manufacturing.*** To achieve this, public and private sectors must collaborate on targeted investments into new mining projects, processing plants, technical expertise, and innovation ecosystems, ensuring that South Africa transitions from being largely a supplier of raw materials to a hub for innovative intermediate and end-use products. This approach will not only boost economic resilience but also enhance the country's competitiveness in international markets, aligning with national development goals and regional integration efforts.

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The document is structured into four areas; namely, **Section A** which outlines the country's position on critical minerals, **Section B** which presents a critical minerals strategic overview, **Section C** which outlines pillars of the strategy and strategic interventions to support its implementation, and **Section D** which outlines key considerations for the successful implementation of the strategy.

This strategy proposes the following catalytic interventions to maximise the full benefits of critical minerals:

- Provision of targeted mineral specific, sector wide and cross-cutting incentive packages, including tempering with administered prices
- Increasing exploration investments
- Developing and appropriately utilising quality geoscience data
- Developing technology innovations for mining efficiency to reduce costs and risks, improve recoveries and support technological startups
- Addressing bulk infrastructure bottlenecks
- Strengthen regional partnerships for production and regional beneficiation hubs
- Conduct higher value-added processing of minerals

1 https://www.sanews.gov.za/south-africa/critical-minerals-sector-key-driving-global-economic-growth

SECTION A: SOUTH AFRICAN POSITION ON CRITICAL MINERALS

2. INTRODUCTION

Minerals have historically been pivotal to economic modernisation, underpinning industrialisation, technological advancements, and wealth generation. In developing nations, minerals have historically provided artisanal employment, tax revenue, and foreign exchange earnings. However, they have also been linked to environmental degradation, displacement of communities, negative health impacts, illegal mining, and the continuation of inequality. Conversely, developed nations have used their historical influence and expertise to optimise wealth via mineral extraction and processing, thereby enhancing their economies.

With technological advancement, society has grown progressively reliant on a new category of minerals, referred to as 'critical minerals,' which are vital for:

1. **Microelectronics**
2. **Clean energy production and storage**
3. **Digitisation**
4. **E-mobility**
5. **Medical devices**
6. **Advanced manufacturing**

In contrast to conventional minerals mainly used for wealth preservation or steel manufacturing, critical minerals such as lithium, cobalt, rare earth elements (REEs), and platinum group metals (PGMs) are essential for realising technological and sustainable development objectives.

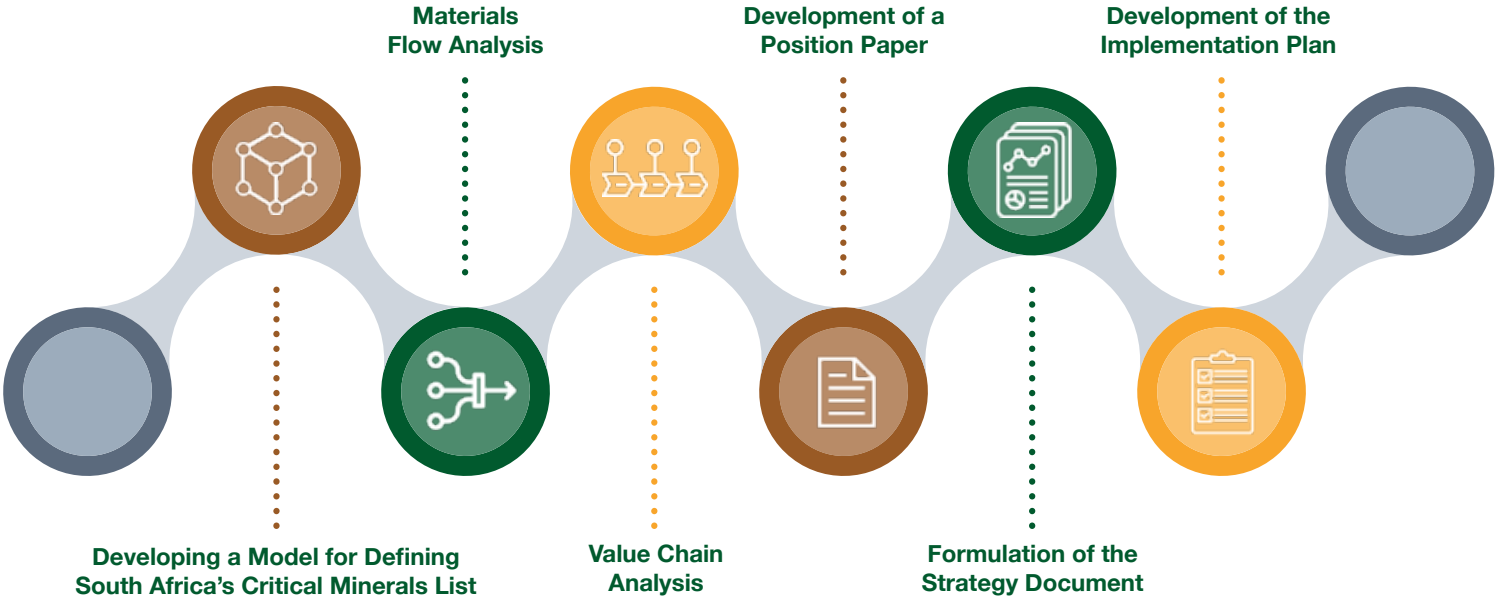
South Africa possesses a wealth of these minerals, which are becoming increasingly crucial for the global shift towards a low-carbon and technologically advanced economy. The nation's abundant reserves of PGMs, manganese, vanadium, chromium and titanium place the country as a key player in the critical minerals global supply chains. These essential minerals present South Africa with a distinct opportunity to stimulate economic growth, create employment and support the country's re-industrialisation agenda.

Although South Africa ranks among the leading producers of various critical minerals, its mineral value chains are primarily upstream, focused on extraction and export with limited beneficiation and value addition. Furthermore, the nation's processing and manufacturing capacities are deficient, restricting the acquisition of higher value-added advantages from these minerals. Consequently, tackling these challenges is essential for South Africa to optimise its potential and guarantee sustainable participation in the advancing global critical minerals market.

The demand for critical minerals is expected to increase significantly due to their application in supporting transition to low-carbon economies, especially in technologies such as electric vehicles, hydrogen fuel cells, wind turbines and battery storage systems (International Energy Agency, 2021). Projections indicate that attaining global net-zero emissions objectives by 2050 will necessitate a sixfold augmentation in critical mineral inputs relative to present consumption. This increase in demand is expected to coincide with ongoing supply shortages, market instability and issues pertaining to supply chain vulnerabilities and geopolitical tensions. These factors offer both opportunities and risks for South Africa, necessitating the implementation of targeted interventions to capitalise on opportunities in downstream processing, research and development (R&D), infrastructure development, skills development and regional integration.

3. THE PROCESS FOLLOWED TO FORMULATE THE CRITICAL MINERALS STRATEGY

The development of the Critical Minerals Strategy for South Africa followed a comprehensive and methodical process designed to ensure the identification and prioritisation of minerals and metals critical to the country's economic and industrial development. This process was divided into several key phases, each contributing to the formulation of a robust and actionable strategy. The steps undertaken are as follows:



(i) Developing a Model for Defining South Africa's Critical Minerals List

The initial phase involved creating a rigorous model to define the minerals critical for South Africa. This model was designed to identify minerals that are strategically important for economic growth, industrial development, job creation and national security. The criteria for classification included the economic importance of the mineral, its supply risk, and the potential impact of supply disruptions on key industries. Several engagements with critical stakeholders were undertaken during this phase. The outcome is a defined list of critical minerals and metals, which served as a foundation for the subsequent stages of the strategy development.

(ii) Materials Flow Analysis

The second phase involved a detailed materials flow analysis, which examined both local and global production, consumption, imports, exports, and recycling of identified minerals and metals. The objective of this stage was to map current market trends, key drivers, and constraints affecting the demand and supply of these minerals. This analysis aimed to enhance the understanding of material efficiency and sustainability while assessing environmental impacts of the entire lifecycle of the minerals.

(iii) Value Chain Analysis

The third phase focused on a comprehensive value chain analysis. This analysis provided an understanding of opportunities within the minerals sectors in South Africa. It involved a detailed market assessment of demand across the upstream, midstream, and downstream segments of the value chains. The assessment also examined existing and potential industrial capabilities, supply chain logistics, and the advancement of South Africa's circular economy and Environmental, Social and Governance (ESG) initiatives, focusing on increasing recovery, reuse, and recycling rates. These opportunities were mapped against the strengths of South Africa's natural resources, mining market and broader economy to ensure alignment with national strategic goals.

(v) Formulation of the Strategy Document

Building on the position paper, a comprehensive strategy document was then formulated. This document outlines the strategic objectives, goals, and actions necessary to secure South Africa's critical minerals supply and leverage these resources for economic and industrial advancement. The strategy is forward-looking, aligning with the National Development Plan and global trends in the minerals sector.

(iv) Development of a Position Paper

The findings from the previous phases formed a basis for the position paper. This document synthesised key insights from the model, materials flow analysis, and value chain analyses reports. It articulated South Africa's strategic stance on critical minerals, highlighting the country's priorities and policy measures required to support the development and sustainable management of these resources.

(vi) Development of the Implementation Plan

The final phase of the process involved the development of a detailed implementation plan. This plan provides a roadmap for executing the strategy, including timelines, responsible entities, and key performance indicators. It also outlines the resources and partnerships required to achieve the strategic objectives. The implementation plan ensures that the strategy can be translated into actionable steps, with clear guidance on monitoring and evaluation to track progress.

Additionally, twenty one (21) commodity studies were undertaken in parallel; namely, platinum group metals (PGMs), gold (Au), iron ore (Fe), coal (C), manganese (Mn), chromium (Cr), ferroalloys, nickel (Ni), cobalt (Co), copper (Cu), rare earth elements (REEs), vanadium (V), titanium (Ti), diamonds (C), zirconium (Zr), uranium (U), phosphate, fluorspar, antimony (Sb), lithium (Li) and graphite (C). This comprehensive analyses of twenty one commodities sufficiently provided a clear picture of the state of the mining industry in South Africa.

4. OVERVIEW OF THE DOMESTIC MINING ENVIRONMENT

Mining in South Africa began in the 1870's, with the discovery of gold and diamonds, which laid a foundation for the transformation of South Africa from an agricultural to a modern industrial economy. The South African economy remains very much resource dependent with mining contributing significantly to the financial and fiscal health of the country through foreign exchange reserves, taxation and employment. The internal environment for critical minerals is shaped by its mineral endowment, infrastructure dynamics, regulatory and policy frameworks, and socio-economic conditions. South Africa is among the top mining and mineral processing nations, with a diverse portfolio of critical mineral resources.

While South Africa's resource base presents immense potential, internal challenges significantly impede the county's ability to capitalise on these resources. Expenditure on exploration and R&D falls short of the targeted 1% of GDP and 5% of total global exploration investments, respectively. Further, South Africa's dominance in PGMs presents opportunities for market influence but also exposes the country to risks, such as declining demand for PGMs in automotive manufacturing due to the rise of electric vehicles; with the nascent Hydrogen Economy yet to impact PGM demand in a significant way.

Infrastructure deficiencies, particularly energy shortages, rail networks, and port systems constraints for bulk exports constitute the biggest risk to the mining industry. Challenges with illegal mining disincentivise mining exploration activities while potentially jeopardising the viability of mining operations. Social strife in host communities poses political and socio-economic instability risks for potential investors. Additionally, skills shortages in advanced mining techniques and mineral processing impede efforts to unlock the sector's full potential. Efforts to resolve these challenges should help in attracting Foreign Direct Investment (FDI) and financing from countries eager to invest in mineral processing plants. Equally, most local firms lack the expertise required for the leap into value-enhancing processing.

