Horizon Europe Framework Programme (HORIZON)

D9.3 – South Africa Case Study

WP9 - Task 9.4

Date [31/01/2024]

H. Cornelissen[1], K Nondwangu[1], S Manyala[1], S Phetla[1], M Kolomela[1], S Ndlela[1], N Pillay[2], P Jourdan[3], R Goode[4], D. Perkins[5]

[1]DMT Kai Batla,

Funded by
the European Union

Disclaimer

Document information

Grant Agreement / Proposal ID	101057832
Project Title	EU-**Africa** Partnership on Raw **Ma**terial **Val**ue chains
Project Acronym	AfricaMaVal
Project Coordinator	Guillaneau Jean-Claude (jc.guillaneau@brgm.fr) - BRGM
Project starting date (duration)	1st June 2022 (42 months)
Related Work Package	WP9
Related Task(s)	Task 9.4
Lead Organisation	BRGM
Contributing Partner(s)	DMT-KB
Due Date	January 2024
Submission Date	January 2024
Dissemination level	

History

Date	Version	Submitted by	Reviewed by	Comments
28/09/2023	Draft	DMT-KB – H. Cornelissen	BRGM – C. Zammit	Typos, structure & content to review
08/11/2023	V1	DMT-KB – H. Cornelissen	BRGM – C. Zammit	Structure & content to review
17/01/2024	FINAL	DMT-KB – H. Cornelissen	BRGM – C. Zammit	Minor comments
25/01/2024	FINAL	BRGM – C. Zammit	BRGM. J. Melleton	

Table of Contents

Funded by
the European Union

List of Figures

List of Tables

Funded by
the European Union

Abbreviations and Acronyms

Acronym	Description
AfCFTA	African Continental Free Trade Agreement
AfDB	African Development Bank
AMCU	Association of Mineworkers and Construction Union
ANC	African National Congress
AOI	Areas Of Interest
ASM	Artisanal and Small-scale Mining
BEE	Black Economic Empowerment
B-BBEE	Broad-Based Black Economic Empowerment
BIT	Bilateral Investment Treaties
BRIC	Brazil, Russia, India and China
BRICS	Brazil, Russia, India, China and South Africa
CIPC	Companies and Intellectual Property Commission
COMESA	Common Market for Eastern and Southern Africa
CRMs	Critical Raw Minerals
DAI	Development Alternatives Incorporated
DBA	Disc-Based Association
DMRE	Department of Mineral Resources and Energy
EAC	East African Community
ECRMs	Extended Critical Raw Materials
EITI	Extractive Industries Transparency Initiative
EIU	Economist Intelligence Unit

ESG	Environmental, Social and Governance
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HDI	Historically Disadvantaged Individuals
IEC	Independent Electoral Commission
ILO	International Labour Organisation
IMF	International Monetary Fund
IPG	International Partners Group
JET IP	Just Energy Transition Investment Plan
JETP	Just Energy Transition Partnership
JSE	Johannesburg Stock Exchange
MCSA	Minerals Council South Africa (formerly the Chamber of Mines)
MPM	Mineral Potential Mapping
MPRDA	Minerals and Petroleum Resources Development Act, 2002
NECOM	National Electricity Crisis Committee
NLCC	National Logistics Crisis Committee
NUM	National Union of Mineworkers
OECD	Organisation of Economic Cooperation and Development
PGM	Platinum Group Metals
PRECCA	Prevention and Combating of Corrupt Activities Act, 2004
PRI	Principles for Responsible Investment
RF	Random Forest
RSA	Republic of South Africa

Funded by
the European Union

SADC	Southern African Development Community
SAHRC	South African Human Rights Commission
SAIMM	South African Institute of Mining and Metallurgy
SAMCODE	South African Minerals Reporting Code
SAMESG	South African guideline for the reporting of ESG
SAMRAD	South African Mineral Resources Administration System
SAMREC	South African Minerals Reporting Code
SLP	Social and Labour Plan
SOE	State Owned Enterprise
TDCA	Trade and Development Cooperation Agreement
US$	United States Dollar
WEF	World Economic Forum
WP	Work Package
WTO	World Trade Organisation

Wording

Mineral prospectivity: "Mineral potential mapping is concerned with quantifying and mapping the likelihood that mineral deposits are present in a study area. It is synonymous to mineral prospectivity mapping, which is concerned with quantifying and mapping the likelihood that mineral deposits may be found by exploration in a study area."

Keywords

ECRM, Mineral potential, Ore processing, Refining capacities, Recycling units, Value chain, Primary raw material, Secondary raw material, Bottlenecks, Finance, Investment, Sustainability, ESG, Land-use, Taxation, Mining regulation, Mining policies, Child labour, Responsible extraction, South-Africa, Pan-African

Executive Summary

South Africa is a country that is vastly rich in mineral resources. The scope of report precludes an in-depth treatment of all aspects of the country; rich geology, and the ecosystem of supports systems, institutes of learning, legislation and industry that has developed over more than a century in support of this mineral wealth.

The structure of this report has been adapted to facilitate a rapid overview, with significant amounts of additional information provided in appendixes to reduce the bulk of the main report.

The objective of the report is to provide the reader with an overview of the country as a producer of Critical Raw Minerals (CRMs) and to present a balanced view of the structure of the economy, the institutions and legislation that guide mineral exploitation, and the support industries available for these industries. This overview starts with a brief look at the geology and mineral prospectivity maps of the country, focussing on CRM's.

The chapters that follow, then turn the reader's attention to a look at economic parameters, international cooperation, and legislation. An important aspect of mineral investments in the mining sector for both large-scale and small-scale activities, is the consideration of Environmental, Social and Governance aspects, and these are addressed.

The closing chapters of the report address indicators for the Twin Transition in the country, and the final chapter provides an assessment of the country as an investment destination, giving more specific details of projects that may interest readers and potential investors.

South Africa's mining and mineral industry is vast and complex. Despite the decline of mining's relative importance in terms of absolute contribution to Gross domestic product (GDP), it has shaped the landscape of the country, its infrastructure development and labour relations in ways that remain evident to the present day. The new global demand of CRM's has seen South Africa ready to engage with buyers and investors from all over the world and, given the persistent decline of the traditional mineral commodities since the 2008 global financial crisis, this interest is met with eager anticipation from a variety of stakeholders within well-organised sectors in the country.

This report provides the reader with an overview of the current scenario and key aspects of CRM prospectivity, institutions and potential in South Africa.

The report is an integral part of the larger AfricaMaVal project and, in that context, provides this country overview specifically aimed at European Union (EU) investors and decision-makers. The report demonstrates South Africa's suitability as a destination of choice for stable future CRM supply to the EU.

Funded by
the European Union

1. Extended Critical Raw Materials (ECRM) supply potential of South Africa

NOTE: *In consideration of size limitations in this report and the availability of ample alternative sources, the geology of South Africa in this chapter is restricted to only these brief statements. Interested readers are referred to APPENDIX_1.1_GEOLOGY for more information about the main geological features and economically significant ore deposits. APPENDIX_2.1_MINING_LIST presents List of Major CRM operations in South Africa. Table 1. Presents a list of the known CRM deposits in the country.*

1.1. Inventory of the ECRM

1.1.1 Geological setting

The geology of South Africa records large parts of the Earth's history from Mesoarchean to recent time. This implies a high diversity of geological environments and associated mineral resources that evolved during the geologic evolution of the country (**Fig. 1**). The oldest rocks constitute the Kaapvaal Craton in NE South Africa, which are comprised of Mesoarchean consist of grey, banded gneisses, various granitoids, and rather well-preserved volcanic rocks that show evidence of submarine extrusion and constitute the so-called greenstone belt. In the NE corner of the country, the Kaapvaal Craton is separated from the Zimbabwe Craton of similar age and composition by the Limpopo Belt which is an east-northeast trending zone of granulite facies tectonites with large scale ductile shear zones that evolved in the Palaeoproterozoic era and are interpreted as uplift structures of the overthickened crust. In the west the Kaapvaal Craton is bound by the Palaeoproterozoic Kheis Belt, whereas in the centre it is overlain by the Witwatersrand Basin Neoarchaean (2700 Ma) and the Early Palaeoproterozoic (2500 Ma) Transvaal Supergroup. The latter comprises predominantly clastic sedimentary rocks at the base, carbonate rocks and banded iron formations in the central part and a thick pile of sediments and volcanic rocks at the top; it is hosts to the world's largest manganese resources. The Transvaal Supergroup is intruded by the Bushveld Complex at 2050 Ma, which is home to world-class metallic deposits of PGE, nickel, and chrome.

The Precambrian geology west of the Kheis Belt is covered by sedimentary rocks of the Neoproterozoic Nama Group and Cenozoic sands of the Kalahari savannah. However, geophysical data indicate the presence of another underlying Archaean core, referred to as the Kalahari craton, the main part of which is located in southern Namibia. To the south, the Kalahari Craton is bound by the Namaqua Belt, which represents a Mesoproterozoic orogen and comprises Mesoproterozoic and Paleoproterozoic components that accreted at the older cratons and mobile belts. The Namaqua Belt probably underlies large parts of central and southern South-Africa which are, however, covered by Palaeozoic to Mesozoic rocks of the Karoo Supergroup. The continuation of the Namaqua Belt below the Karoo Basin into the Natal Belt of eastern South Africa is likely.

Neoproterozoic sedimentation, volcanism and Pan-African tectonics is recorded in the Gariep Belt along the Atlantic coast at the western boundary of the country. The deformation partly affected the Namaqua rocks, too.

Deposition of the Cape Supergroup upon the folded Meso and Neoproterozoic rocks during Cambrian times was followed by a new phase of deformation resulting in the Cape Fold belt, which follows roughly the coastlines of the Atlantic and Indian Ocean in the southwestern part of South Africa.
The Karoo Supergroup was deposited after a hiatus on these and older rocks from Carboniferous to Jurassic periods and covers most of central and southern South Africa (**Fig. 1**). The early phase in the

break-up of Gondwana is recorded in the lower Jurassic (182-180 Ma) Drakensberg lavas of eastern Natal which form part of the upper Karoo SG.
Cretaceous rifting at about 70 Ma is represented by the alkaline Sutherland Suite in the Northern Cape. Cenozoic sands of the Kalahari Group cover the north-central part of South Africa.

South Africa has a wide-ranging geology comprising cratons, orogenic belts, greenstone belts, and large impact craters. Furthermore, the country is mainly covered by the basal Kaapvaal craton, encompassed by the Namaqua-Natal Belt and the Cape Fold Belt (**Fig. 1)**. The cratons, a relatively stable continental crust, have sustained a continuous accumulation of younger cover rocks (Hunter et al., 2006), further classified into stratigraphic units (**Fig. 2**). These stratigraphic units are divided into three categories, i.e., lithostratigraphic, biostratigraphic, and chronostratigraphic. Chronostratigraphic units are categorized based on the geological time scale, while biostratigraphy is focused on fossil content; lastly, lithostratigraphic characterization is where different units are grouped into complexes, supergroups, groups, and formations.

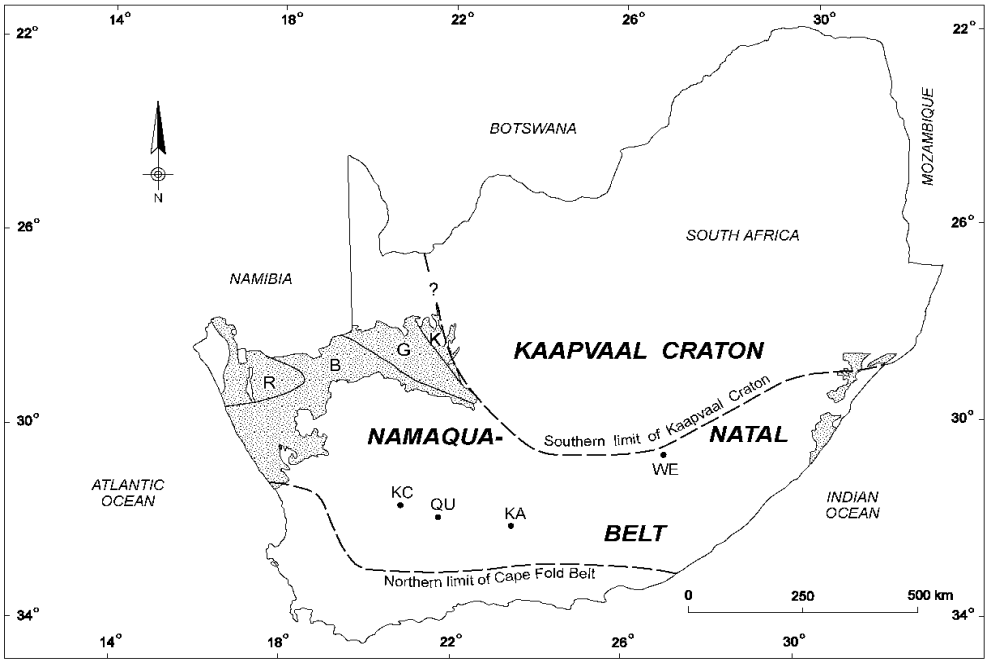


Figure 1. Cratons and orogenic belts in South Africa (Source: Eglington & Armstrong, 2003)

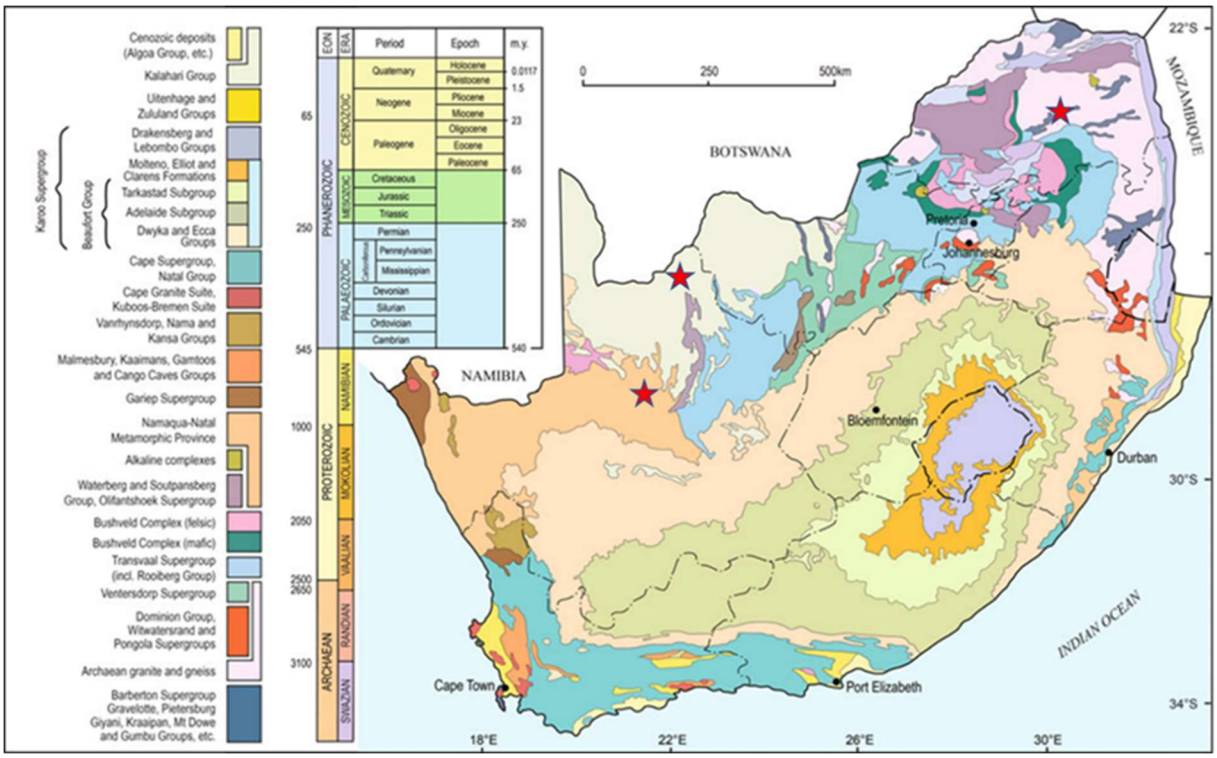


Figure 2. A geological map that shows overlying lithostratigraphic features of South Africa and their associated ages. The red stars represent the national provinces (Limpopo, Northern Cape and Northwest provinces) where most ECRM producing projects are located[1]

Cratons and Orogenic Belts

South Africa's geology is extremely diverse and includes orogenic bands, massive impact craters, greenstone belts, and cratons. A sizable mining industry that produces gold, diamonds, iron, and coal, amongst others, by leading mining houses is supported by the geology of South Africa. The Great Escarpment, which borders South Africa's high plateau to the west, south, and southeast, and the rocky mountains of the Cape Fold Belt make up its geomorphology, with Kaapvaal forming the base and bordered by the Namaqua Natal belt.

Stratigraphy of South Africa

For this report, Lithostratigraphic characterization is applied to define different units of rocks and group into Supergroups, groups, and formations to describe the geology of South Africa. South Africa comprises of three geological supergroups, namely: Karoo Supergroup, Transvaal Supergroup and Cape supergroup, which are described under the Cape Fold Belt. Details of these are contained in the Annexures.

[1] . Source: Grab & Knight, 2015

1.1.2 Known Ore deposits and occurrences

The known ore deposits of South Africa have been studied and developed for well over a century. A significant amount of geological information is available for the country, most of which is created and hosted by the Council for Geoscience, a state-owned enterprise dedicated to this purpose. The list presented in Table 1 below is extracted from public information sources and contains only the CRM's as defined in the EU list. Interpretation of the location of the CRM deposits in South Africa is best achieved by matching this list with the maps provided as Figures 2 and 7.

Table 1: Known ore deposits and occurrences in South Africa

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
Antimony (Sb)	Associated with Au, Beryl-Emerald	• Stibnite is the main source of antimony. • It is found on epithermal vein deposits and precipitated by hydrothermal processes.		Murchison Range, Limpopo: Brownfield Willows silver mine Pretoria: Brownfield
Barite	Associated with Pb, Cu, Fluorspar (in pegmatites); Apatite, REE, Scheelite, Mo	• Diagenic • Occurs in veins along faults, fractures, and shear zones. • High-T pegmatites and veins • Sedimentary deposits related to hydrothermal springs	• Barite is exported as barium sulphate (barytes). It is directly shipped after initial crushing.	Brownfield
Beryllium	Associated with Li, Ta, Nb, scheelite, bismuth By-product: Bi	• Hosted by beryl-emerald in Murchison. • It is sourced from pegmatites fields of Northern Cape, Mpumalanga and Limpopo.	• Beryllium emissions during production and use are minor. • Concentration of beryllium in the atmosphere, the surface and on drinking water is low.	Brownfield
Bismuth	By-product: Ag, Cu, Arsenopyrite	• Occurs in a form of native bismuth and bismuthinite. • It is deposited by epigenic ore fluids		
Coking Coal	By product: Ammonia, Hydrogen, sulphides	• South Africa produces predominantly thermal coal and imports most of its hard coking coal. • Bituminous	• Processing processes: →bake coking coal in an unoxygenated oven to make it "plastic" before it solidifies to coke particles. • Environmental impact:	• Makhado Project in Limpopo, southwest of Musina (Brownfield)

Funded by
the European Union

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
			→Saline and acidic water from mining operations, sourced from pyrite and iron sulphide, are toxic for aquatic life. →Abandoned and operating mines emit methane gas which is a greenhouse gas. →South Africa has no law on pollution but has particulate emission standards on atmospheric emissions from coal utilization. →Underground water infills contaminate surface water and aquifers. →Coal dumps cause low-level atmospheric emissions, land degradation, groundwater pollution.	• Uitkomst Colliery (Brownfield)
Cobalt	Associated with Ni, Cu, Zn, U, Precious Metals	• Associated with hydrothermal deposits		Brownfields
Copper	Associated with Zn, Pb; Barite (Kaapmuiden greenstone); W, Ag (Rustenburg Layered Suite) By products: Sb, fluorspar	• VMS Deposits along the Copper-Zinc Line in Murchison Greenstone Belt • In Black Mountain and Broken Hills base-metal mining district, copper deposition occurs as strata bound sedimentary exhalative. • Prieska, Areachap and Jacomynspan have volcanic exhalatives. • Kaapmuiden greenstone belt: volcanogenic massive sulphide deposits	• Environmental impact: →oxidation of sulphides when exposed to the atmosphere creates sulphuric acid which results in heavy-metal drainage and leaching. →In the Okiep copper district is arid therefore, acid drainage is localized, as opposed to the Concordia area. →Smelters contribute to the sulphur emissions into the air and copper soil pollution	Brownfields
Fluorspar	Associated with hematite, barite, Sn Is a by-product of molybdenum deposits	• Volcanogenic forming intrusive pipes and extrusive stratiform deposits. • Manto-type forming lenticular bodies. • Hydrothermal stockwork, veins and pipes		Brownfields

Funded by
the European Union

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
Graphite	Associated with coal, Precious metals	• Associated with hydrothermal deposits	• Processing graphite involves grinding and screening methods to recover disseminated flake graphite and fine flakes are recovered by flotation processes.	Brownfields
Lithium	Associated with Be	• The main source of lithium in South Africa is pegmatites. • Exploitable lithium mineral occurs in a pyroxene end-member, spodumene. • Spodumene occurs in zoned pegmatites in the Limpopo and Northern Cape, whereas in the southern parts of KwaZulu-Natal and southeastern parts of the Vredefort dome, in the Free State, it is unzoned.	• There are no Li refinery plants known in South Africa. • Lithium ore is beneficiated to separate out by products. Environmental impacts: soil degradation and biodiversity loss	Brownfields
Magnesite	Associated with scheelite	• Supergene and hypogene deposits occurring as stockwork veinlets (Kaapmuiden area BGB)		
Manganese	Associated with Fe, P, Ba, W, Cu, Zn	• BIF-hosted sedimentary deposits (Kalahari Manganese Field and Rooinekke deposits) • Karst-hosted deposits- (Postmansburg Manganese Field) • Ooilitic deposits (Tolwe manganese deposits)	Manganese beneficiated in South Africa High-purity Mn sulphate for the Li battery market produced in the only plant outside China.	
Nickel	Associated with Pt, Pa, Rh, Au, Cu (Uitkomst Complex); Cu, Co, Zn (Bushveld complex)	• Magmatic stratiform deposits and nickeliferous pipes • Lateritic deposits • Hydrothermal deposits	• Environmental impact: →oxidation of sulphides when exposed to the atmosphere creates sulphuric acid which results in heavy-metal drainage and leaching.	?

Funded by
the European Union

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
Phosphate	Associated with apatite	• Igneous origin (Glenover, Bushveld complex and Soutpansberg pegmatites) • Phosphatic limestones, nodular and calcareous sands (Saldanha and Mamre) • Metasomatic vein-type deposits (Potgietersrus and Middelberg district)		Brownfields
PGMs	Associated with Sn, V, Ti, chromite, base metals By-products: nickel and copper	• Layered mafic intrusions	• Processing processes: →From mining, the ore is processes using froth floatation process. 13 concentration plants owned by Amplats exits. →Floatation concentrate is dried and smelted in an electric furnace. There are four smelter complexes for PGMs. →PGMs are refined, removing base metals by precipitation, redissolution and thermal reduction. There are only three PGM refineries in SA. →Refined PGMs are fabricated into ingots, wire/rod, tube, and chemical compounds and then sold to end-users. • Environmental impacts: →Water requirements for the concentration stage not met due to limited water supply. →Waste rock and effluent water need to be treated before being discharged into the environment. →Dust, gases, and effluent water generated from smelters pollute the environment.	Brownfields
REEs	Associated with fluorspar, apatite (phosphate), vermiculite (Cu), phlogopite	• Occurs in carbonatite and alkaline complexes. • Deposition occurred by hydrothermal processes.		