Globally, the critical minerals environment is largely driven by:

1. **Renewable energy transition**
2. **Geopolitical dynamics**
3. **Technological advancements**
4. **International trade policies and standards**

South Africa's ability to position itself as a reliable supplier of critical minerals globally depends on its ability to navigate this complex environment.

Furthermore, geopolitical tensions and trade restrictions have heightened the need for diversified supply chains, which ultimately creates potential opportunities for South Africa to emerge as a dependable alternative supplier of minerals and high-valued products.

4.1. Overview of South Africa's Major Geological Formations

According to the 2024 statistics from the Department of Mineral and Petroleum Resources (DMPR) and the US Geological Survey (USGS), South Africa possesses ore reserves to a value of more than **US$2.5 trillion,** with **16 commodities ranked in the Top 10 internationally. The country has the largest known reserves in the world** of Platinum Group Metals (PGMs) with a market share of (88%), Manganese (80%), Chromite (72%) and Gold (13%). It is **ranked second** in Titanium minerals with a global reserve market share of (10%), Zirconium (25%), Vanadium (32%), Vermiculite (40%) and Fluorspar (17%). In addition, the country contains 2% of the world's antimony reserves, see Figure 1.

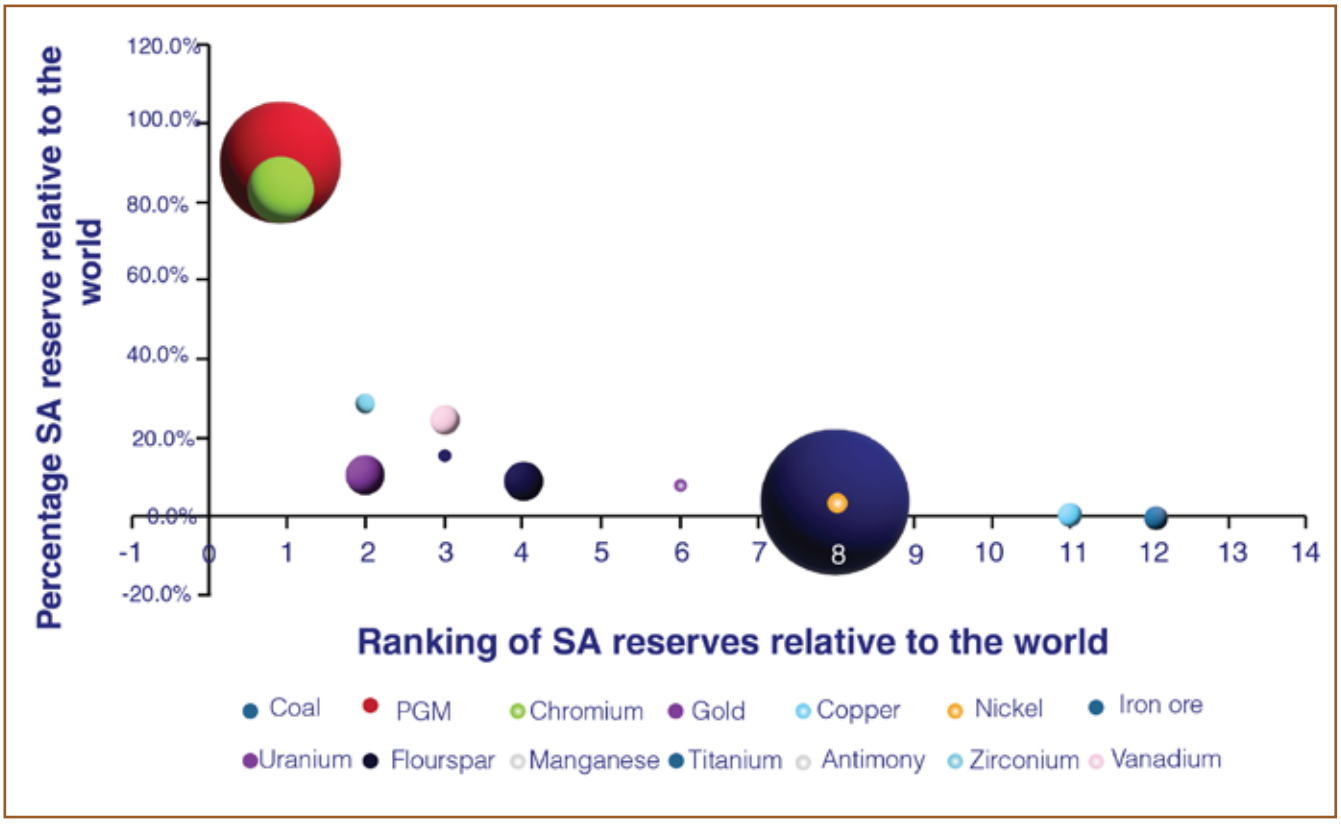


Figure 1: SA Major Geological Formations
(Source: Minerals Council of South Africa, Investec Securities estimates, U.S Geological Survey)

4.2. South Africa's Mineral Industry Production

South Africa is currently **ranked 5th internationally** in terms of mining contribution to Gross Domestic Product (GDP) and the country is ranked in the **top three globally** in terms of production of PGMs (59%), Vanadium (25%), Ferrochrome (39%), Alumino-silicates (60%), Vermiculite (35%), Zirconium (32%), Titanium minerals (19%), Manganese ore (17%) and Antimony (2%); with its Gold (8%), Coal (4%), Iron ore (4%), and Ferro-silicon, Silicon metal and Fluorspar ranked in **the top ten globally.** At current production rates, South Africa's PGM, coal and gold reserves are projected to last for the next 250 years, 200 years and 27 years, respectively (State of South African Mining Industry, DMPR, 2024).

4.3. Exploration Trends | Globally and Locally

4.3.1. GLOBAL EXPLORATION TRENDS

The global mining exploration budgets rose in 2022, with the scramble for 'green metals' such as lithium leading the pack in terms of growth. Global exploration spend reached $12.8 billion in 2023, and South Africa set itself a target of capturing 5% of global exploration spending. The survey found that SA had attracted just 0.8% of global exploration budgets in 2022 and 0.92% of global exploration budgets in 2023.

Transition Metals — specifically copper, nickel and lithium posted strong exploration budget growth. The copper budget rose by 12% to $3.12 billion, the highest year-over-year increase since 2014 and the third consecutive year of double-digit percentage growth. Lithium budgets were the most noteworthy, increasing by 77% year-over-year to $829.6 million. Nickel budgets rose by 19% year-over-year, with a budget of $732.2 million.

COPPER: +12% ($3.13B)

LITHIUM: +77% ($829.6M)

NICKEL: +19% ($732.2M)

4.3.2. SOUTH AFRICA EXPLORATION TRENDS

South African exploration spending reached $117.4 million, less than 1% of global exploration spending in 2023. South Africa's share of global exploration has been consistently below 1% for three consecutive years and nowhere near the more than 5% two decades ago. Despite the year-over-year development capital increases, exploration budgets have lagged lately, with the 2023 budget of $117.4 million only being a third of the 2012 peak of $322.5 million.

South Africa has had little grassroots exploration projects, many of the exploration programmes are at late stage and feasibility, and on expanding existing mining operations, especially in the platinum sector.

4.3.3. NATIONAL ECONOMY | GROSS FIXED EXPLORATION CAPITAL FORMATION

Although mining exploration declined between 2015 and 2023, gross fixed capital formation (investment in plant and machinery) increased by 17,33% during the same period. The 2023 development capital investment in South Africa witnessed a continued recovery, up 133% to a five-year high of $1,985.5 million from $1,068.4 million in 2020, supported by investment in gold and PGMs

4.4.Mining Contribution to the Economy | South Africa

The overview of the mining contribution to the South African economy from 2020 – 2023 is summarised in Figure 2-3. In these figures, the contribution is presented using six indicators; namely, mining production value, employment creation, contribution in taxes to fiscus, contribution to gross domestic product (GDP), total primary sales and mineral exports. In 2023, **PGMs, Gold, Iron ore and Coal** together accounted for **81% of total sales, 84% of export sales, and 87% of employment,** with the PGMs being the leading sector in terms of employment at **40%. Chrome and manganese** together accounted for **14% of total sales, 13.6% of export sales and 7.3% of employment.** There was an increase in mining sales and revenue of **152.8 per cent** between **2015 and 2018.** Subsequently, PGMs realised a spike in growth of sales in 2021 while growth in the rest of the minerals increased steadily between 2015 and 2023. Additionally, from 2020-2023, mining contribution to GDP was 7.1%, 7.6%, 7.3% and 6.3%, respectively.

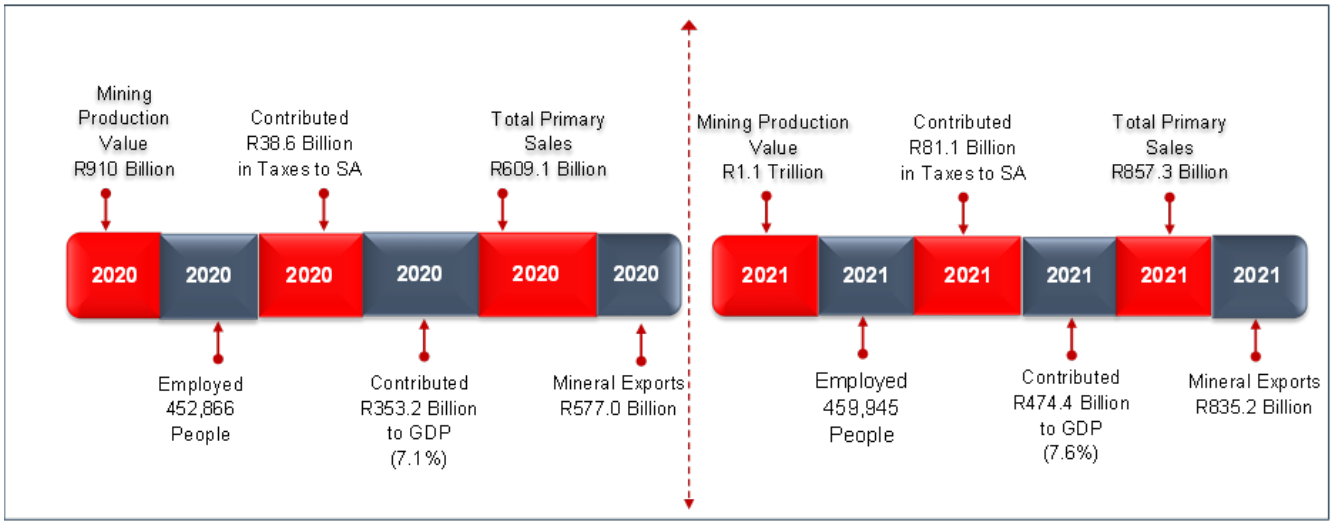


Figure 2. South Africa Mining Contribution
(Source: Minerals Council of South Africa: Facts and Figures, 2020 and 2021)