Funded by
the European Union

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
	By products: Zr, U, Ag, Au, Pa, Pt, Ni, Magnetite,	• Epithermal deposits have low REE content		
Tantalum		• Pegmatites are the main source of Ta.		
Niobium	Associated with Sn, Ta, beryl, tourmaline, garnet Occurs as a by-product	• Brookite is the host of Nb. • Pegmatites are the main source of Nb		
Tin	Associated with scheelite, Pb and Cu	• Hosted in cassiterite. • Occurs as syngenetic pegmatite-pneumatolytic pipes (in Zaaiplaats),and epigenic deposits as fault breccia and replacement deposits within arkositic sediments and quartz (Rooiberg Leeuwpoort), felsites, granites and granophyres. • Pegmatites of granite-gneiss terrains (Bushmanland sequence and Richtersveld Complex)	Sn is crushed, screened and separated, and smelted in South Africa	
Titanium	Ilmenite and rutile are associated with zircon, monazite and garnet By product: Pig-iron recovered from processing ilmenite	• Sedimentary origin from beach placer deposits	• Tisand conducts dune mining and mineral separation. • RBIT conducts the smelting and beneficiation process. Environmental impact: • TiO2 processes requires the use of sulphuric acid which has a negative environmental impact. The use of sulphuric acid has been reduced by switching from ilmenite to a slag feedstock or chloride process, which is more environmentally friendly. • Less waste is produced from the chloride process. • Ilmenite is only chlorinated in places where laws permit the inexpensive deep welling of iron dichloride.	• Brownfields

Funded by
the European Union

Main commodity	Other commodity(ies) (co- or by-product)	Deposit geology	Industrial factors	Development stage
Tungsten	• Associated with Cu, Mo	• Occurs in high grade copper sulphide deposits or as magmatic hydrothermal zones associated with potassic alteration and skarn metasomatic deposits		Brownfields
Vanadium	• Associated with Pb-Zn (Zeerust)	• Hosted by titaniferous magnetic seams in the Bushveld Complex • Manganese wad layers (Zeerust, Transvaal)		

Funded by
the European Union

1.2. Prospectivity and mineral high potential mapping

1.2.1 Selection of the ECRM for mineral prospectivity

Among the 34 ECRMs present in South Africa, only four were selected for Mineral Potential Mapping (MPM) to demonstrate the principle of the method (**Al, Ba**, **F**, and **Mn**). For each commodity, up to three areas of interest were defined around localities where known occurrences are recorded in the mineral databases of the French Geological Survey (BRGM) and/or Council for Geosciences (CGS). The lack of geoscientific data (e.g. aerial and ground geophysics, satellite data, soil and stream geochemistry) and the relatively low resolution of the geological maps used for this study (varying from 1:2M to 1:250k) imply only limited interest of the weakly constrained mineral potential maps for exploration. There was no use to illustrate this for the whole range of CRM's. The MPM was performed using the disc-based association (DBA) grid method coupled with Random Forest (RF) method (*Vella, 2022*); the algorithm applying these principles has been labelled "FAMME" by the author. The method analyses the local spatial associations of geological variables and features of various natures to describe the relationships between the predictors and the mineralization. This allows the identification of geological environments in the study area around each node of the DBA grid, and the integration of both quantitative and non-quantitative spatial data, such as geophysical anomaly maps and location of geological map units, respectively. In a second step, RF classification is used to perform a generalization of complex geological environments and features and evaluate their likelihood to host potential mineralization occurrences by giving a score between 0 (low potential) and 1 (high potential). The database for the MPM of South Africa comprised the following:

- SIG-Afrique mineral resources database – BRGM
- GIS Council of Geoscience mineral resources data base – CGS
- GIS Council of Geoscience 1:1,000,000 geological map –CGS
- GIS Council of Geoscience 1:1,000,000 structural data (faults, thrusts)
- GIS Council of Geoscience 1:1,000,000 dykes
- GIS Council of Geoscience merged 1:250,000 geological maps –CGS
- SIG-Afrique 1:2,000,000 structural data (faults, thrusts) – BRGM
- UNCCD 1:500k SOTER – soil map of southern Africa
- SRTM (Shuttle Radar Topography Mission)
- Slope

The DBA grid for predictive modelling is mainly defined by **five parameters**:

- Size of cell – d;
- Buffer for lithologies – R;
- Buffer for mineral occurrences – R1. It can be null (= false), in this case the search radius will be restricted to the cell size (d)
- Buffer for faults – R2. It can be null (= false), in this case the search radius will be restricted to the cell size; it can also take into account the distance of the cell to the neighbouring faults (distance)
- Buffer for soils – R3. It can be null (= false), in this case the search radius will be restricted to the cell size

In order to maximize the grid resolution while minimizing overlaps and cells with only one lithology, the parameters of DBA grid for the four selected commodities in individual areas of interest (AOI) used in this study are as indicated in Table 2:

Table 2 The applied parameters for production of the MPM of South Africa

Param/AOI	Al_East	Ba_East	Ba_West	F_NE	F_SW	Mn_East	Mn_Cen	Mn_West
d	2500	1750	3000	1800	1000	1750	1400	1400
R	10000	7000	6000	9000	6000	7000	7000	7000
R/d	4	4	2	5	6	4	5	5
R1	2000	1000	3000	2000	2000	2000	2000	2000
R2	no faults	500	1000	distance	500	750	500	750
R3	false	no soil	no soil	false	false	false	false	false

1.2.2 Mineral high potential areas

Eight mineral potential maps, which were produced for the four ECRM's **Al** (bauxite), **Ba**, **F**, and **Mn** are presented in Appendix_1.2_MPM_RSA. The results of the DBA-RF (TN, FN, FP, TP = confusion matrix) together with the critical parameter for the assessment of the analysis are shown in Table 3.

Table 3 Results of data driven mineral potential mapping in South Africa applying the FAMME

	TN	FN	FP	TP	TPR	FPR	PPA [%]	Prec. [%]	Acc. [%]	J-score	Thresh.
Al (bauxite)	28559	1	1411	156	0.99	0.05	5.2	9.96	95.3	0.95	0.56
Ba-East	78222	1	977	53	0.98	0.01	1.3	5.15	98.8	0.97	0.45
Ba-West	6783	1	16	23	0.96	0.00	0.6	58.97	99.8	0.96	0.68
F-NE	90646	1	2269	222	1.00	0.02	2.7	8.91	97.6	0.97	0.41
F-SW	113621	0	1276	250	1.00	0.01	1.3	16.38	98.9	0.99	0.6
Mn-East	81973	20	8605	543	0.96	0.10	10.04	5.94	90.5	0.87	0.54
Mn-Central	68865	15	3280	238	0.94	0.05	4.86	6.77	95.4	0.90	0.49
Mn-West	54161	3	5808	291	0.99	0.10	10.12	4.77	90.4	0.89	0.51

Note: *True Positive (TP) and True Negative (TN) correspond to the number of grid cells, which are correctly predicted by the RF model (i.e. mineralized and non-mineralized cells, respectively). Inversely, False Positive (FP) and False Negative (FN) correspond to the number of grid cells, which are incorrectly predicted by the RF model (i.e. mineralized instead of non-mineralized cells and non-mineralized instead of mineralized cells, respectively).* ***FP indicate cells with high mineral potential****, which so far are not indicated in the mineral occurrence data base. From these data the following useful parameters are calculated: True positive rate (TPR, also "recall") = TP/(TP+FN), False positive rate (FPR) = FP/(FP+TN), Percentage of prospective area (PPA) = (TP+FP)/All, Precision = TP/(TP+FP), Accuracy = (TP+TN)/All and J-score = TPR – FPR.*

The statistically most favourable factors for exploration of each commodity are shown in Table 4.

Table 4 Statistically most favourable factors for exploration of each commodity

	F1	F2	F3	F4	F5	F6
Al (bauxite)	srtm	Pvo	slope	ACh	Frr	jd
Ba-East	slope	srtm	APmg	ANbr	APon	APft
Ba-West	slope	fault	srtm	EC-STa	STkp	ED-CAkn
F-NE	Rnb	Rsc	srtm	PTe	slope	Rra
F-SW	STrv	srtm	ECbp	STlv	STk	ECbw
Mn-East	ANml	srtm	Lpe	ORsw	ANbr	Rtr
Mn-Central	srtm	SDwo	ANkl	ANrv	ORgm	ANff
Mn-West	Ope	slope	srtm	Lpq	fault	S-Dn

Bauxite - Al

Bauxite forms by weathering of bedrock under tropical conditions; chemical and physical processes transform the rocks into in-situ soils called saprolite. Aluminium and iron are among the immobile elements that are concentrated in the residual soils, which are known as bauxite and laterite. Bauxitic soils in Republic of South Africa (RSA) are restricted to the Eastern Cape, Kwazulu-Natal, and Mpumalanga provinces in the east of the country over an area of approximately 90,000 km^2 size. Here,

98 bauxite deposits are registered in the mineral databases of BRGM and CGS. The AOI for the MPM study was increased around this central part to ca. 250,000 km.

The data for the production of the MPM comprised the 250k geological maps of RSA, the UN-CCD 500k SOTER soil map of southern Africa, the SRTM and the slope. Tectonic structures were not taken into account, as they play no role in the genesis of saprolite. The resulting MPM shows, besides locations with known bauxite occurrences, high potential in the areas in-between and in a horseshoe shaped area NW of the principal bauxite zone, which could be an interesting target for future green field exploration.

The DBA-RF model has an accuracy of ~95 % and indicates that about 5 % of the AOI have potential for bauxite. The statistically most favourable factors are, in decreasing order, **srtm**, **Pvo** (Volksrust Formation = shale siltstone, minor sandstone), **slope**, **Ach** (Rhodic Acrisols), **Frr** (Rhodic Ferralsols) and **jd** (Jurassic dykes), the latter of which are abundant in that area but probably of minor importance for the formation of bauxite.

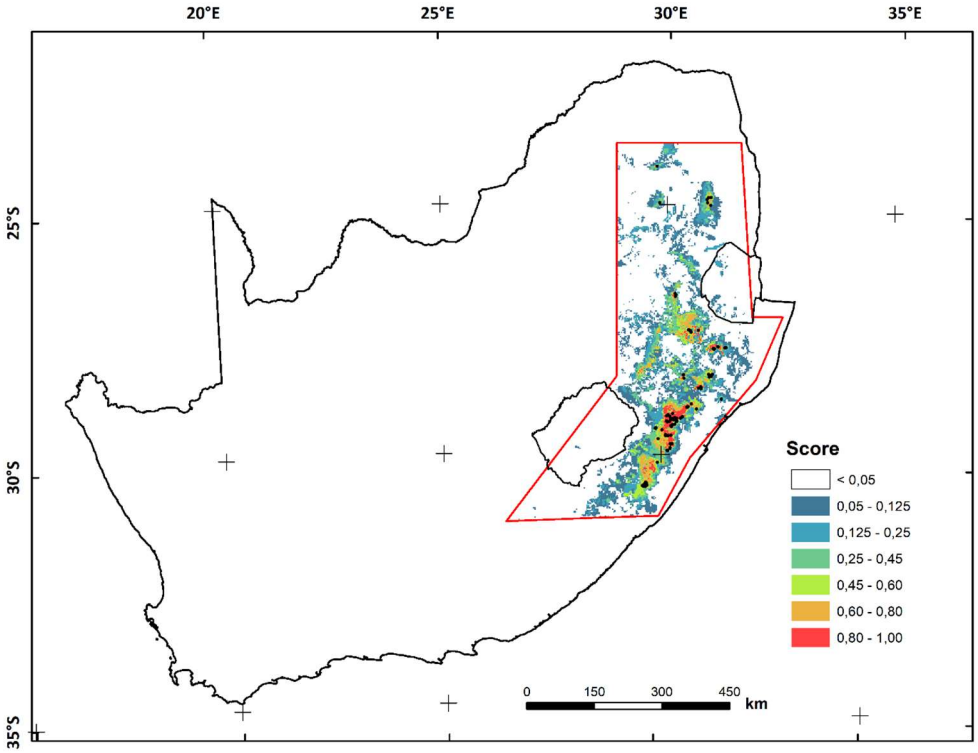


Figure 3. Mineral Potential Map of bauxite (Al). The investigated AOI is outlined in red; known occurrences are indicated as black dots.

Barite - Ba

Barite is the main mineral for barium; it forms under widely varying conditions, including sedimentary, magmatic and structural-controlled environments. In South Africa, the known mineral occurrences are situated mainly in the NE Limpopo-Mpumalanga provinces (51 occurrences), a second province is located in the western Namaqua Belt (14 occurrences). Accordingly, two AOI (Ba-East, ca. 240,000 km^2) and (Ba-West, ca. 60,000 km^2) were defined for which the MPM's were produced.

The DBA-RF model for northeastern RSA (Ba-East) has an accuracy of ~99 % and indicates that about 1.3 % of the AOI is prospective for barium deposits. The statistically most favourable factors are, in decreasing order, **slope**, **srtm**, **APmg** (Makhutswi gneiss), **ANbr** (tonalite), **APon** (Onverwacht Group,

hornblende gneiss), and **APft** (Figtree Group: siltstone, shale, greywacke, chert, ferruginous chert, pyroclastics).

The DBA-RF model for the Namaqua Belt (Ba-West) has an accuracy of 100% and marks about 0.6 of the AOI as prospective for barium deposits. The statistically most favourable factors are, in decreasing order, **slope**, **fault**, **srtm**, **EC-STa** (Aggeneys Subgroup: Quartz-muscovite-biotite-sillimanite schist, muscovite schist, pebbly gneiss, quartzite, magnetite quartzite, marble, amphibolite, conglomerate, grunerite-garnet-magnetite rock), **STkp** (Klip Bakken Gneiss), and **ED-CAkn** (Knersvlakte Subgroup: Green and purple mudrock, shale, siltstone, sandstone, limestone, gritstone, conglomerate, minor chert).

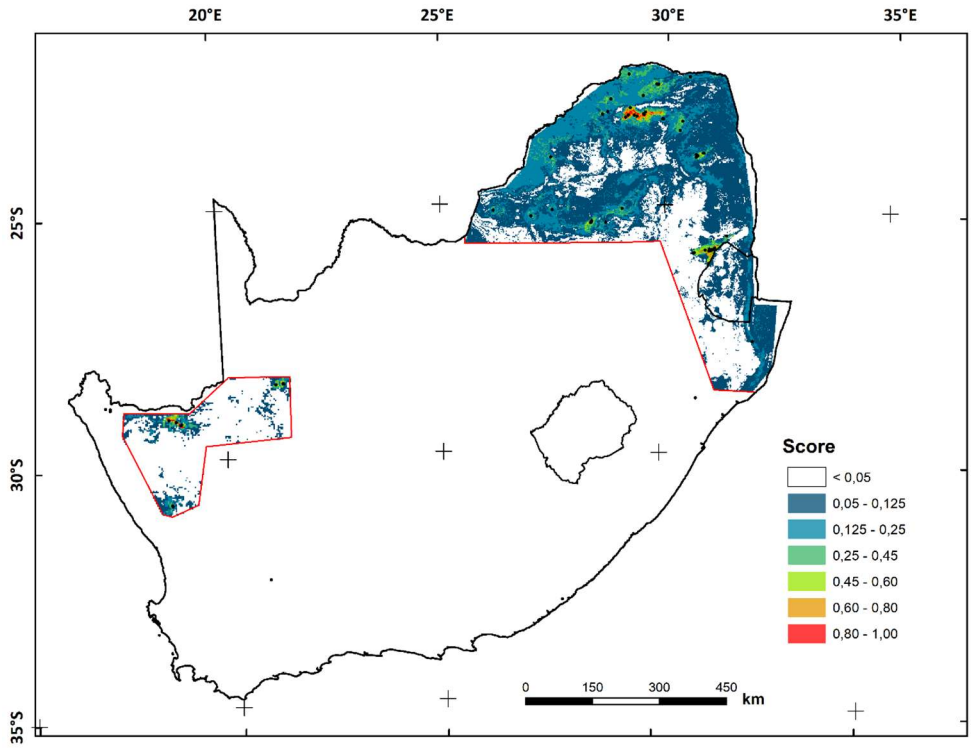


Figure 4. Mineral Potential Map of barite (Ba). The investigated AOI's are outlined in red; known occurrences are indicated as black dots.

Fluorite - F

Fluorite is the main mineral for fluorine and occurs in South Africa in sedimentary, fault controlled (vein type) and magmatic deposits. Three very large deposits (class A) in the Limpopo-Mpumalanga provinces northeastern South Africa (AOI: F-NE, ca. 325,000 km^2) are of carbonate-hosted Mississippi Valley type (MVT) and six large to very large deposits are associated with granite. Altogether 68 mineral occurrences are described in the database of BRGM and CGS in this region. A second area with 12 fluorite occurrences is situated at the eastern termination of the Namaqua Belt in the northern Cape Province (AOI: F-SW, ca. 115,000 km^2), which is however, largely obscured by overlying Cenozoic sands of the Kalahari.

The data for the calculation of the MPM in the northeastern AOI (F-NE) comprised the 1M geological map (CGS), 1M structural data (CGS), UNCCD 1:500k SOTER soil map, srtm, and slope. The MPM shows high potential around the known occurrences and in their wider extension, thereby following roughly the geology of the northwestern Witwatersrand basin and the srtm. In the central part the prospective area has a horseshoe shape comprising most of the higher scores. Additionally, smaller curvilinear

belts are situated in the west and NE of the AOI. The DBA-RF model has an accuracy of ~97 % and indicates that about 2.7% of the AOI is prospective for fluorine. The statistically most favourable factors are, in decreasing order, **Rnb** (Nebo granite: Pink to grey, coarse-grained to porphyritic biotite/hornblende granite, microgranite), **Rsc** (Schrikkloof Fm: fine-grained, flow-banded, porphyritic and spherulitic felsite), **srtm**, **PTe** (Epipetric Plinthosols), **slope**, **Rra** (Rayton Fm: quartzite, hybrid metasomatised and fenitised rocks).

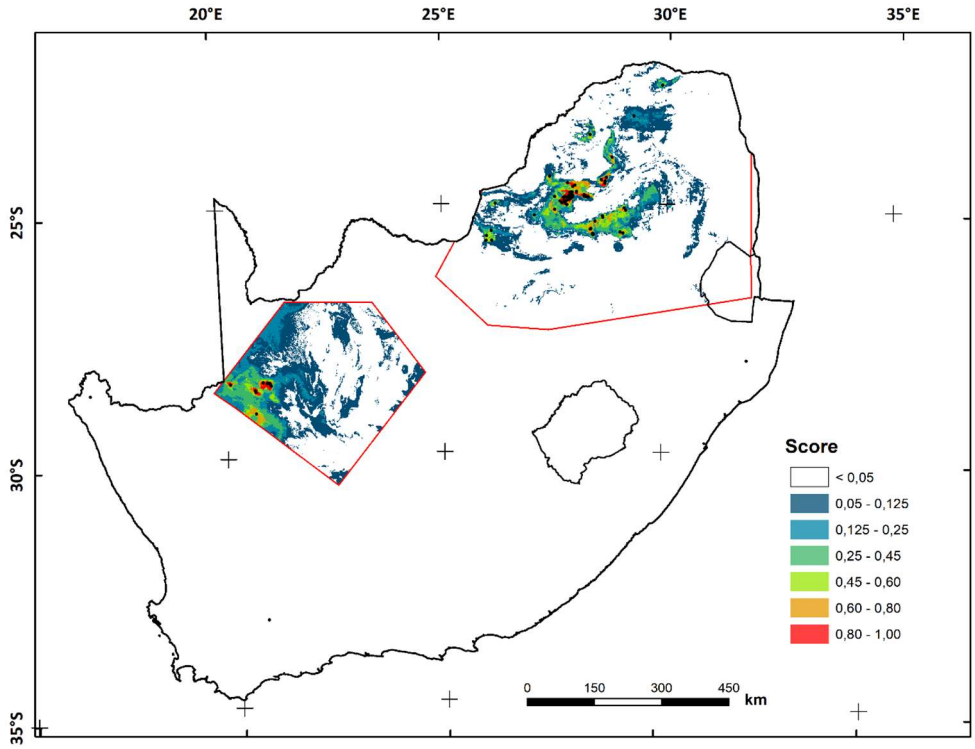


Figure 5. Mineral Potential Map of fluorite (F). The investigated AOI's are outlined in red; known occurrences are indicated as black dots.

The data for the calculation of the MPM in the Northern Cape Province (AOI: F-SW) included again the 1M geological map (CGS), 1M structural data (CGS), UNCCD 1:500k SOTER soil map, srtm, and slope. The prospective area is limited to the western corner of the AOI, where the basement is outcropping. The MPM illustrates four smaller areas with medium to high mineral potential around the known Fluorite occurrences. The DBA-RF model has an accuracy of ~99 % and indicates that about 1.3% of the AOI is prospective for fluorite. The statistically most favourable factors are, in decreasing order, **STrv** (Riemvasmaak Gneiss: Pink-weathering coarse-grained or augen leucogneiss), **srtm**, **ECbp** (Biesje Poort Subgroup: Grey, fine- to medium-grained, pelitic, quartz-feldspar and amphibole gneisses, lenses of quartzite, amphibolite, calc-silicate rocks, marble, schist), **STlv** (Louisvale Granite: Light grey, moderately to well foliated biotite granite), **STk** (Keimoes Suite: Dark grey to leucocratic, equigranular to porphyritic granite, granodiorite, charnockite, minor diorite), **ECbw** (Brakwater Metamorphic Suite: Fine-grained quartz-feldspar gneiss, biotite gneiss, amphibolite, calc-silicate rocks, aluminous gneiss, minor quartzite, garnetiferous augen gneiss).

Manganese – Mn

South Africa is home to 80% of the Earth's known manganese resources and the country is presently the biggest producer of this commodity in the world. All major deposits are situated in two areas of north-central and north-eastern RSA in the Postmansburg and Kalahari Manganese fields where they are hosted by the Palaeoproterozoic Transvaal Supergroup. The age of the unconformity-bounded

deposits at the base of the Pretoria Group is about 2100-2000 Ma. Two areas of interest (Mn-East, ca. 275,000 km^2, 166 occurrences and Mn-Central, ca. 140,000 km2, 49 occurrences) were defined within these areas for the MPM. The third group of manganese occurrences in southwestern RSA follows the Cape Fold Belt over about 850 km length, parallel to the coasts of the Indian and Pacific oceans. The area of interest (Mn-West) has a size of about 115,000 km and includes 50 occurrences. A fourth, small group of five Mn occurrences in the Namaqua Belt of northwestern RSA was not considered for MPM.