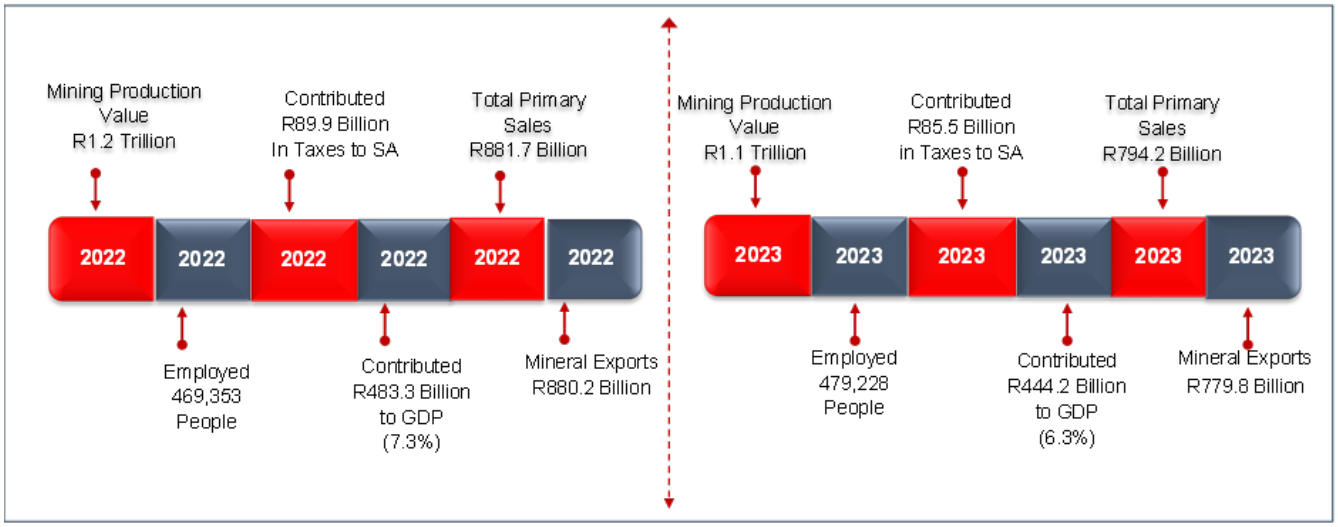


Figure 3. South Africa Mining Contribution
(Source: Minerals Council of South Africa: Facts and Figures, 2022 and 2023)

SECTION B: CRITICAL MINERALS STRATEGIC OVERVIEW

The developed and developing economies are leveraging on the domestic and external supply of critical minerals to bolster their manufacturing capacity and global competitiveness in the race to secure a stake in emerging industries. **As such, strategies for most countries revolve around improving access to the right mix and quantities of critical minerals, exploiting value through building or expanding refining capacity and processing the materials into end-use applications.**

The upstream and downstream value chain activities for critical minerals hold enormous opportunities for economic growth, industrial expansion, job creation, skills development, research, development and innovation (RDI) and recycling. More importantly, these minerals are poised to play a crucial role in meeting global Sustainable Development Goals (SDGs) and net-zero emissions commitments. Yet without appropriate strategic interventions, mineral producers like South Africa could remain trapped as raw ore suppliers while most value is captured by the major global processing and manufacturing centres (SAIIA, 2023)[2].

The global significance of critical minerals has largely been driven by the world's economic powerhouses in their quest to compete on high-value products made from these ore bodies. In the process, each country has formulated a list of minerals considered critical within the context of their respective economic and industrial needs, increasingly based on security and control of supply. Consequently, critical minerals (also referred to as strategic minerals) lack a standard definition or classification criteria.

Comparison of Critical Mineral Listings Recognised by Country:

1. **UK: 18 Minerals**
2. **India: 28 Minerals**
3. **Canada: 34 Minerals**
4. **50 minerals (excludes mineral fuels but includes aluminium for aerospace)**

Despite these differences, common minerals such as lithium, cobalt, manganese, vanadium, graphite, PGMs, and Rare Earth Elements consistently appear across multiple lists.

Although certain minerals are repeatedly recognised as critical by various nations, minerals such as nickel and copper are conspicuously absent, despite their inclusion in the 'Big Six' essential minerals vital for attaining net-zero objectives. This could be attributed to perceived diminished supply chain risks or the swiftly advancing chemistry of electric vehicle (EV) batteries. While the specific lists may vary, the global viewpoint underscores a collective acknowledgement of the significance of these minerals in the advancing realms of technology, energy transition and economic stability.

The adoption of critical mineral lists partly influences the strategic focus of key producing countries as they seek to benefit from supply chain incentives from big economies. Developing countries also tend to adopt classification approaches of developed economies, which often exclude minerals that are critical for emerging economies.

2 SAIIA, 2023. Exploring the critical mineral ecosystem in South Africa – Country barriers and enablers.

Critical minerals are further characterised by a unique heavy geographic concentration of selected commodities and global spread in the reserves of complimentary minerals often produced comparatively at small volumes.

Therefore, no single country possesses the full complement of critical mineral reserves. Those with significant global reserves employ a range of strategies to control or limit supply, including mining statutes and prices. Concentration, however, also implies a high risk of supply shortages if production in large producing countries is interrupted[3].

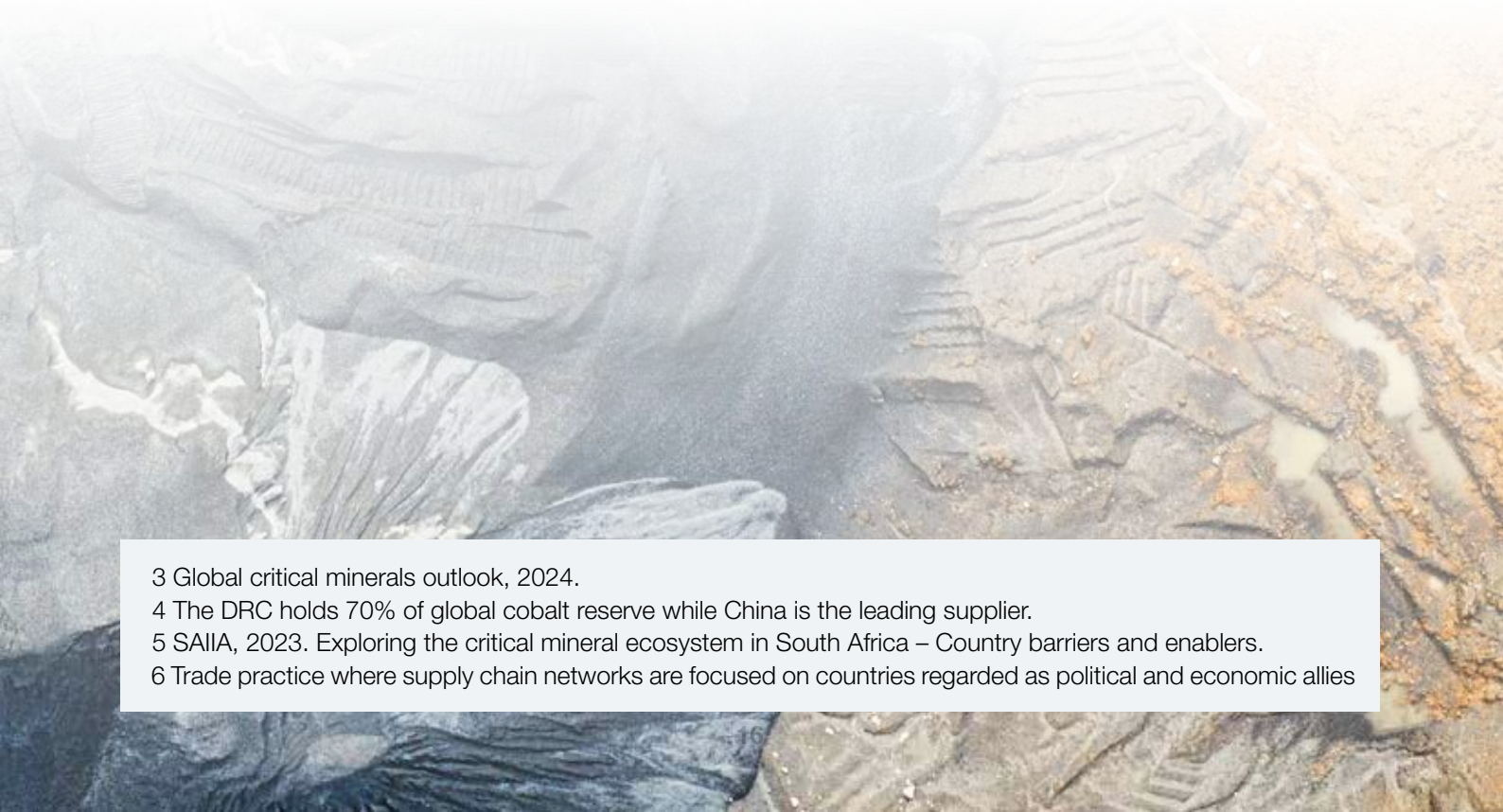
Countries that depend on imports focus on:

- Promoting new exploration
- Acquiring and developing new foreign mining projects
- Providing public investments and tax incentives for domestic beneficiation
- Encouraging responsible and sustainable resource diplomacy

Stockpiling is another pillar of the strategy gaining prominence among leading economies. Through this approach, and combined with substantial processing capacity, some countries have become leading suppliers of a specific mineral even without the reserve endowment, as is the case with cobalt[4]. Building regional linkages is yet another strategy used to maximise value from critical minerals.

The increasing demand and competition for critical minerals is driving unending geopolitical tensions over which countries can gain access to these resources and how to best manage them[5]. The consequences of this are evident in the growing use of export restrictions by mineral producing countries and counter friendshoring[6] measures by importing countries. Geopolitical tensions force smaller countries to attach their political interest to the supply of critical minerals. This may also reinforce the underdevelopment of the downstream supply chain capacity for critical minerals, especially as developed countries secure the Just Energy Transition (JET) technologies.

The complex dynamics and intricate forces surrounding critical minerals demand a comprehensive and forward-thinking strategy to effectively navigate the evolving global landscape. Such a strategy is essential to unlock the full economic potential of these minerals while aligning with global priorities, including sustainable supply chains, net-zero emissions targets, and adherence to Environmental, Social, and Governance (ESG) standards.



3 Global critical minerals outlook, 2024.
4 The DRC holds 70% of global cobalt reserve while China is the leading supplier.
5 SAIIA, 2023. Exploring the critical mineral ecosystem in South Africa – Country barriers and enablers.
6 Trade practice where supply chain networks are focused on countries regarded as political and economic allies

5.1. Defining Critical Minerals For South Africa

Critical minerals lack standardised definitions and classifications due to their dependence on national contexts and priorities; they are country-specific or region-specific. The definition or classification is generally guided by these overriding factors; namely, importance to the country's overall economy or key sectors of the economy, as well as security and control of supply, and value capture. Criticality is linked to how a mineral is susceptible to supply disruptions and the country's strategic intentions to maximise value or competitive edge in global supply or value over a (locally) abundant mineral. Criticality may however further be linked to the non-substitutability and low recycling rate of a mineral.

The significance of minerals is profoundly shaped by their uses and applications in contemporary technological and industrial processes. The increased dependence on minerals for emerging technologies highlights their importance, as their availability directly affects the capacity to produce and implement these technologies on a large scale. A mineral's criticality is determined not only by its geological abundance but also by its strategic significance, technological uses and the potential risks of supply interruptions, necessitating the secure management of these minerals' supply chains in a swiftly changing global market. Many nations globally have established distinct criteria for criticality to identify and monitor a selection of critical minerals and metals.

DEFINITION | SOUTH AFRICA:

While a universally accepted definition is lacking, critical minerals in the context of South Africa are "minerals that are essential for the overall economic development, job creation, industrial advancement and contribution to national security.

VISION:

- To secure long-term economic growth and maximise value from critical mineral resources while positioning South Africa as a dependable global supplier of raw and processed materials, and high-valued end products.