The data for the calculation of the MPM in the AOI "Mn-East" comprised the 1M geological map (CGS), 1M structural data (CGS), UNCCD 1:500k SOTER soil map, srtm and slope. The MPM shows that areas with medium to high Mn-potential follow the general geology outlining the structure of a basin. In the SW part of the AOI a branch off from the main structure and an isolated arc display medium to high scores on the MPM but are devoid of known occurrences. They represent therefore new exploration targets. The DBA-RF model has an accuracy of ~91 % and indicates that about 10% of the AOI is prospective for manganese. The statistically most favourable factors are, in decreasing order, **ANml** (Malmani Subgroup: dolomite, stromatolitic, interbedded chert, minor carbonaceous shale, limestone and quartzite), **srtm**, **Lpe**, **ORsw** (Swaershoek Formation: Medium- to coarse-grained sandstone (pebbly in places), conglomerate, trachyte, quartz porphyry), **ANbr** (Black Reef Formation: Quartzite, subordinate conglomerate and shale), and **Rtr** (Timeball Hill and Rooihoogte Formations: Mudrock, quartzite (ferruginous in places), wacke, chert breccia, minor diamictite, conglomerate, shale, magnetic ironstone)

The data for the calculation of the MPM in the AOI "Mn-Central" comprised the 1M geological map (CGS), 1M structural data (CGS), UNCCD 1:500k SOTER soil map, srtm and slope. The resulting MPM shows the highest scores around the known Mn deposits in the central part of the AOI. However, slightly elevated Mn potential is suggested in the NE part, which is covered below Kalahari sands and in the sand-covered area to the west of the known deposits, thereby outlining a basin geometry. These somehow surprising results could be interesting for future green field exploration. The DBA-RF model has an accuracy of ~95 % and indicates that about 4.9% of the AOI is prospective for manganese. The statistically most favourable factors are, in decreasing order, **srtm**, **SDwo** (Wolhaarkop Formation: Ferruginised brecciated banded ironstone), **ANkl** (Klippan Formation: Conglomerate, talus breccia, quartz arenite, shale, andesite, limestone), **ANrv** (Reivilo Formation: Chert-poor dolomite characterized by giant stromatolite domes, laminated, iron-rich dolomite, ferruginous chert), **ORgm** (Gamagara Formation: Conglomerate and shale), and **ANff** (Fairfield Formation: Stromatolitic dolomite)

The data for the calculation of the MPM in the AOI "Mn-West" comprised the 1M geological map (CGS), 1M structural data (CGS), UNCCD 1:500k SOTER soil map, srtm and slope. The resulting MPM shows high scores around the known targets which can be combined into an arc-shaped irregular ridge in the central part of the AOI. Several curvilinear structures between the known occurrences show high scores, especially at the eastern termination of the AOI and provide new exploration targets. The DBA-RF model has an accuracy of ~90 % and indicates that about 10% of the AOI is prospective for manganese. The statistically most favourable factors are, in decreasing order, **Ope** (Peninsula, Pakhuis and Cedarberg Formations: Pebbly quartz arenite, diamictite, minor conglomerate, mudrock, siltstone and shale), **slope**, **srtm**, **Lpq** (Lithic Leptosols), **fault**, **S-Dn** (Nardouw Subgroup: Pebbly quartz arenite, diamictite, minor conglomerate, mudrock, siltstone and shale).

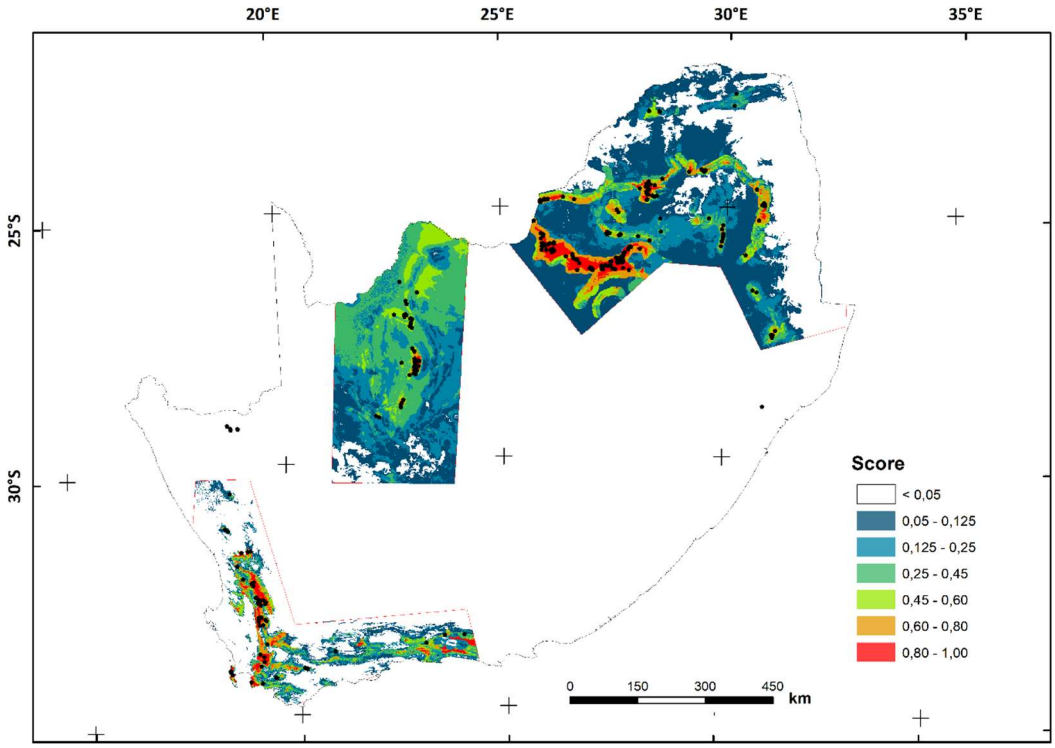


Figure 6. Mineral Potential Map of manganese oxides (Mn). The investigated AOI's are outlined in red; known occurrences are indicated as black dots.

Funded by
the European Union

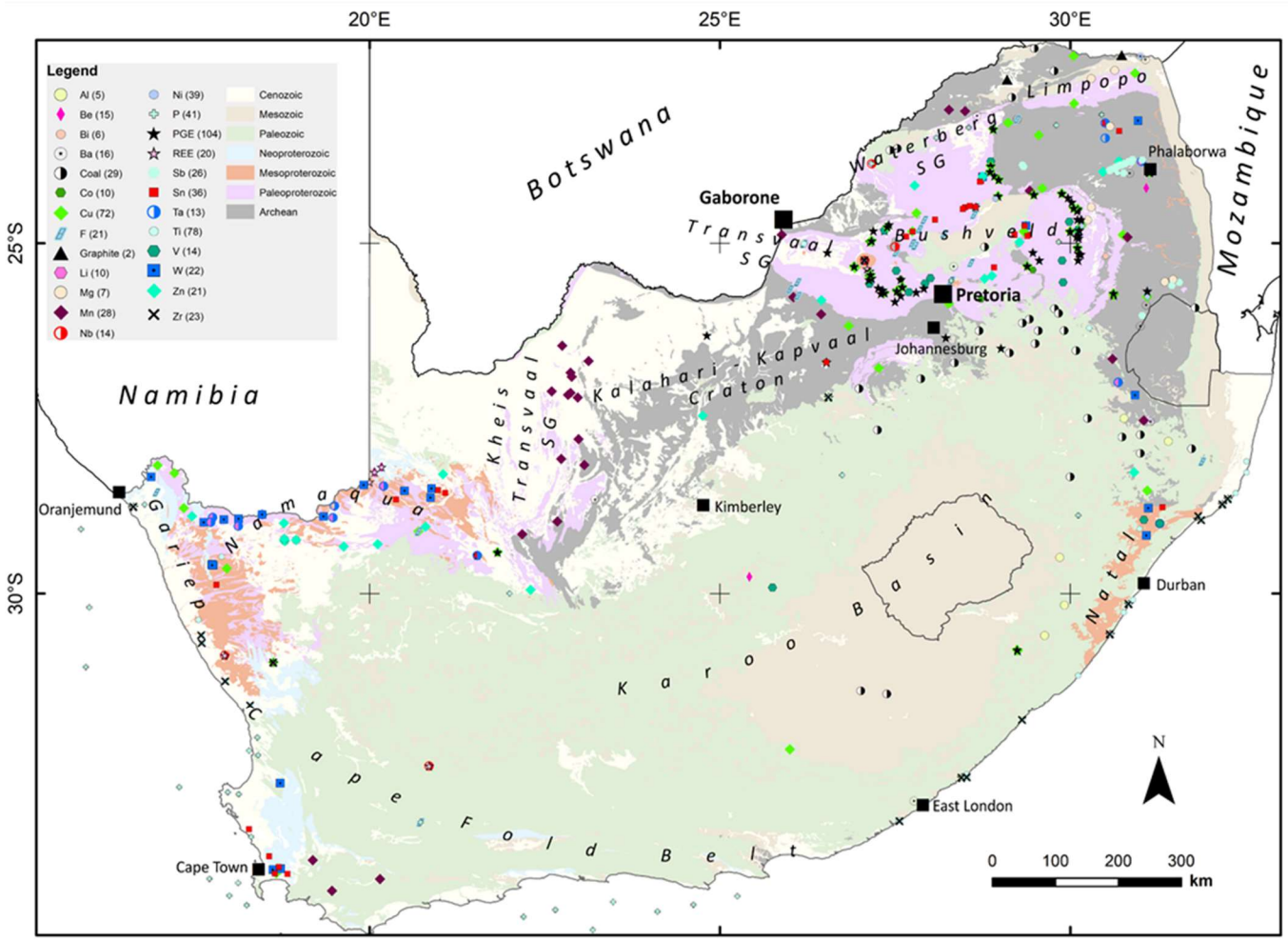


Figure 7 Map of the Main CRM deposits of South Africa

Funded by
the European Union

1.3. Ore processing and refining capacities

South Africa has well-developed mineral processing industry as far as the primary mineral processing phases (crushing, grinding, milling, flotation, chemical, pyro-metallurgical and biological mineral extraction) are concerned. The larger mining operations and especially high-value metals (gold and PGM's) have vertically integrated these processing operations. The energy intensive phases of these industries have suffered heavily from the effects of ongoing load-shedding in South Africa and have made large investments to adjust their operations and increase their independence from the national electricity grid. Metal refining operations and more specialised, knowledge-intensive product developments largely occur off-shore. The overall trend since the 2008 market decline has been downward, as the industry was also affected by load shedding since then. In individual cases, the processing facilities for specific mineral commodities are being developed or improved, however.

Table 5: List of major ECRM's mined in South Africa and description of processing activity

Commodity	Description of industry activity
Phosphate Rock 301 000 t mined annually	A majority of the phosphate rock produced in South Africa is mined from the foskorite zone at the Phalaborwa Igneous Complex which has been industrially mined since 1953 and is still currently exploited by the state-owned enterprise Foskor (Roux et al., 1989). This opencast mine has the capacity to yield 2.6 million tons per annum of phosphate rock concentrate from processing 35 million tons of ore per annum. As of 31 March 2022, Foskor produced 1.58 million tons (2021: 2.17 million tons) of phosphate rock concentrate; 294 000 tons (2021: 301 000 tons) of phosphoric acid and 197 000 tons (2021: 264 000 tons) of granular fertiliser (MAP) (Foskor, 2022). Foskor uses the phosphate rock to produce phosphoric acid and fertilisers including monoammonium phosphate and diammonium phosphate at its plant in Richards Bay (Yager et al., 2022). Nationally, phosphate rock is currently being mined at a rate of 34 million tons per year and ore reserves have been estimated to be 70 years and resource of + 100 years (Porteus, 2018). Mine ore is upgraded from 6.8% P2O5 to a final rock phosphate product of 37 % P2O5 (Porteus, 2018). The Elandsfontein formation on the West Coast is also poised to be a major contributor of phosphate rock ore. Production at the mine was planned for the first quarter of 2017 by the owning companies Kropz Elandsfontein and African Rainbow Capital (Yager et al., 2022). The company plans to produce 1 Mtpa on site for international export and domestic sale (Kropz, 2023; Yager et al., 2022). However, due to various challenges the mine had been delayed and the last update from the company put expected steady state production to begin 2022. The company announced their first bulk sale of 33,000 tonnes of phosphate concentrate in January 2023 (Kropz, 2023). In August, Kropz announced that the commissioning of the mine was delayed for an undetermined period. The companies planned to produce 1.5 Mt/yr of phosphate rock for domestic and export markets (Kropz, 2023).
Fluorspar 223 000 t mined annually	South Africa has the largest fluorspar reserves globally with 17 % of the world total (DMRE, 2009). In 2017 the national production of fluorspar was a marked increase from the previous year where 177,000 t was produced (Yager et al., 2022). Most of the South Africa fluorspar production occurs at Vergenoeg Mine majority owned by Minersa Group. In 2017 they increased their output to 223,000 from 177,000 in 2016. According to Yager et al., (2022), the maximum production capacity of acid-grade fluorspar is 250, 000 tpa and 30, 000 tpa of metal grade at Vergenoeg Mine. Sepflour's Nokeng mine is positioned to become another major contributor to the industry. The mine began operations in 2019 and the mine is reported to have a maximum capacity of 600 000 tpa of 185, 000- 130,000 tpa of acid grade fluorspar of 97 % fluorspar. Buffalo fluorspar mine as well as the Witkop fluorspar mine owned by Sallies have previously been active producers in the fluorspar industry but have since been mothballed. In 2020, 97% of the fluorspar was exported to countries like Germany, the Netherlands, the United States, India and China (OEC, 2020). Approximately 5% of the fluorspar