GOALS:

- To attract investments in exploration, production, processing and beneficiation of critical minerals;
- To provide targeted support for the expansion and localisation of the critical mineral value chains, and
- To foster regional and international cooperation for sustainable supply of critical minerals and metals.

5.2. South Africa's Critical Minerals selection criteria

It is imperative that the development of the critical minerals list takes a science-based approach and is forward-looking in terms of identifying all essential minerals needed by the economy (i.e. inclusive of locally non-available resources). The guiding principles revolve around ensuring that these minerals are harnessed to support national development goals, industrial growth and sustainable resource management while also addressing the growing global demand for cleaner energy technologies, e-mobility and advanced manufacturing.

Export significance:

One of the guiding principles is the recognition of minerals that play a pivotal role in South Africa's export economy. Critical minerals such as PGMs, manganese and chromium are key contributors to foreign exchange earnings, making them fundamental to maintaining a healthy balance of payments and generating national revenue. As these minerals hold substantial value in international markets, South Africa must continue to strengthen its position as a global supplier by investing in value addition, beneficiation and supply chain optimisation, ensuring that export opportunities are maximised.

Local economic significance:

Critical minerals contribute significantly to domestic economic activities, job creation and regional development. The mining sector is a key employer in South Africa, providing livelihoods for about a million people including contractors. By identifying and prioritising minerals that have strong local economic significance, such as manganese, iron ore, coal and vanadium, the strategy ensures that these resources support inclusive growth and contribute to addressing socio-economic challenges. This principle emphasises the need for fostering local processing, beneficiation and downstream industries that can create additional value and employment opportunities, aligning with the country's broader developmental goals.

Industrial importance:

The critical minerals strategy acknowledges the essential role minerals play in supporting South Africa's industrialisation agenda. Minerals like PGMs, lithium, cobalt and REEs are integral to manufacturing advanced technological products such as batteries, hydrogen fuel cells, wind turbines and electric vehicles (International Energy Agency, 2021). By focusing on these minerals, the strategy seeks to facilitate the growth of high-tech industries, enhance the country's industrial capabilities and position South Africa as a leader in emerging sectors like renewable energy, e-mobility and advanced manufacturing.

Development alignment:

The strategy aligns the exploitation and development of critical minerals with national development priorities, as outlined in key policy documents such as the National Development Plan (NDP) 2030. This alignment ensures that the extraction and use of critical minerals support South Africa's broader goals of poverty alleviation, job creation and sustainable development. Minerals are not only a source of fiscal revenue but also offer opportunities to drive industrialisation, infrastructure development and technological innovation, thereby promoting economic transformation and reducing inequality.

Global market demand:

Recognising the rising global demand for critical minerals, particularly those essential for energy transition, defence, aerospace, mobility sectors and digital technologies, is a fundamental guiding principle. As the world shifts toward renewable energy and decarbonisation, minerals such as lithium, cobalt, nickel and REEs are in high demand. South Africa's ability to supply these minerals offers a strategic advantage and the opportunity to integrate more deeply into global value chains, attract foreign investment and contribute to the world's energy transition.

Application and use - driving the criticality of minerals:

The guiding principles emphasise that the criticality of minerals is not merely defined by their geological abundance but by their role in contemporary technological and industrial applications. Minerals such as lithium, cobalt and nickel are indispensable in the production of lithium-ion batteries for electric vehicles and energy storage systems, while REEs are fundamental to the manufacturing of wind turbines, high-performance magnets and microelectronics. The importance of PGMs, especially in hydrogen fuel cell technology and catalytic converters, further underscores their criticality.

The strategic importance of these minerals is also determined by their position within the downstream value chain, where they contribute to advanced technological products and applications. Countries with a competitive edge in supplying, manufacturing and processing of critical minerals can influence global market dynamics and secure a dominant role in emerging industries. Therefore, South Africa's strategy must prioritise investments in mineral processing, refining, beneficiation and technology development to exploit its comparative advantage fully.

Based on the above principles and multiple factors, a comprehensive methodology was adopted for this strategy and is based on assessing the criticality of minerals across five primary criteria: **export significance, local economic significance, industrial importance, development alignment and global market demand.**

The following indicators were then adopted:

1. **Supply risk indicator**
2. **Comparison with critical mineral lists (CMLs) of trading partners indicator**
3. **Export potential indicator (EPI) & product diversification indicator (PDI)**
4. **Employment indicator**
5. **Domestic sales indicator**
6. **Export sales indicator**
7. **Substitutability indicator**
8. **Importation of essential minerals (i.e. locally non-available resources) indicator.**

5.3. The List of Critical Minerals for South Africa

The computational results for each indicator were rated on a scale of one to ten for each mineral and metal. The cumulative scores from all the indicators were aggregated to determine the overall criticality of each mineral and metal. The analysis of total criticality scores for various minerals revealed a significant range in the overall importance of these resources. This data serves as an essential reference for shaping the country's critical minerals strategy, pinpointing minerals that are of paramount importance for an economic growth path.

Criticality and classification mix depends on the underlying market conditions as well, including the number of ongoing exploration activities, the magnitude of reserves and quantity of production, the distribution of extracted ore in terms of local processing, exports and the export destinations as well as the prevailing commodity prices. These market conditions are linked to the factors driving the criticality classification mix and they are also shaped by internal and external environmental forces discussed previously.

The multifactor analysis resulted in a list of critical minerals and metals for South Africa, which is presented in Table 1 below. The list includes minerals that are produced in South Africa as well as locally non-available resources. Strategically, the list provides greater certainty and predictability to investors, developers, communities, and trading partners on national priorities.

Notably, the mix of South Africa's top critical minerals has important uses in steel alloys. Steel remains the world's most used and recycled metal. It is a vital input in construction, manufacturing, infrastructure and the energy sector. Strategically, the focus on steel must contend with the revival of local steel processing capacity, energy consumption intensity and overcapacity in major trading partners such as China.

Table 1:
The list of critical minerals and metals for South Africa*

Criticality	Minerals and Metals
High-Criticality Minerals	Platinum
	Manganese
	Iron Ore
	Coal
	Chrome Ore
Minerals with Moderate to High Criticality	Gold
	Vanadium
	Palladium
	Rhodium
	Rare Earth Elements
Minerals with Moderate Criticality	Copper
	Cobalt
	Lithium
	Graphite
	Nickel
	Titanium
	Phosphate
	Fluorspar
	Zirconium
	Uranium
	Aluminium

***** *The list of critical minerals and metals will constantly be reviewed and updated as the criticality classification mix is dependent on underlying market conditions, technological advancement, substitutability, recycling and geopolitics among other factors.*

SECTION C: PILLARS OF THE STRATEGY AND INTERVENTIONS

The local and global critical minerals landscape is convoluted and yet interconnected in a way that requires country specific support interventions for exploration, production and value capture to navigate the ever evolving geopolitical, market and technological forces. In the realm of technology-driven mineral and resource development, a strategy cannot be cast in stone. Not only does this require fit-for-purpose interventions but also responsive actions on the part of government and effective public-private partnerships. The strategy therefore outlines a framework comprising a gamut of cross-cutting, critical mining specific and sector specific interventions to maximise the broad range of economic benefits of critical minerals for South Africa. It leverages the attendant policies such as the beneficiation strategy, exploration strategy, and mining charter, as well as the applicable incentives schemes.

The Critical Minerals Strategy focuses on the following pillars:

1. **Geoscience and Exploration,**
2. **Value Addition and Localisation,**
3. **Research, Development and Innovation,**
4. **Skills Development,**
5. **Infrastructure and Energy Security to support local value addition,**
6. **Fiscal Instruments,**
7. **Harmonisation of the Regulatory Regimes,**
8. **Circular Economy and ESG, and**
9. **Bolstering Regional Integration.**

This strategy is predicated on promoting sustainable extraction of selected critical minerals but also balancing limitless exportation of raw ore with domestic imperatives for processing and beneficiation. It is also aimed at strengthening targeted research and development into locally registered and produced end-use applications. The strategy further outlines a range of interventions to realise greater downstream value addition taking cognisance of ancillary legislation and policies as well as various incentive programmes. The strategy implementation matrix is tabulated in Appendix A.

6.1. Pillar I | Geoscience Mapping and Exploration

South Africa must prioritise exploration and resource discovery, with a particular focus on high-demand critical minerals such as lithium, graphite, copper, rare earth elements and similar high-value minerals to replace closing mining projects. These minerals are not mere commodities, but rather the essential building blocks of the low-carbon economy, the global transition to renewable energy, and the transformative technologies of the future. Neighbouring countries, such as Zimbabwe and Mozambique, have already witnessed notable success through targeted mineral exploration, creating new revenue streams, employment, and impact on the global stage. By prioritising exploration and resource discovery, South Africa can reclaim its place as a leader in the global minerals landscape, driving economic growth, technological innovation, and human development.

There are, however, challenges to mining exploration, including:

Lack of greenfield exploration projects:

South Africa has had little greenfield mining exploration for 30 years, while the existing exploration projects focus on expanding existing operations, especially in the platinum sector (Christianson, 2023). The small number of future minerals projects launched in South Africa in recent years are largely redevelopments of existing resources, including the copper deposits in the Okiep/Springbok area, Northern Cape, and the REEs in Steenkampskraal deposit north of Vanrynsdorp in the Western Cape.

Existing policies are insufficient to promote exploration:

The South African investment, and specifically the mining investment environment, is not globally competitive for exploration and mining (Minerals Council of South Africa, 2024). The South African government has initiated critical policy reforms, including the implementation of the Exploration Strategy and the ongoing review of the MPRDA. These measures are now demonstrating encouraging initial results, laying the foundation for long-term sectoral growth.

Exploration and mining are still not inclusive:

Junior miners are critical in exploration as they are highly specialised firms which find, prove and engage in early development before selling on to a major company that will operate the mine. Johannesburg Stock Exchange (JSE) has only twelve (12) listed junior mining companies as opposed to over 500 in other exchanges abroad. The exchanges with a high number of listed junior mining companies can attract more exploration investments. Recent developments include the Industrial Development Corporation (IDC) and the Department of Mineral and Petroleum Resources establishment of a R400 million fund to support exploration by junior miners. Furthermore, inaccessibility to quality geoscience data hinders exploration. Small-scale or junior companies experience major deterrents to meaningfully participate in exploration, spanning the inordinate amounts of time and money sought to access geoscience data to direct exploration activities.

The risk of not moving fast enough with implementing the exploration strategy is that many countries are ensuring their own security of critical minerals to aid their own development and energy transition efforts. The World Bank confirms that minerals will be needed at scales significantly beyond current production levels. Therefore, there is a first movers' advantage to secure critical mineral sources globally and this scramble for critical minerals presents opportunities for the strengthening of existing trading partners and emerging of new trading partners. There is also competing interest between the exploration of new minerals and achieving meaningful socio-economic development.

Strategic Interventions:

- Address regulatory bottlenecks by reviewing and streamlining regulatory requirements across licensing departments, to align regulatory processes amongst departments and for improved turnaround time on the processing of prospecting rights – create a one-stop shop licensing system.
- Augment the Junior Exploration Fund to increase the exploration investment into exploration of high-demand critical minerals such lithium, graphite, rare earth elements, copper, and similar high-value minerals.
- Explore the adoption of a flow-through shares scheme.

6.2. Pillar II | Value Addition and Localisation

Value addition and localisation offer not only a path to economic empowerment but also a decisive step toward reducing our dependency on foreign manufacturers. By building robust local beneficiation and manufacturing capabilities, South African-made products with value added locally can be used in the domestic economy and exported to global markets. This approach does not just grow GDP; it creates well-paying jobs, develops skills within communities, and strengthens the economy at every level. For the South African people, it means a future filled with opportunity.

This strategy does not view critical minerals in isolation; instead, they are treated as part of a larger ecosystem that drives essential technologies such as electric batteries, fuel cells, and other clean energy systems. Approaching these minerals collectively under a low-carbon materials sector strategy, we open avenues for investment, development, and job creation, ensuring that South Africa not only supplies the raw materials but also leads in the production of high-value, end-use products. Thus, the sector versus commodity approach offers strategic alignment for key minerals like manganese, cobalt, and lithium. It focuses on their role in the global battery and energy storage industries. By investing in beneficiation and processing specific to these applications, South Africa can create a robust, interconnected supply chain ready to meet

international demand. Such initiatives should entail utilisation of domestic capacities. But this should deliberately be combined with collaborative efforts with global partners in **research** and **access to technology, manufacturing** (including the original equipment manufacturers (OEMs)), **financing / investment, infrastructure, standard-setting** and **regulations, skills development** and other endeavours – promoting South Africa as an ideal location for these partners' operations.

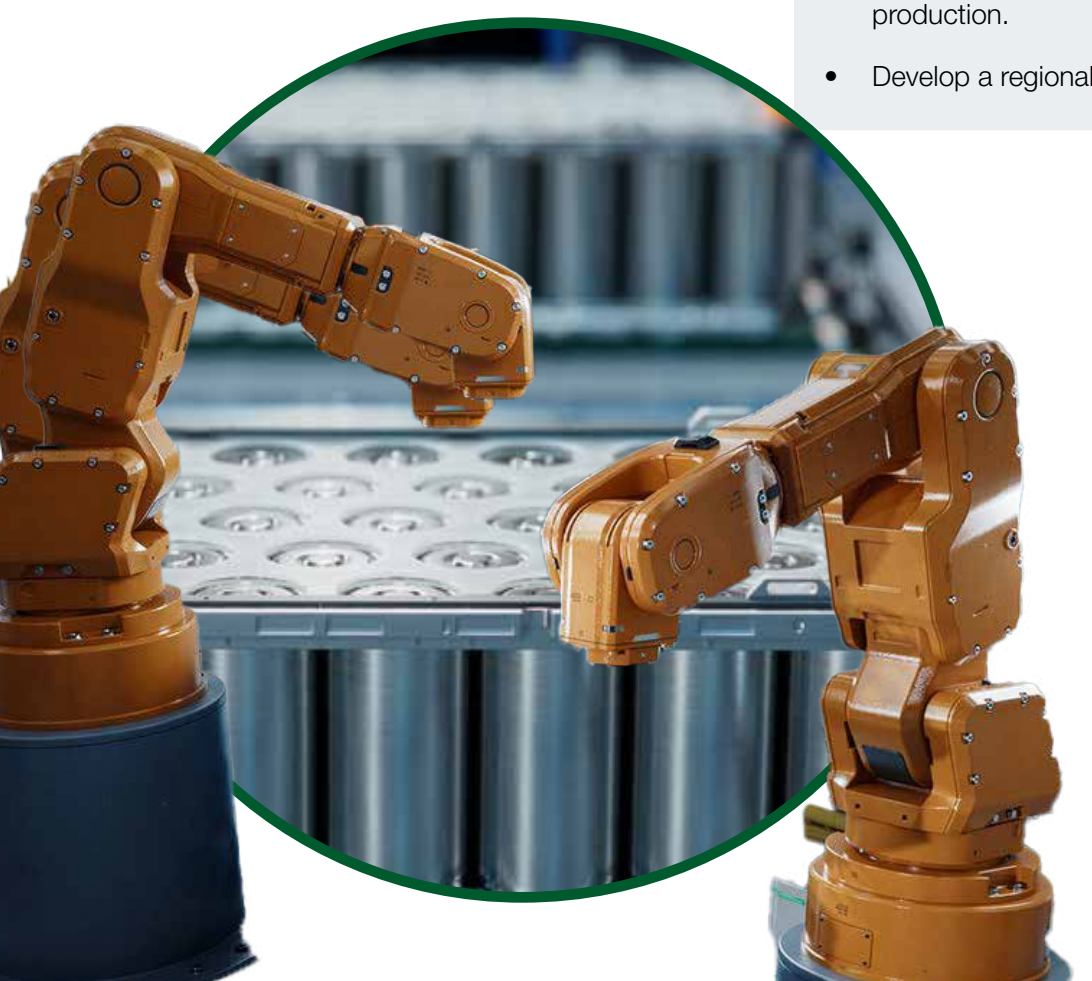
6.2.1. ENERGY STORAGE | ENERGY STORAGE MATERIALS AND BATTERIES

South Africa is the world's largest producer of manganese, a critical input for battery materials. Additionally, the country produces other battery materials including vanadium, nickel, iron, and lithium. Sub-Saharan Africa is estimated to hold about 30 per cent of the volume of world's proven critical mineral reserves; however, conducts little higher value-added processing of minerals.

South Africa can leverage its minerals reserves, mining capability, mineral processing capability, refining capability, precursor processing expertise as well as future demand of critical minerals. In addition, South Africa can leverage its advanced mineral processing infrastructure and expertise to become a processing hub for industrially important / critical minerals in the Southern African region.

Strategic Interventions:

- Position South Africa as a regional hub for processing and refining of critical minerals, the production of precursor materials and cathodes.
- Position South Africa as a regional hub for battery manufacturing
- Establish lithium-ion battery assembly activities for both electric vehicles and stationary storage
- Vision and Support for Indigenisation: Battery Cell and Electrode Stack Manufacturing through incentivisation of production, sales or capacity
- Establish vanadium redox flow battery manufacturing activities
- Over long-term, establish Lithium-ion manufacturing facility
- Develop a Comprehensive Battery Plan Creation: Value Chain Strategy and Implementation
- Create world-class processing hubs dedicated to critical minerals such as Centres of Competence in Precursor/Battery Material production.
- Establish special economic zones and beneficiation hubs that offer infrastructure support, technical assistance and streamlined regulations to encourage local processing and production.
- Develop a regional battery hub



6.2.2. ENERGY GENERATION | HYDROGEN AND FUEL CELLS

South Africa has invested in the development of the hydrogen economy predicated on the beneficiation of PGMs. This goal emanated as far back as 2007 when the Hydrogen South Africa Strategy was approved by the South African government. Over the years, the strategy has given rise to the hydrogen society roadmap (HSRM) (DSTI, 2022)[7], which aims to unite stakeholders on a common vision on how to use and deploy hydrogen and hydrogen related technologies as part of our economic development and greening objectives. The HSRM outlines several catalytic projects in the country to develop the hydrogen economy and these include the Platinum Valley Initiative (hydrogen valley), the CoalCO2-X Project, Boegoe Baai global hub for future fuel, and Sustainable Aviation Fuels Project.

Strategic Interventions:

- Create world-class research and manufacturing hubs dedicated to Hydrogen and Fuel Cells
- Catalyse fuel cell stacks manufacturing through incentivisation of production, sales or capacity
- Build demonstration, piloting and manufacturing facilities for catalysts, electrode membrane assemblies and fuel cell stack production
- Invest in hydrogen infrastructure
- Strengthen beneficiation support by fast-tracking industrialisation partnerships with Original Equipment Manufacturers (OEMs) in energy transition technologies

6.2.3. FERROCHROME AND FERROALLOYS INDUSTRY | REVIVAL OF SMELTING CAPACITY IN SOUTH AFRICA

One of South Africa's key priorities outlined in the National Development Plan 2030 is to drive industrial growth. Increased beneficiation of mineral resources has an important role in driving this industrial growth. With its substantial mineral resources, notably holding 72% of the world's chromite ore, South Africa is a significant producer of ferroalloys. However, in the last 10 years, the ferroalloys industry in South Africa has been severely hit by several challenges; namely, the escalating cost of electricity, poor rail and port performance, and increased competition from China, anchored by an anomaly with South Africa being its driver. Resultantly, several of the local ferroalloy smelters have closed down leading to job losses, decreased exports and loss in export revenue. As the demand for steel grew, underpinned in the main by the rapid expansion of the Chinese economy, this resulted in increasing demand for South Africa's resources. Ore exports of ferrous minerals from South Africa have consequently expanded.

Domestic smelting capacity, on the other hand, has decreased overall because of the regrettable permanent closure of smelters, such as the demise of Highveld Steel and Vanadium, and the mothballing of several other smelters. The lost manganese smelting capacity has moved elsewhere, with new smelters favouring places with long-term energy deals.

In 2019, about 34 of the 59 chrome furnaces had been shut down, and this unfortunately supported the continued growth in exporting of ore. This closure and mothballing of individual furnaces and entire smelters are what led to the country's share of ferrochrome global market dropping to 26% in 2019 from 39% in 2009.

Given these challenges, a set of targeted interventions are outlined through a multistakeholder approach to address the decline in refining capacity in the short term as well as increasing refining capacity in the medium to long term.

7 DSTI, 2022. Hydrogen Society Roadmap for South Africa

Strategic Interventions:

- Develop competitive and favourable electricity tariffs for the ferroalloys sector
- Explore the use of financial instruments on chrome ore exports
- Some of the existing incentives be repurposed to be export incentives for ferroalloys
- Feasibility of developing dedicated rail corridors for transporting ferroalloys to ports be explored
- Stimulate domestic demand (increase domestic production of stainless steel by designating increased local content for stainless steel products procured by Government)
- Addressing the export parity pricing for locally produced ores
- Review implementation of carbon taxes on the ferroalloys sector and negotiate for the exclusion of Carbon Border Adjustment Mechanism (CBAM) on ferrochrome

6.2.4. STEEL INDUSTRY

South Africa has some of the world's advanced manufacturing industries, particularly in the steel industry as well as in defence and aerospace. Minerals such as iron, chrome and manganese are critical inputs for the steel industry, and titanium is a key component used in defence and aerospace components. South Africa is the seventh world producer of iron, and a leading producer of manganese and chrome which are needed to produce steel. More than 90 % of manganese is used in the production of steel globally. South Africa produces steel locally and exports the raw ores. Traditional steel production uses grey hydrogen to reduce the iron, and therefore, there is an opportunity to use green hydrogen to decarbonise the steel sector.

Strategic Interventions:

Development alignment:

The global shift toward low-emission steel production presents a significant opportunity. South Africa's access to renewable energy resources (solar, wind) and iron ore reserves positions the country as a potential hub for green hydrogen-based steelmaking. Early-stage investment in hydrogen infrastructure can help South Africa capitalise on the growing global demand for green steel and attract international investments and partnerships.

Support local beneficiation through trade measures:

There should be focussed implementation of trade measures to support local industry and to improve industries' overall competitiveness; increase productive capacity; investments; retain and create jobs; enhance skills development as set out in the steel and metals fabrication masterplan (DTIC, 2021).

6.2.5. AUTOMOTIVE SECTOR | E-MOBILITY

Several initiatives signify South Africa's plans to transform its automotive sector. The country is planning to invest a portion of the Just Energy Transition Fund towards developing new energy vehicles (The Presidency, 2023)[8]. The Hydrogen Society roadmap has laid out the plans to build a mobility corridor along from Mogalakwena in Limpopo to Richards Bay in KwaZulu-Natal (DSI, 2022)[9]. This corridor will enable infrastructure development to support hydrogen fuel cell powered trucks for road transport. The automotive sector masterplan aims to grow South African vehicle production to 1% of global output, increase local content in South African assembled vehicles, and deepen value addition within South African automotive value chains amongst other objectives (DTIC, 2018)[10]. The Electric Vehicle White Paper (DTIC, 2023)[11] seeks to set a course to transition the auto industry from primarily producing Internal Combustion Engine (ICE) vehicles to a dual platform that includes electric vehicles in the production and consumption mix, alongside ICE vehicles in South Africa by 2035.