	mined in the country was consumed locally due to a lack of domestic processing facilities. A majority of the fluorspar in the country is used by NECSA's subsidiary, Pelchem SOC to produce hydrofluoric acid (Yager et al., 2022).
Silicon 51 000 t mined annually	South Africa is a major contributor to the silicon metal industry, though the industry has seen some slow-down. Previously, a major player in the industry was Ferroglobe which produced silicon metal at its eMalahleni and Polokwane (Yager et al., 2022). The two facilities host furnaces and crushing facilities to produce silicon metal. Their Polokwane plant can produce 51,000 tonnes per annum (Shabalala, 2022). However, due to high operating costs and a decline in the price of silicon metal Ferroglobe ceased production of silicon metal (Yager et al., 2022). Additionally, challenges with securing a reliable energy supply due to the scheduled rolling blackouts or "loadshedding" implemented by the national power utility company, Eskom[2], has resulted in difficulties restarting operations.
Nickel 31 800 t mined annually	Most of the South Africa's nickel production is as a co-product of PGM mining. In fact, ~ 87 % of South Africa's total nickel output is a co-product of PGM mining (DMRE, 2009). Around 12 % of the domestic output and primary nickel is mined at Nkomati Nickel which has been placed on care and maintenance due to high cost of operation and low profit margins (ARM, 2022). The main concentrator at Nkomati has a maximum capacity of 375 kt of ore per month (Nornickel, 2020). African Rainbow Minerals has considered restarting mine operations as nickel prices have seen an uptick. National reporting of nickel production is sporadic however, the DMRE (2009) reported that in 2006 South Africa produced 1.4 Mt of nickel ore and 384.1 kt of refined nickel in 2009. According to a USG survey, Implats, a major PGM producer in South Africa, produced 17,100 t of refined nickel in 2017, of which 4,500 t was a co-product of the company's PGM mining operations (Yager, 2022). In 2020 the company produced 15, 400 t of refined nickel. Amplats owned by Anglo American produced 26,100 t of refined nickel in 2017 and 23,036 in 2019 which fell substantially to 13,874 t in 2020. Another potential major contributor to the Nickel industry is a joint venture between Sibanye-Stillwater's Lomnin mine and Thakadu Group which was aiming to build a nickel sulphate plant at Lonmin's base metals refinery with a maximum capacity of 30 000 t annually of nickel sulphate and an average steady state of 25 000 t/y. The nickel sulphate production will be targeting the lithium-ion battery market (Thakadu Group, 2021).
Aluminium 714,000 t mined annually	Currently, South Africa does not produce bauxite. Instead, primary aluminium is produced from imported alumina (Yager et al., 2022). As it stands, the South32 owned Hillside aluminium smelter in Richards Bay is the major producer of aluminium in South Africa. In 2022 saleable production from the Hillside smelter stood at 714 kt which was a 3 kt decrease from the previous year due to the impact of increased load shedding.
Vanadium 7700 t mined annually	South Africa is one of the world's major producers of vanadium. According to the US Geological Survey, in 2020, South Africa produced an estimated 22,000 metric tons of vanadium, which was about 2% of global production. Most of this vanadium comes from the Bushveld Igneous Complex. There are two primary vanadium producers in South Africa: Glencore and Bushveld (Yager, 2022). Evraz Highveld Steel and Vanadium was previously a major contributor to the industry, but the company has since dissolved with its assets likely to be bought by Robusteel (Liedtke, 2021). Rhovan Mine owned by Glencore produced 9,500 t in 2017. Vamecto mine owned by Bushveld can produce 2,850 t/yr and Bushveld plans on upgrading this to 5000 t/y (Yager, 2022). Bushveld also owns the Vanchem primary vanadium processing facility. This facility produces vanadium pentoxide, ferrovanadium and vanadium chemicals and is capable of producing vanadium trioxide. Vanchem uses the salt-roast beneficiation process.

[2] Eskom Hld SOC Ltd or Eskom (Afrikaans: Elektrisiteitsvoorsieningskommissie) is a South African electricity public utility.

Titanium	According to the DMRE (2009) the production of titanium between 2006 and 2009 fluctuated between 950 kt to 1223 kt. In 2019 South Africa produced 820 kt of ilmenite and 110 kt of rutile (Roux, 2020). The biggest titanium producer in South Africa is Richard Bay Minerals (RBM) the company also produced pig iron and processed ilmenite to titanium slag (Yager, 2022). In 2019 RBM approved the development of the Zulti South Project but has however paused their work here. Based on their production plans including Zulti South and North as well as their current operations, RBM's total ilmenite production could increase to more than 2.2 Mt/yr. RBM produced 880,000 t of titanium slag in 2012 (Yager, 2022). KZN Sands Fairbreeze owned by Tronox located 20 km south-west of Richards Bay produces a titanium slurry by using hydraulic mining at the Hillendale mine. Fairbreeze had a capacity of 500,000 t/yr of ilmenite, 55,000 t/yr of zircon, and 25,000 t/yr of leucoxene and rutile (Yager, 2022). There is also a processing complex in Empangeni, 20 km west of Richards Bay which has smelting capacity for ilmenite to produce titanium dioxide slag (DMRE, 2008). Namakwa Sands also owned by Tronox which is an open-pit mine and concentration plant located 385 km north of Cape Town (Tronox, 2023). Here after primary concentration the ore is further processed in a secondary concentration plant to yield a magnetic and non-magnetic stream (Tronox, 2023). This facility produced 180,000 t of titanium slag in 2017. There was also 26,000 t of rutile as well as 450,000 t of ilmenite. A key player in R&D as it pertains to titanium feedstock is Mintek. In collaboration with Anglo American they developed a DC arc smelting process used by the Tronox-operated plants in South Africa (DMRE, 2008). A major player in the upstream titanium value chain is Nyanza Light Metals plant which produces titanium dioxide pigment (Roux, 2020). Together with a New Zealand company they plan to construct a pigment plant with a 100,000 tpa capacity.
PGMs 271 000 t mined annually	South Africa is the world's largest PGM producer owing the nation's vast PGM reserves. South Africa's PGM output is predominantly produced in the Bushveld Complex with 0.1 % coming from the gold deposits of the Witwatersrand and Free State, and the Phalaborwa copper deposit (DMRE, 2010). In 2017, platinum-group metal mine production fell from 263.653 kg in 2016 and 304,00 kg in 2007 to 260,264 kg (Yager, 2022). Platinum made up 50 % of PGM mine output by volume in 2017 (Yager, 2022). Amplats, owned and operated by Anglo American, is one of the largest PGM producers in South Africa. In 2017 Amplats produced 155,500 kg of refined PGMs specifically 78, 129 kgs of refined platinum, 51,893 kg of refined palladium, 10,053 kg refined rhodium, and 15,500 kg of refined iridium and ruthenium (Yager, 2022). Modikwa Mine produced 10,022 kgs in 2017, Union mine produced 9,558 and the Mototolo Platinum mine produced 5,704 kg. The Mogalakwena Mine produced 370,000 ounces of refined platinum. Kroondal which is 50% owned by Sibanye Stillwater has two concentrator plants which process ore at a rate of 590, 000 t a month. In 2022 Amplats PGM production fell by 30 % from the previous year to 28 000 kg owing to the rebuild of the Polokwane smelter. In 2022 Amandelbult produced 20,213 kgs of PGMs, which is a minor decrease from the previous year's production at 21,914 kgs (Anglo American, 2022). The smaller Unki and Mototolo mines also owned by Amplats produced 6, 577 kgs and 8,221 kgs in 2022 respectively. The jointly owned Bafokeng Rasimone Platinum Mine. The mine produces around 4847 platinum per year and in 2017 it produced 8,800 kgs of PGMs. Styldrift Mine also owned by Royal Bafokeng Platinum produced 6151 kg of PGMs in 2021 which marked an 11 % increase from the year before (Royal Bafokeng Platinum Ltd., 2021). Implats, another major player in the PGM industry produced a total of 92,685 kg of refined PGMs in 2017 (Yager, 2022). Impala is 96% owned by Implats and has operations situated on the western limb of the world-renowned Bushveld Complex near Rustenburg in South Africa (Yager, 2022). Here, 36,500 kgs of PGMs (including

	gold) were produced in 2018. Two rivers, a joint venture between Impala and African Rainbow Minerals and managed by African Rainbow Minerals. The operation comprises two on-reef decline shafts and a concentrator plant and has a life-of-mine offtake agreement with Impala Refining Services (IRS). In 2016 Two Rivers produced 183 400 ounces of refined platinum. Bokoni Mine which has recently been acquired by African Rainbow Minerals for which African Rainbow Minerals Targeted steady-state production of 300 000 ounces per annum by 2028 (ARM, 2021). Other major mines include Lonmin owned by Sibanye-Stillwater which produced 338,475 kg of refined PGMs in 2018, Marula mine owned by Impala which produced 210 000 ounces of concentrate in 2020 (Impala, 2021). There is also Booysendal which is owned by Northam Platinum which in 2018 produced 185 000 oz of PGMs concentrate.
Cobalt 2,300t mined annually	Most of South Africa's refined cobalt production is a co-product of PGM mining as well as of the single nickel mine operation, the Nkomati mine. The USGS estimates South Africa's cobalt reserves at 15 kt (DMRE, 2009). Most of the cobalt reserves can be found in Merensky Reef, the Plat Reef and UG2 chromitite layer. These three layers are in the Bushveld Complex geological formation. South Africa's cobalt is produced as a by-product of the mining and refining of platinum-group metals (PGMs) operations as well as a by-product of a single nickel mine operation, the Nkomati mine (DMRE, 2009). In 2017 the refined cobalt production from PGM operations was 1,062 t while the cobalt associated with nickel was at 851 t.
Lead 35 000 t mined annually	From 2000 to 2009 South Africa's lead mine output was relatively stable at an average of above 40 kt per annum. The closure of Broken Hill and Swartberg mine in 2006 resulted in a 13.3 % production drop (DMRE, 2014). Black Mountain Mine owned by Vendanta Resources Ltd. is a major producer of lead in the country. In 2017, the mine produced 48,150 t of lead ore (Yager, 2022). Gamsberg mine also owned by Vendanta Resources Ltd was completed in 2019 and has increased national production. Its current production of this mine is 400,000 t/yr (Vendanta, 2021). The reopening of Swartberg shaft at Black Mountain in 2013 did contribute to production though limited.
Manganese 14 900 t mined annually	South Africa possesses 75 % of the world's identified manganese resources (DMRE, 2013). As of 2017, manganese ore production in South Africa was 14.14 Mt, which represents a marked increase from 10.81 Mt in 2016 and the measly 6 Mt in 2007 (Yager, 2022). This gradual increase can be attributed to increased production at Mamatwan, the Nchwaning, and the Wessels Mines as well as the opening of the Kalahari, the Kudumane, and the Tshipi Borwa Mines (Yager, 2022). A major contributor in the industry is South 32 Ltd. which operates Mamatwan open pit mine and the Wessels underground mine near Hotazel in Northern Cape Province (South32 Ltd., 2023; Yager, 2022). Mamatwan mines has a mining output capacity of 2.3 Mtpa and Wessels has 0.6 Mtpa at an optimised rate (South 32 Ltd, 2016). Assmang, a subsidiary of Assore, operates Gloria mine as well as Nchwaning 2 and Nchwaning 3 all of which are collectively known as Black Rock. Output at Black Rock increased from 2.71 Mt in 2016 to 3.62 Mt in 2017 (Yager, 2022). An expansion project at the mine is expected to increase total production of Black Rock to 4.6Mtpa.
Coking Coal	South Africa has abundant amounts of thermal coal, however, coking coal is fairly limited. Makhado project in the Limpopo Province in 2019 at the Soutpansberg coal field will represent one of the only coking coal projects in the country. According to MCMining which owns the mine, production was anticipated to begin in 2020 however it is unclear whether production has begun. The company plans to produce 700,000 t/yr of coking coal.