Strategic Interventions:

- Development of South African battery and fuel cell electric vehicle productive capacity and market
- Engaging global auto companies for localisation of electric vehicles manufacturing
- Develop the electric vehicles and charging Infrastructure Roadmap
- Invest in hydrogen infrastructure
- Develop a regional framework for partnership
- Conduct a risk assessment on the local internal combustion engine vehicle component manufacturing

6.2.6. DEFENCE AND AEROSPACE | LOCAL TITANIUM BENEFICIATION

South Africa has vast titanium reserves but lacks a robust downstream industry for titanium products such as aerospace components, medical implants, and industrial equipment. It is therefore necessary to establish manufacturing facilities to produce titanium-based products like aircraft parts, engine components, and medical implants. South Africa has immense potential to expand its titanium industry by addressing gaps in the value chain and focusing on high-value downstream applications. Strategic investments in titanium powder production, component manufacturing, recycling, and partnerships with global industries will help South Africa access more of the global titanium market while advancing technological innovation and environmental sustainability.

Strategic Interventions:

- Invest in R&D programs for Titanium Extraction and Processing
- Developing Local Titanium Component Manufacturing
- Support local beneficiation through trade measures

8 The Presidency, 2023. Just Energy Transition Implementation Plan 2023-2027
9 DSI, 2022. The Hydrogen Society Roadmap
10 The DTIC, 2018. Automotive sector masterplan
11 The DTIC, 2023. Electric vehicles white paper 2023.

6.3. Pillar III | Research and Development and Building a Skilled Workforce

Research and Development:

By strategically investing in research and development, South Africa can transform its mineral wealth into internationally renowned high-tech products and innovative processes. This is more than an economic initiative; it is a visionary leap into a future in which South Africa shapes global industry standards. The R&D investment focus should prioritise high-impact areas that are critical for the green economy and next-generation technologies. Driving research in battery materials, fuel cells, and advanced beneficiation methods, will unlock the potential to process critical minerals into high-value products. Given the endowments available in Africa, including its youthful population, it is not idealistic to envisage capacities within South Africa and the rest of the continent to manufacture such sophisticated components as computer and other microchips, for instance.

- Support artificial intelligence (AI) and internet of things (IoT)-based mining and mineral processing innovations
- Establish a Critical Minerals Testing & Certification Centre
- Drive partnerships with universities, industry leaders, and international tech firms, ensuring our innovations are world-class and commercially viable
- Develop Regional & International R&D Partnerships

Strategic Interventions:

- Establish National Critical Minerals Research, Development and Innovation hubs:
  - Supporting startups and RDI projects that focus on interventions that can make South Africa's mining sector more globally competitive
- Invest in Research and Development towards: Battery precursor materials; High performance battery cathode materials to beneficiate manganese, nickel, cobalt and lithium; PGM based catalysts and membrane electrode assemblies (MEAs) for electrolysers and fuel cells; Next-generation solar technologies, which can reduce dependency on silicon; Certification and testing for batteries; and Titanium extraction and processing technologies, such as more efficient beneficiation methods and environmentally friendly extraction processes.
- Launch R&D Commercialisation Fund for startups and innovation projects

Building a Skilled Workforce:

Critical minerals hold immense potential for economic growth, but to realise its full potential, South Africans must have the necessary skills, opportunities, and support to meaningfully participate in the industry. Investing in education, training, and community development will ensure equitable benefit sharing. A people-centred approach critical mineral strategy must prioritise skills development and training in high-demand skills across the mineral value chain from exploration and mining to advanced processing, manufacturing, and even research. Public-private partnerships with universities, training institutions, and mining companies (a multiple helix approach) will deliver targeted education that ensures our citizens are ready to excel in these critical industries. Further, actively promoting diversity and inclusivity within the workforce can create a sector where women, young people, and previously marginalized groups take on prominent roles.

Strategic Interventions:

- Align occupational demand and education supply from higher learning institutions to ensure that the quality of graduates meets the needs of the existing and emerging sector for critical minerals. For instance, skills such as programming required for battery certification and codes, battery packs and cell assembly; and researchers specialising in battery materials are needed.
- Establish accredited educational and training programmes, in cooperation with international institutions and training providers, for energy storage technology professionals.
- Introduce a ‘critical minerals workforce planning’ to create a uniform understanding of the skills landscape, gaps and demand.
- Prioritise government and industry awareness campaigns to improve relations with host communities and understand broad range of direct and indirect opportunities for employment, climate impact reduction and industrial expansion.

6.4. Pillar IV | Infrastructure and Energy Security

South Africa requires infrastructure that aligns with its ambitions in areas such as energy, transportation, water, and digital connectivity. Investing in world-class infrastructure is not merely about logistics; it is about establishing a foundation for sustained economic growth, regional empowerment, and future-ready industries. Reliable energy supply and efficient transport and logistics will significantly enhance South Africa's position as a dependable global supplier. A revitalised rail network can reduce costs, increase capacity, and lessen the environmental impact of transportation. Similarly, upgrading our ports will ensure faster, more reliable exports, positioning South Africa as a premier hub for critical minerals. Access to renewable energy sources and implementing differentiated tariffs for key mineral sectors, such as ferrochrome smelting, will keep our industries competitive globally.

Integrated water management is critical for sustainable mining operations. Our infrastructure plan must include strategic investments in water recycling, desalination, and efficient water management systems. These measures will not only support mining and other business activities but also safeguard local communities and protect the environment. As the mining industry increasingly embraces digital technologies, South Africa's infrastructure must evolve to include robust digital networks and data centres. This will enable advanced mining techniques, real-time data collection, and managed automation, empowering our mining workforce, enhancing productivity, and attracting high-tech investments to our mineral sector.

Strategic Interventions:

- Establish special economic zones and beneficiation hubs that offer infrastructure support, technical assistance and streamlined regulations to encourage local processing and production.
- Develop a Green Mining Infrastructure Support Initiative to promote infrastructure investments (energy, transport, water) for mining operations.
- Expedite Operation Vulindlela reforms to improve energy supply reliability, unlock bulk supply logistical constraints and improve the efficiency of ports
- Address electricity costs associated with mining, processing and manufacturing for critical minerals:
    - implement energy efficiency standards for equipment, energy use, reporting systems and energy conservation plans to decrease the overall operational costs associated with electricity.
- Introduce water demand management or water-less mine requirements
- Augment the current infrastructure fund to finance publicly and privately developed infrastructure that connects critical minerals mines to processing facilities and global value chains.

6.5. Pillar V | Financial Instruments to Support Local Beneficiation

A robust financing framework is essential to support this strategy, ensuring a stable and competitive environment while aligning with broader geopolitical and economic objectives. The proposal includes a mix of tax incentives, royalty adjustments, and investment credits to encourage domestic exploration, extraction, and processing of critical minerals. A tiered taxation system can be introduced, offering lower corporate tax rates or accelerated depreciation for projects that focus on minerals deemed strategic for supply chain resilience.

Additionally, royalty reductions or exemptions can be granted for new projects that incorporate sustainable mining practices or invest in value-added processing within national borders. Government-backed loan guarantees and public-private partnerships (PPPs) can further incentivize investment in infrastructure critical for mining operations, such as roads, rail, and energy supply, reducing operational costs for miners and enhancing long-term competitiveness.

The introduction of a powerful, differentiated incentive structure that rewards local processing over raw exports can enhance the local value capture from critical minerals. This is not merely smart economics; it is a bold step toward building a self-sustaining, future-ready South African economy. Well-designed incentives ensure stable, predictable costs;

companies can make long-term commitments, creating thousands of jobs and generating billions in economic activity.

Strategic Interventions:

To ensure these fiscal instruments yield results, targeted interventions should focus on:

- Introducing differentiated electricity tariffs for highly valued processed minerals with high energy intensity.
- Providing R&D tax credits for technological innovations in sustainable mining and mineral processing.
- Establishing special economic zones and beneficiation hubs that offer tax benefits, infrastructure support, technical assistance and streamlined regulations to encourage local processing and production.
- Fast-tracking permitting and licensing for projects that align with national security.
- Implementing a local content policy to ensure that fiscal benefits translate into domestic job creation, skills development, and technology transfer.
- Establish a dedicated critical minerals processing investment program targeted at both local and multinational producers of critical mineral end-use applications.
- Establishing a strategic partnership framework with allied nations to harmonise fiscal incentives and promote cross-border investments in critical minerals.

These targeted measures would help create a self-sustaining ecosystem that strengthens national control over critical minerals while reducing dependency on foreign sources.

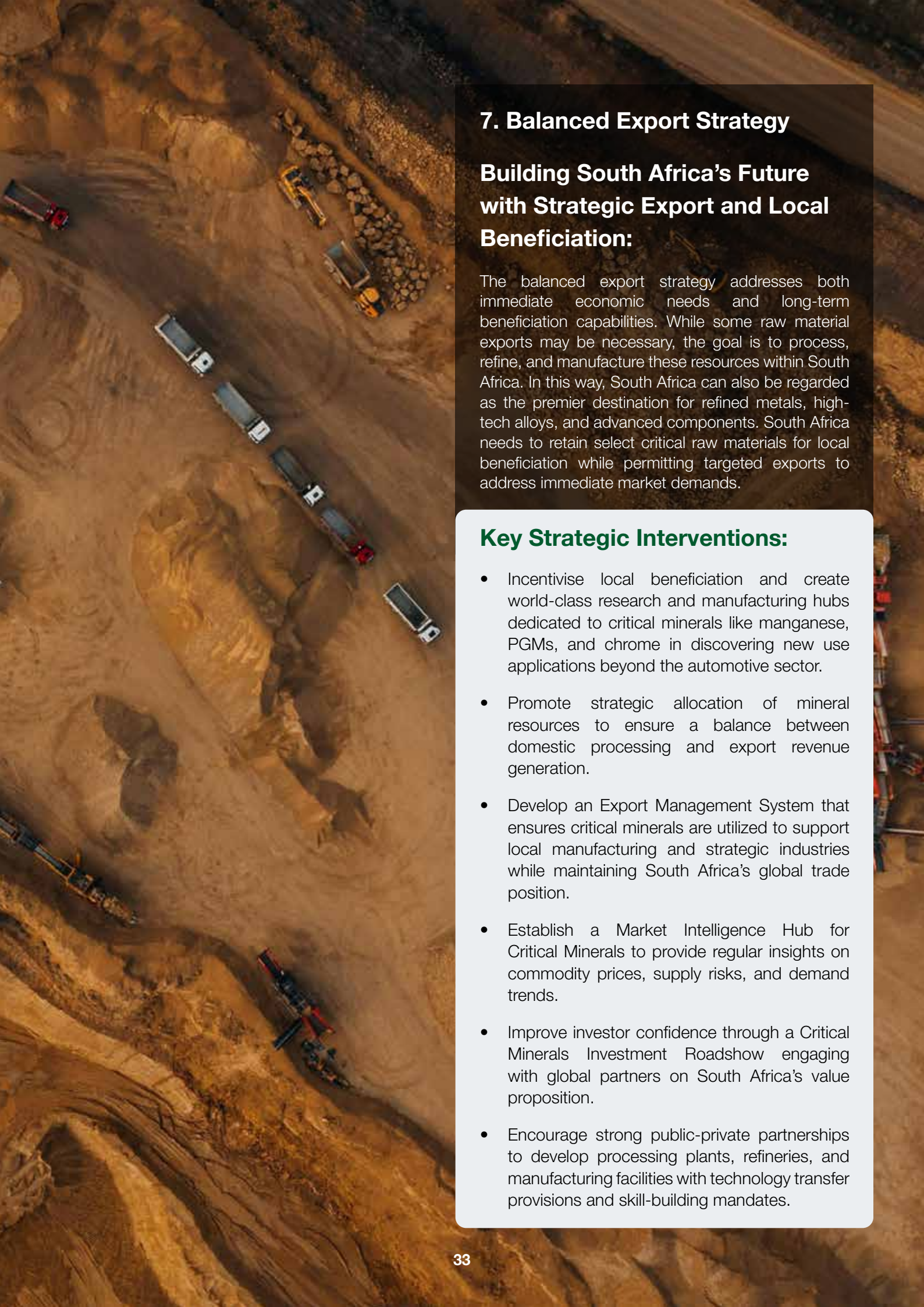
6.6. Pillar VI | Harmonisation of the Regulatory and Policy Framework

Mineral endowments are not in themselves a competitive advantage. Mineral value chains are rapidly evolving, with cutting-edge technological advancements constantly challenging the market. To sustainably grow the local industry and compete globally in specific value chains, there is urgency to implement policies that can provide an enabling environment for increased mining output and improved competitiveness in niche areas such as in energy applications, electromobility and recycling. Policies and incentives should address issues on access to funding for small-scale businesses, localisation to induce local demand and improve competitiveness of domestic suppliers.