2. Assessment of the ECRM value chain

2.1. Characterisation of the value chain for primary and secondary raw materials

South Africa currently has some 2000 operating mines, quarries, and mineral processing facilities (DMRE, 2022). Administration of the minerals industry is the responsibility of the Department of Mineral Resources and Energy (DMRE) governed by the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) and the Mine Health and Safety Act (Act No. 29 of 1996). The two Acts, along with other enabling legislation, provide the regulatory framework for the promotion and regulation of the mining, minerals, and petroleum industry with a mission to ensure equitable access to and sustainable development of the nation's mineral resources and related matters.

Three DMRE's divisions deal primarily with minerals. Minerals and Petroleum Regulation is responsible for minerals management, mineral regulation and administration, and environmental enforcement and compliance. A Mining, Minerals and Energy Policy Development division deals with mining, minerals, and energy policy development management; minerals policy; economic analysis and statistics; economic growth, promotion, and global relations and with minerals and energy planning. A Mine Health and Safety Inspectorate division deals with health and safety of employees in the mining industry through mine, health and safety management and a mine safety inspectorate (DMRE, 2021).

Performance of the DMRE has attracted criticism from the private sector variously due to a poorly functioning mining cadastral system, opaque decision-making, delays in processing mining permits and discontinuing the publication of up-to-date mineral statistics.

2.1.1 List of the mining and recycling projects

Private sector

South Africa's major mining companies, listed in Table 6, collectively produce approximately 90% of mineral production by value. While the country has some 2000 operating mines, referred to above, production in all commodity categories is overwhelmingly undertaken by large mining groups that have been in existence for several decades, save for platinum, coal, and manganese where several new entrants were established in the 2000s.

Table 6 Major mining companies by commodity group[3]

Platinum	Coal
Anglo American Platinum	Coastal Fuels
Barplats	Exxaro Resources
Bauba platinum	Glencore Coal
Impala Platinum	HCI
Ivanplats	Ilima Coal
Limberg Mining Company	Kuyasa Mining
Nkwe Platinum	Mbuyelo Group
Northam Platinum	MC Mining
Platinum Group Metals	Msobo Coal
Royal Bafokeng Platinum	Sasol Mining

[3] Source: Minerals Council, 2023. Note: Several companies mine more than one commodity.

Sedibelo Platinum Siyanda Resources Wesizwe Platinum	Seriti Resources Thungela
Manganese	**Gold**
Assore Kudumane Resources SA Manganese Koornfontein Mines South32 - Tshipi é Ntle United Manganese of Kalahari Vaalbult	DRDGOLD Gold Fields Harmony Gold Pan African Resources Theta Gold Village Main Reef
Chrome	**Zinc/Copper**
Chrometco Glencore Chrome Samancor Tharisa	Black Mountain Orion minerals Palabora Mining Company
Diversified mining	
African Rainbow Minerals Sibanye-Stillwater	

A full list of CRM mining operations and projects is provided in the Appendix_2.1_MINING_LIST.

South Africa's formal small and mid-tier producers that are not represented by the organized mining industry are estimated to contribute about R88 billion to the economy and provide 45 000 direct jobs. This sector contributed 7.5% to the R1.18 trillion value of mining production and 9.5% to total employment in 2022. These companies are most active in industrial minerals followed by diamonds, coal, iron ore and manganese, gold, chrome and PGMs (Minerals Council, 2023).

The composition of net fixed investment for the period 1993 to 2021 is shown in **Figure 8**. From 2014 onwards fixed investment has declined, initially tracking commodity prices but deeper structural issues have taken over. Various factors are contributing to this capital expenditure decline: constrained electricity supply; a swing in the capital-labour ratio in favour of labour, evident since 2008, despite mines becoming deeper; input costs running ahead of commodity price rises; a worsening security situation; deteriorating quality of transport, logistics and border services constraining export performance; policy uncertainty around changing Mining Charter requirements, prospecting rights and a collapse of the Government's mining cadastral system hindering mining permitting. Cumulatively these factors are substantial problems for the mining industry.

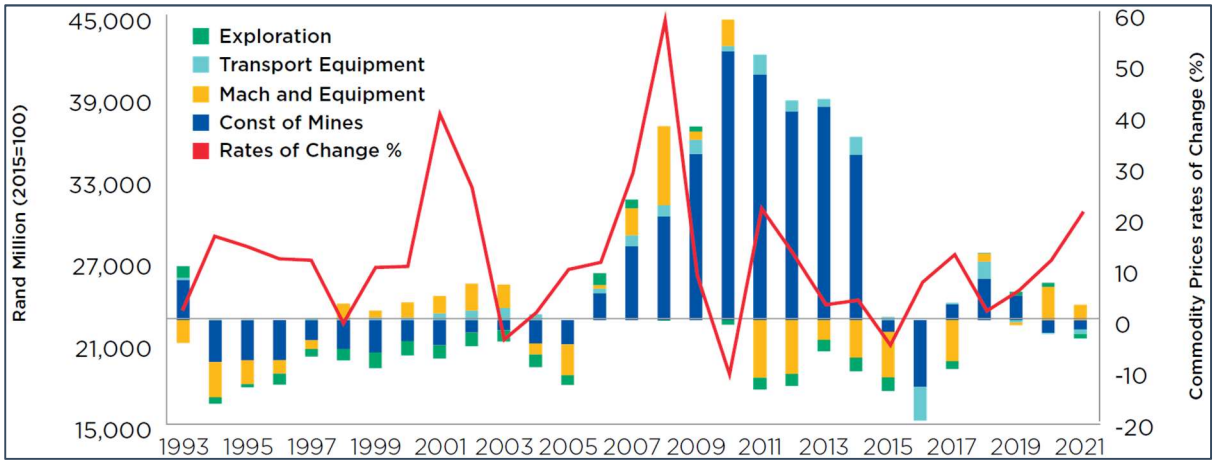


Figure 8 Composition of net fixed investment (LHS constant 2015 Rand) compared to commodity price movement (RHS % change) 1993 to 2021[4]

In response to these problems, several strategies have been started by the organized mining industry, including:

- Working with the state-owned rail operator Transnet to improve capacity and reliability of rail bulk transport.
- Recognizing that mining research, development and innovation capacity has been denuded over time, the mining industry needs to modernize in technical, safety, environmental and social spheres. The Minerals Council has encouraged members to increase R&D efforts and act through research partnerships with the public science system, see section on Mandela Mining Precinct below.
- Efforts to revive exploration activity directed at the DMRE, the Council for Geoscience and Treasury to improve the regulatory environment and pool of capital. South Africa attracted 2% of global exploration in 2012, but less than 1% today.
- Improving security in the mining industry through the application of 4th Industrial Revolution technologies.

Informal players

Accurate information on informal small-scale mining is not available but has increased in recent years as unemployment has risen. To assist informal miners, the DMRE has established an artisanal mining directorate to provide technical assistance, improve safety and reduce environmental damage.

Illegal mining and criminal extortion have become pervasive and extremely costly to the formal mining sector causing significant lost lives and revenue. Theft of infrastructure, products, and diversion of goods during transport have escalated in recent years. Illegal mining in abandoned mines is a major risk to the health and safety of surrounding communities. A hierarchy of participants runs through a well managed 5 tier criminal syndicate system from underground workers through to top international receivers and distributors usually work through international refineries and intermediary companies. Joint police, prosecution and mining company committees operate to counter this scourge, yet combatting these violent and entrenched criminal syndicates is extremely challenging.

[4] Source: Minerals Council, 2023 based on data from Stats SA, World Bank, SA Reserve Bank

Recycling Operations

South Africa has several recycling operations for various types of metals. It must be noted that tailings reprocessing on large mines is sometimes allowed in partnership with smaller companies. These operations are limited in number and are always confined to the mine property under license, to maintain effective control over health and safety of operators. Table 7 lists the independent (not on mine site) metal recycling facilities known in South Africa. Table 8 lists the tailings retreatment projects in South Africa.

Table 7: Recycling operations in South Africa

Name of company	Location	Commodity recycled	Degree of maturity
Star Recycling Company	Gauteng	Copper, Brass, Aluminium, Lead, Zinc & Stainless steel, Iron, Steel	Operational
Amalgamated Metal Recycling (a subsidiary of Insimbi Group)	Cape Town, Gauteng, Durban	Fe, steel, Al, Cu, zinc, stainless steel, lead, Ni, brass, Sn, bronze, etc.	Operational
Primo Recycling	Gauteng	Iron steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Operational
Maningi Metals	Gauteng	iron, steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Operational
AST Recycling	Johannesburg, Cape Town, Durban	E-waste, catalytic converters	Operational
Cast Products	Johannesburg	Steel	Operational
Vulcan Metal & Logistics	Johannesburg	iron, steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Operational
Wykco Group	Gauteng	iron, steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Operational
Palladium Recycling	Gauteng	PGMs	Operational
Blue Sky Metals	Kwazulu-Natal	iron, steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Operational
Desco Electronic Recyclers	3 Branches: Gauteng, KZN and Western Cape.	WEEE and associated plastic waste as well as ferrous/ non-ferrous metals recovery.	Operational
Kusini Resources Proprietary Limited	Gauteng	Mine waste recycling and value recovery. PGM recovery from catalysts	Operational

Table 8 Tailings retreatment projects in SA

Name of company	Location	Commodity recycled	Ownership	Degree of maturity
Louis Moore Tailings facility	Limpopo	-		Development
Mooinooi Tailings Plant	North West	PGMs	Samancor	Operational
Marikana Eastern Tailings Dam	North West	PGMs	Sibanye-Stillwater	Operational

Name of company	Location	Commodity recycled	Ownership	Degree of maturity
Zandfontein Tailings Dam	North West	PGMs	Eastern Platinum (Barplats)	Operational
Thakadu Battery Plant	Johannesburg	Nickel and Cobalt	Thakadu	Operational
Sylvania Dump Operations	North West	PGMs	Sylvania Platinum Limited	Operational
Booysendal South tailings storage facility	Limpopo	PGMs	Northam	Operational
Western Limb Tailings Retreatment	North West	PGMs	Sibanye-Stillwater	Operational
Marikana Bulk tailings retreatment	North West	PGMs	Sibanye-Stillwater	Operational

2.1.2 Existing ESG indicators

Environmental, Social and Governance (ESG) reporting has become a requirement by many stock exchanges world-wide. There are different internationally acknowledged ESG standards and frameworks, which include:

- The Global Reporting Initiative (GRI), the most used sustainability reporting framework that maps out principles and performance indicators for companies to report on ESG performance;
- The Carbon Disclosure Project, a reporting system through which companies disclose greenhouse gas emissions, water management and climate change strategies;
- The United Nations Global Compact, a sustainability initiative for companies to align their strategies and operations in the areas of human rights, labour and anti-corruption;
- The International Finance Corporation Sustainability Framework
- The Equator Principles

In the South African context, the Johannesburg Stock Exchange (JSE) Sustainability Reporting Index is the recognised exchange body which regulates ESG reporting on the South African Securities Exchange. When issuing their Sustainability and Climate Change Guidance, the JSE emphasised that "While intended primarily for JSE-listed companies, this guidance will also be of value to institutional investors and the different entities that they invest in (including non-listed companies and debt issuers), as well as a range of stakeholder groups interested in sustainability/ESG disclosure and performance." (Johannesburg Stock Exchange, JSE's Sustainability and Climate Change Disclosure Guidance, 2022) The JSE prides itself for its progressive listings requirements incorporating the King Codes and its 2004 Sustainability Reporting Index (SRI), which they call the ESG Index. The JSE is signatory to the UN-backed Principles for Responsible Investment (PRI), the co-chair of the Global Investors for Sustainable Development Alliance, and a member of the World Federation of Exchanges' Sustainability Working Group. However, the JSE acknowledges that while it is considered to have existing requirements for sustainability/ESG disclosure "…no detailed guidance to assist listed companies on sustainability/ESG reporting has been issued until now." (ibid)

As the South African Environmental, Social and Governance Committee (SAMSEG Committee) reported, "Numerous organisations have moved towards greater transparency when disclosing ESG information in recent years and have contributed greatly through the development of industry-specific technical standards." (The South African Environmental, Social and Governance Committee, 2017) The South African Minerals Reporting Code (SAMCODE) Standards Committee provided leadership in the development and publication of the South African guideline for the reporting of ESG parameters within the solid minerals, oil and gas industries (the SAMESG Guideline), which was first released in 2016. According to SAMCODE Standards Committee the guideline has evolved to provide

direction on ESG reporting requirements for public reporting, as defined in SAMREC (South African Minerals Reporting Code).