There is therefore a need to harmonise policies. Changes in mining policies, energy and climate creates uncertainty, which affects investments into mineral value chains. There is a need to establish a clear, stable, and transparent regulatory framework that supports investment and balances the need for social equity with business incentives.

Strategic Interventions:

- Address regulatory bottlenecks
- Review and streamline regulatory requirements across licensing departments to align regulatory processes amongst departments
- Improved turnaround time on the processing of prospecting rights – create a one-stop shop licensing system.



7. Balanced Export Strategy

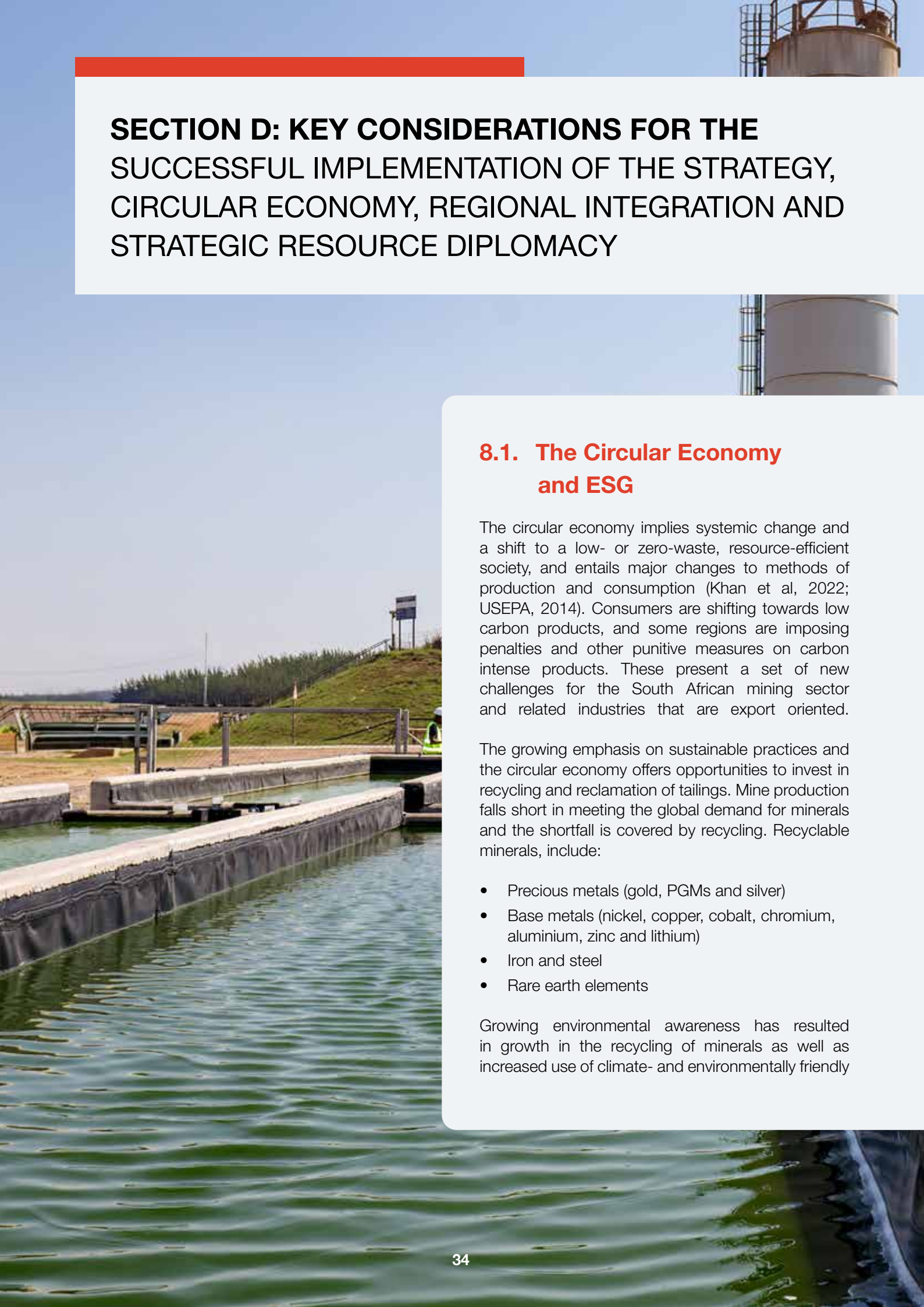
Building South Africa's Future with Strategic Export and Local Beneficiation:

The balanced export strategy addresses both immediate economic needs and long-term beneficiation capabilities. While some raw material exports may be necessary, the goal is to process, refine, and manufacture these resources within South Africa. In this way, South Africa can also be regarded as the premier destination for refined metals, high-tech alloys, and advanced components. South Africa needs to retain select critical raw materials for local beneficiation while permitting targeted exports to address immediate market demands.

Key Strategic Interventions:

- Incentivise local beneficiation and create world-class research and manufacturing hubs dedicated to critical minerals like manganese, PGMs, and chrome in discovering new use applications beyond the automotive sector.
- Promote strategic allocation of mineral resources to ensure a balance between domestic processing and export revenue generation.
- Develop an Export Management System that ensures critical minerals are utilized to support local manufacturing and strategic industries while maintaining South Africa's global trade position.
- Establish a Market Intelligence Hub for Critical Minerals to provide regular insights on commodity prices, supply risks, and demand trends.
- Improve investor confidence through a Critical Minerals Investment Roadshow engaging with global partners on South Africa's value proposition.
- Encourage strong public-private partnerships to develop processing plants, refineries, and manufacturing facilities with technology transfer provisions and skill-building mandates.

SECTION D: KEY CONSIDERATIONS FOR THE SUCCESSFUL IMPLEMENTATION OF THE STRATEGY, CIRCULAR ECONOMY, REGIONAL INTEGRATION AND STRATEGIC RESOURCE DIPLOMACY



8.1. The Circular Economy and ESG

The circular economy implies systemic change and a shift to a low- or zero-waste, resource-efficient society, and entails major changes to methods of production and consumption (Khan et al, 2022; USEPA, 2014). Consumers are shifting towards low carbon products, and some regions are imposing penalties and other punitive measures on carbon intense products. These present a set of new challenges for the South African mining sector and related industries that are export oriented.

The growing emphasis on sustainable practices and the circular economy offers opportunities to invest in recycling and reclamation of tailings. Mine production falls short in meeting the global demand for minerals and the shortfall is covered by recycling. Recyclable minerals, include:

- Precious metals (gold, PGMs and silver)
- Base metals (nickel, copper, cobalt, chromium, aluminium, zinc and lithium)
- Iron and steel
- Rare earth elements

Growing environmental awareness has resulted in growth in the recycling of minerals as well as increased use of climate- and environmentally friendly

methods for recycling. Recycling in South Africa poses many challenges, and the process is not economically viable. However, as a mining country, reclamation of tailings and discards, and extraction of their value across the many commodities offers great opportunities for taking full advantage of the circularity of mining.

There is a well-established secondary market for some of the recyclable minerals such as gold and PGMs. Recycling is growing due, among others, to vulnerabilities in critical minerals supply chains. Similarly, the recycling of battery minerals is also growing. While South Africa's mineral value chains are not focused on recycling, the country will benefit from establishing recycling for the sustainability of its mineral endowments. For example, investing in lithium recycling technologies and facilities could complement the growth of lithium mining in South Africa and help create a sustainable, circular economy within the lithium value chain.

In South Africa, coal fly ash (CFA) has potential for economically recoverable grades of rare earth elements (REEs) and these can produce a new, non-traditional source of specific REEs. REEs are essential for permanent magnets used in wind turbines and electric vehicles motors.

Coal is a significant component of South Africa's energy mix, therefore, investments into clean coal technologies and carbon capture technologies will reduce the impact on South Africa's carbon footprint. South Africa has been investing in gasification technology to reduce its dependence on coal, increasing its consumption of natural gas and increasing renewables for a diverse energy mix.

Strategic Interventions:

- Invest in critical minerals recycling
- Develop a decarbonized mining and smelting framework to integrate energy-efficient mining practices and cleaner processing technologies.
- Build competency to extract minerals from secondary sources; such as extracting Rare Earth Elements from coal fly ash (CFA).
- Invest in cleaner coal technology pathways, including carbon capture, storage and utilisation (CCS & CCSU).

8.2. Bolster Regional Integration

South Africa, as a continental leader in mining and mineral production with well-developed infrastructure and strong links to international markets, has a unique opportunity to enhance its critical minerals strategy implementation through regional integration. By forging a larger, interconnected market with neighbouring countries, South Africa can boost the region's investment appeal, unlock underutilised resources, and address risks of uneven critical minerals geographic concentration while securing access to critical resources like Lithium and Rare Earth Elements. This requires collaborative policies that prioritise openness over protectionism, streamline bureaucratic procedures, and harmonise mining regulations to create a stable and predictable investment environment.

Further, there would be mutual benefit among regional partners from technology transfer, enhanced value addition, and greater market access, fostering growth across the region. By developing regional hubs for mineral processing and manufacturing, Southern Africa can achieve greater economic diversification, economies of scale, and competitiveness in the global critical minerals value chain, aligning with the goals of the African Continental Free Trade Area (AfCFTA). South Africa's critical minerals strategy must embrace regional collaboration to address resource gaps, mitigate risks, and create a unified front that harnesses the full potential of Southern Africa's critical mineral reserves, paving the way for shared prosperity and sustainable development.

Regional mineral beneficiation hubs, bilateral and multinational agreements, could offer potential opportunities for the establishment of downstream activities. The African continent has incomparable reserves and mining capacity in key minerals required for the battery value chain, and other clean energy technologies (fuel cells and electrolysers). These include copper (Democratic Republic of the Congo (DRC), Zambia and South Africa), cobalt (DRC, Madagascar, South Africa), graphite (Mozambique, Tanzania, Madagascar), iron ore (South Africa) and others.

Develop a regional framework for partnership:

Establish a framework under which African countries collaborate with partner countries to develop the industrial capacity necessary to make the continent a key industrial player in electric vehicle manufacturing as well as battery and fuel cell value chain. The transition to electric vehicles is likely to drive demand for battery and fuel cell minerals such as manganese, nickel, cobalt, PGMs iron and lithium, both within South Africa and the rest of Africa, providing an opportunity for increased regional industrialisation and the development of regional value chains.

Strategic Interventions:

- Collaborate with regional partners to establish battery production hubs utilizing nickel, graphite, cobalt, and PGMs, to strengthen the regions' manufacturing capacity and global competitiveness.
- Facilitate Regional Critical Minerals Cooperation Agreements within SADC for securing strategic raw materials not available domestically.
- Africa Region Partnerships: Co-invest in South Africa for a Regional Mineral Beneficiation Hub.
- Invest in or acquire equity stakes in mining operations across the region, ensuring security of supply while contributing technical expertise, infrastructure, and beneficiation capacity.
- Engage with the UN Panel on Critical Energy Transition Minerals for knowledge-sharing and alignment with global sustainability standards.

8.3. Geopolitical Landscape and Considerations: Strategic Resource Diplomacy is Driving Policy Shifts on Critical Minerals

The escalating demand for critical minerals is intensifying global geopolitical and trade conflicts as nations acknowledge their strategic significance for economic development, technological progress and national security (Lee, 2021). As the world shifts to a low-carbon future, critical minerals have become essential elements in clean energy technologies, electric vehicles and advanced manufacturing. This has intensified competition for access to these minerals, leading to resource nationalism, trade restrictions and efforts to secure supply chains, which are increasingly becoming major sources of geopolitical rivalry (Humphries, 2019).

China's pre-eminences in the production, processing and manufacturing of essential minerals have positioned it at the epicentre of these geopolitical tensions. China presently dominates over 70 per cent of the global supply chain for various critical minerals, including REEs, lithium, cobalt and graphite, which are vital to produce electric vehicles, wind turbines and solar panels (Mancheri et al., 2019). This concentration of supply affords China considerable leverage in global markets, enabling it to influence prices, regulate supply chains and dictate trade terms.

The ramifications of China's dominance in the rare earth elements (REE) market have been highlighted by several successful challenges brought before the World Trade Organization (WTO). Following China's accession to the WTO in 2001, it imposed export restrictions on nine REE minerals. Recognizing the importance of critical minerals in the 1980s, China classified REEs as strategic commodities under state control and planning. Initially, China flooded the market with oversupply at lower international prices, outcompeting global rivals. However, it later imposed export restrictions, which led to a series of WTO disputes.

By applying a combination of export duties, quotas and price floors, China created a two-tier price system benefitting local manufactures – while global competitors faced high global prices and stricter environmental requirements[i]. As a result, multiple companies were forced to add factory capacity in China (through collaborations with local firms) to access the inputs.

Following China's playbook, the world is witnessing a growing trend of protectionism and resource nationalism. Zimbabwe banned export of raw lithium in 2022 citing opportunity costs to the tune of €1,7 billion for processing the mineral into lithium-ion batteries[ii]. Indonesia, the world's top producer of nickel, banned export of nickel ore in 2020 to encourage domestic processing. The value of Indonesia's nickel exports increased from US$3 billion to US$30 billion in the two years following the ban[iii]. Chile, home to 26 per cent of nickel reserves and the world's second largest producer, also signalled intentions to nationalise the lithium industry in 2023[iv].

The growing threat of resource nationalism resulted in the US declaring its reliance on China for critical minerals a national emergency through a presidential executive order issued in 2020[v]. In reaction to China's protectionist approach, the US promulgated the Chips and Science Act in 2022 prohibiting or limiting US-funded companies to expand semiconductor manufacturing and exporting in China and countries considered a threat to national security[vi]. China retaliated with export licensing requirements of its own on gallium, germanium, graphite and antimony, all of which constitute REE minerals crucial for the production of semiconductors, EV batteries and military weapons[vii].

As trade tensions between the two superpowers escalate, China is tightening its grip on global critical mineral reserves under the Belt Road Initiative (BRI) by acquiring, developing and investing in new mines in developing economies. Such investments span Indonesia[viii] (nickel), the DRC (cobalt), Zimbabwe (lithium) and the developed Canada, where government sought to tighten foreign investment in strategic sectors. These investments are usually undertaken through soft power courting governments and building local infrastructure as incentives for 'obtaining' offtake agreements[ix] Both local and international mining projects are purportedly

associated with poor working conditions and environmental hazards, giving Chinese firms an unfair advantage over competitor suppliers[x].

Meanwhile, the US, alongside partner countries in Europe and Asia, have joined forces to break China's monopoly over critical minerals by unveiling the Mineral Security Partnership (MSP) in 2022[xi]. The MSP seeks to accelerate the development of diverse and sustainable critical mineral supply chains through targeted financial and diplomatic support to selected global strategic projects that adhere to environmental, social and governance (ESG) standards.[xii]

Globally, the critical minerals environment is largely driven by the renewable energy transition, geopolitical dynamics, technological advancements, and international trade policies and standards. South Africa's ability to position itself as a dependable supplier of critical minerals and materials globally depends on its ability to navigate this complex environment. The transition to clean energy technologies and electric vehicles (both Battery and Fuel Cell Electric Vehicles) creates a surge in demand for critical minerals such as lithium, graphite, nickel, cobalt, and PGMs. Demand for nickel, cobalt, REEs, and graphite will increase by 65 per cent to 80 per cent by 2040, driven primarily by the significant rise in grid storage and deployment of electric vehicles[12].

The developing geopolitical fragmentations such as Russia's invasion of Ukraine and the derisking (or even de-coupling) from China by the United States (US) impels more economically developed countries to seek diversified supply chains to reduce reliance on one global dominant market, creating some opportunities for South Africa to position itself as a strategic partner (Abidjan, 2023)

The European Union (EU) Critical Raw Material Act (CRMA), which aims to secure a sustainable and resilient supply chain of critical minerals, reflects this new strategic shift. However, this also brings competition from other nations that have vast mineral endowments, including Australia, Canada, and emerging players in Africa such as the Democratic Republic of Congo and Namibia (Antonio & Elvis, 2023)[13]. Therefore, to remain competitive, South Africa must position itself to meet the global environmental, social, and governance (ESG) standards which are not only increasingly a prerequisite for accessing international markets and funding, but also fundamental to its developmental imperatives.
In this context, the strategy seeks to align with these requirements to remain globally competitive.

South Africa's position within the BRICS bloc presents both opportunities and challenges. China, a dominant player in the global processing of critical minerals, is a key partner but also a competitor in the mineral value chain. While Chinese investments offer access to processing technologies and global markets, over-reliance on a single trading partner poses risks, particularly considering rising geopolitical tensions between China and Western economies. Therefore, diversifying trade relationships to include the European Union (EU), the United States, and other African nations is essential to building a resilient and balanced critical minerals strategy.

Political stability and regulatory certainty are also crucial factors in fostering international partnerships. Countries with predictable regulatory environments and strong governance frameworks tend to attract more investment in mining and mineral processing. South Africa's historical mining expertise and well-developed infrastructure position it as an attractive partner; however, addressing challenges such as labour disputes, regulatory delays, and illegal mining will be critical to maintaining investor confidence. Active diplomatic engagements to secure favourable trade agreements and strengthen political ties will further enhance South Africa's global competitiveness in the critical minerals sector.

Finally, South Africa's leadership role in the African Continental Free Trade Area (AfCFTA) provides a unique opportunity to collaborate with other African countries on developing integrated supply chains for critical minerals. By fostering regional cooperation, South Africa can contribute to creating a robust intra-African market for mineral resources and processing capabilities. This approach will not only reduce dependence on external players but also support sustainable economic development across the continent. As geopolitical considerations increasingly shape global trade dynamics, a forward-looking approach will be essential for South Africa to secure its position in the critical minerals landscape.

As nations increasingly compete for control over critical mineral value chains, strategic partnerships and political alliances will play a vital role in securing long-term economic and industrial benefits.

12 IEA, 2022. The Role of Critical Minerals in Clean Energy Transition, International Energy Agency

13 Antonio, A. & Elvis, A., 2023. Critical Minerals and Routes to Diversification in Africa: Opportunities for Diversification into Batteries and Fuel Cells and Mining Equipment Technologies -The Case of South Africa, s.l.: UNCTAD

9. Conclusion

The objective of South Africa's Critical Minerals and Metals Strategy is to harness the country's mineral wealth to drive sustainable growth, innovation, and global competitiveness. By prioritising exploration, local beneficiation, fostering research and development, and addressing critical infrastructure and policy challenges, the strategy lays a foundation for South Africa to transition from a supplier of raw materials to a leader in the global critical minerals value chains.

The strategy acknowledges the challenges posed by infrastructure bottlenecks, skills shortages, and regulatory complexities, while presenting actionable interventions to overcome these barriers. It also aligns with global Environmental, Social, and Governance standards and the imperatives of the African Continental Free Trade Area, positioning South Africa as a responsible and dependable partner in the evolving landscape of critical minerals supply chains. To capitalise on South Africa's mineral endowment, the strategy considers both the internal and external dynamics. Internally, the strategy recognises the urgent need to address infrastructure deficiencies and improve the regulatory and policy environment to attract foreign and domestic investment into exploration, mining and beneficiation activities. The strategy also recognises the significance of building future skills for the sector through investment in education and training, while fostering innovation in mining processing and recycling. Externally, the strategy recognises the need to strengthen international partnerships to facilitate market access, secure technology transfer and foster sustainable mining practices.

Successful implementation of this strategy will require robust collaboration between the government, private sector, academia, and civil society. Through coordinated efforts, South Africa can unlock the full potential of its critical minerals, ensuring inclusive and sustainable development while contributing to global efforts toward a green economy and technological advancement.

As the demand for critical minerals continues to grow exponentially in the coming decades, South Africa is well-placed to seize this opportunity, becoming a beacon of innovation and sustainability in the global mining sector. This strategy is not merely a roadmap but a commitment to securing long-term prosperity for the nation and its people. By acting decisively and strategically, South Africa can transform its mineral endowment into a cornerstone of national and regional economic resilience and leadership.

END NOTES

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ii https://www.africanews.com/2022/12/29/zimbabwe-bans-all-lithium-exports//#:~:text=Zimbabwe%20has%20banned%20all%20lithium,it%20into%20batteries%20in%2Dcountry.

iii https://www.usitc.gov/publications/332/working_papers/ermm_indonesia_export_ban_of_nickel.pdf

iv https://www.globalminingreview.com/mining/14082023/chiles-national-lithium-strategy-brings-risks-and-opportunities/

v https://trumpwhitehouse.archives.gov/presidential-actions/executive-order-addressing-threat-domestic-supply-chain-reliance-critical-minerals-foreign-adversaries/

vi https://www.energypolicy.columbia.edu/chinas-latest-move-in-the-critical-mineral-and-technology-trade-war/

vii https://www.hinrichfoundation.com/research/tradevistas/us-china/rare-earths-trade-war/

viii Chinese companies invested US$30 billion in the nickel Indonesian supply chain.

ix https://aheadoftheherd.com/how-china-cornered-the-market-for-critical-minerals-and-can-the-west-break-its-near-monopoly-on-these-metals-richard-mills/

x https://chinalabor.wpenginepowered.com/wp-content/uploads/2022/11/Trapped_-The-Belt-and-Road-Initiatives-Chinese-Workers-1.pdf

xi Includes Australia, Canada, Estonia, Finland, France, Germany, India, Italy, Japan, Norway, the Republic of Korea, Sweden, the United Kingdom, the United States and the European Union.

xii https://www.state.gov/wp-content/uploads/2023/02/MSP-Principles-for-Responsible-Critical-Mineral-Supply-Chains-Accessible.pdf

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