The SAMESG Guideline provides guidance on the reporting of the following aspects:

- Organisational structure, systems, policies, procedures and risk management plans;
- Compliance related ESG aspects;
- Key environmental parameters;
- External social and political parameters;
- Internal social parameters;
- Conformance and compliance audits;
- ESG liability; and
- Risk analyses and materiality processes

There are technical standards which SAMESG acknowledges and promotes, which include, the International Standard for Organisation (ISO), the World Bank Group Equator Principles, the Principles for Responsible Investment, and the International Finance Corporation Sustainability Framework. The SAMESG also recognises the OECD Guidelines for Multinational Enterprises, the ISO 26000 Guidance on Social Responsibility, Code for Responsible Investing in South Africa, Principles for Responsible Investment, the King Report on Governance for South Africa and the International Corporate Governance Network. It is noteworthy that the Chairperson of the SAMESG Committee observed that "Sustainability reporting is largely undertaken voluntarily by companies, regardless of their listing status on a stock exchange." (Steele-Schober, T, 2021)

Steele-Schober mentioned that the SAMESG is intended to encourage JSE-listed mineral developers to filter through information that many are already collecting to support their voluntary sustainability reporting processes. SAMESG also aims to provide guidance to the junior and mid-tier companies on what information investors are interested in and assist them prepare such information in a manner that best showcases their company's approach to ESG integration. SAMESG helps companies collect and report on site-level data.

2.1.3 Economic links between the formal and informal sectors

Informal mining in South Africa predates the current era by centuries. South African communities made utensils and crafts out of clay and also manufactured agricultural and hunting implements out of iron for centuries before the era of recorded history. .

The formalisation of mining during the colonial era at first allowed indigenous people to participate in mining as claim owners and as labourers in what ranged from artisanal to mechanised operations (Ledwaba, P and Mutemeri, N, 2017).

With the retrenchments in the gold mines and deplorable economic conditions many South Africans started engaging in illegal artisanal mining on abandoned shafts. Artisanal mining gained recognition through the White Paper on Minerals and Mining Policy (1998) when the Department of Minerals and Energy (DME) took a position to redress past injustices. These policy propositions were translated into legislation in the Minerals and Petroleum Resources Development Act of 2002 (MPRDA). However, despite efforts to support the Artisanal and Small-Scale mining (ASM), the sector remains informal even with an increase of the number of permits issued. The DMRE also acknowledges that "*the extent of the industry in terms of players involved, number of people employed, its socio-economic impact, investments, and its contribution to the Gross Domestic Product (GDP), in the form of taxes and royalties is not properly documented"* (DMRE, 2022).

In a new Artisanal and Small-Scale Mining Policy of 2022, the DMRE distinguishes between Artisanal mining and Small-Scale mining. According to the Policy, Artisanal mining refers to "*traditional and customary mining operations using traditional and customary ways and means. This includes the*

activities of individuals using mostly rudimentary mining methods, manual and rudimentary tools to access mineral ore, usually available on surface, or at shallow depths." Small-Scale mining is defined as "*a prospecting activities or mining operation which does not employ specialised prospecting, mechanised mining technologies, chemicals including mercury and cyanide or explosives; or the proposed prospecting or mining operations do not involve an investment or expenditure which exceed such amount as may be prescribed*." (Ibid)

Ledwaba and Mutemeri unpack the illegal form of Artisanal and Small-Scale mining with an observation that it is linked to socio-economic and political imperatives. They differentiate between so called "Zama-Zamas"[5] and the informal Artisanal and Small-Scale miners who are compelled by socio-economic and political factors. The Zama-Zamas are often (but not always) associated with organised criminal gangs and international syndicates while informal Artisanal Small-Scale miners are often given permission by local authorities and would welcome efforts to formalise them (Ledwaba, P, and Mutemeri, N, 2017).

The Artisanal and Small-Scale Mining Policy of 2022 aims to formalise all illegal Artisanal and Small-Scale mining and create an enabling environment for the sector to prosper. The Informal Artisanal and Small-Scale mining sector when formalised and supported could make meaningful contribution to livelihoods, government revenue and the country's economy. There are no legal restrictions as to the type of mineral chosen by artisanal and small-scale miners and as such involves a wide range of minerals, from precious minerals to construction materials. The number of people working in the sector, formal and informal, is estimated between 10 000 and 30 000.

The Artisanal and Small-Scale Mining Policy of 2022 distinguishes between artisanal and small-scale mining in terms of prescribed investment limits. The investment maximum for artisanal mining is R1 million and the maximum investment for small-scale mining is R10 million. Provision is made for a graduation process from artisanal mining to small-scale mining and from small-scale mining to junior mining. The Policy and legal framework will also have different requirements for artisanal mining permit and small-scale mining permit. Permit holders will be formalised and required to affiliate to established associations representing them. Artisanal and small-scale mining permits will become real rights, like mining rights, and holders will be able to transfer, mortgage and capitalise them.

Regarding extent and scope of permits, the DMRE says that "Considering the rudimentary nature of artisanal mining and particularities of small-scale mining the duration and size of permits should be determined taking into consideration factors such as but not limited to the type of mineral being mined, technical and financial resources required, and the environmental impacts associated with the extraction of that mineral." (DMRE, 2022). The DMRE will preserve artisanal and small-scale mining permits for South Africans, with particular consideration given to Historically Disadvantaged South Africans (HDSAs), women, cooperatives and vulnerable groups . Recognising the existence of foreign nationals in illegal mining the DMRE proposes a transitional period for all illegal miners to come forward to be formalised.

ASM operations will be restricted to surface and open cast mining, given the limited skills and financial resources for environmental management and health and safety considerations. The Policy empowers artisanal and small-scale miners to add value to their minerals and trade in the open market. The DMRE will consider a regulated market or a central buying agency for artisanal and small-scale miners to ward off syndicates who often take advantage of the miners. The Policy will enable cooperation between large mining operators and artisanal and small-scale miners through Tributing Agreements.

[5] "Zama-Zama" is a term derived from the Zulu language "-zama", stem of "ukuzama", which means "to try, strive, or make an attempt to obtain something". The term is in common use for illegal miners, often of foreign origin, operating in South Africa.

Owners of tailings and dumps will be encouraged to work with artisanal and small-scale miners considering environmental management and water related legal requirements.

The Small-Scale Mining Directorate will be capacitated to provide institutional support to the artisanal and small-scale mining sector in the areas of training, funding applications and government's incentive schemes. The DMRE is cognisant of the cost factor associated with compliance regarding environmental laws for artisanal and small-scale miners. The occupational health and safety requirements are as stringent as those for mining right holders. In response to these challenges the Artisanal and Small-Scale Mining Policy proposes that government should collaborate with institutions such as the MQA, Mine Health and Safety Council (MHSC), and Organised business to train and empower permit holders to comply with environmental and health and safety requirements. The Policy further proposes that government should have an integrated approach to monitoring compliance and devise mechanisms to provide incentives and disincentives in order to encourage compliance.

2.2. Identification of the bottlenecks along the value chain

In August 2022, the Trade and Private Sector Development (TPSD) Facility of Development Alternatives Incorporated (DAI Global), LLC published a report titled: *"Study on a potential EU - South Africa partnership on Raw Materials Value Chains".* This report was derived from extensive research and many interviews about the climate and opportunities for EU investment in critical mineral projects in South Africa. It touches on many similar issues to the AfricaMaVal project. This chapter has been compiled with inputs from that report as it relates to critical minerals, value chains and the specific projects identified.

The aim of the DAI Global research was to analyse the value chains of specific important raw materials in South Africa and to pinpoint potential avenues of collaboration between the European Union and South Africa.

Ten minerals were examined in the study: cobalt, fluorspar, vanadium, rare earth elements, and the six platinum group metals (PGM): ruthenium, iridium, osmium, palladium, and rhodium. A value chain analysis of green hydrogen and trash from electrical and electronic equipment was also conducted as part of the study.

2.2.1 List of the main bottlenecks and the links between them

The DAI Global report identified the following bottlenecks for the CRM value chains analysed:

Table 9: CRM constraints and opportunities for engagement (per DAI Global, 2022)

CRM	Constraints to investment/ growth
Vanadium	Significant investment is required in vanadium exploration. South Africa's proposed government exploration strategy identifies the following challenges to increasing exploration investment in the broader mining sector. Thus far, section s12J of the Income Tax Act, and other similar incentives have not proven of benefit to junior explorers. There exist limitations to the diversity of available financial instruments, particularly for junior miners. Lack of dissemination of available legislative benefits has resulted in a disjuncture on the use of tax rebate benefits to support exploration development. The rate of commercialisation of flow batteries remains hindered by the high capital costs associated with the sourcing and extraction of vanadium and the low solubility of the vanadium salts that the battery employs.

CRM	Constraints to investment/ growth
	The availability of project financing and the fact that the domestic financial sector is not experienced in new energy storage technologies will be an impediment to the development of VRFBs. There is room to grow South African exports of vanadium however, given the direction set out in The South African Steel and Metal Fabrication Master Plan 1.0, this would (from the perspective of the South African government) need to be balanced against local needs. The best approach to satisfying both goals would be to increase production of vanadium, which requires greater investment in exploration and investment in production capacity.
Fluorspar	Greater investment is required in exploration activities. Whilst South Africa is the fourth highest producer of fluorspar, decades of a lack of investment into exploration and expansion of production have left the country with significantly less production than its counterparts. There has been a reluctance to invest in the technology and infrastructure required for beneficiation of fluorspar. This is exacerbated by a skills shortage and the length of time it takes to develop fluorochemical facilities. Long development timelines also necessitate large up-front capital deployment. Investment in Sepflour's undeveloped Welgevonden and Kruidfontein prospects is an option for European investors.
REE	A lack of experience in and data on this sector's performance in South Africa will make it difficult for many investors to participate at the various stages of the value chain. European investors could partner with mining companies to provide risk capital and fund the exploration and development of REEs in South Africa. Due to the early stage of development, there is ample opportunity for European companies to position themselves early to participate in the beneficiation of REEs (once supply is ready), through equipment supply, technology transfer and capacity building.
Cobalt	The growth of the cobalt sector is not prioritised by the South African government. Local beneficiation of cobalt has not been prioritised, as such there may be opportunities for European companies to assist in the creation of local cobalt value chains that are matched to South Africa's relatively limited supply. European companies that produce beneficiated products like cobalt salt and cobalt metal could explore the role of South Africa in actualising the desire of Democratic Republic of the Congo (DRC) and Zambia to produce value added intermediary products for battery production. This aligns well with Southern African Development Community (SADC) regional value chain development efforts supported by the African Development Bank (AfDB). The beneficiation of the limited quantities of cobalt produced by South Africa could then be linked to cobalt production from the DRC, Zambia and Zimbabwe helping to meet the critical mass required for such investments. In addition, South Africa also offers well developed financial markets for capital raising.
PGM's	South Africa's PGM sector is vertically integrated from mining to fabrication, however there are areas within the sector that require further development. There is limited domestic capacity to service, refurbish and fix the smelters and furnaces used to process PGMs, resulting in mining companies being forced to wait for international practitioners to attend to their equipment which can result in expensive backlogs. South Africa lags behind in the creation of PGM related research and knowledge products which has resulted in limited domestic technology development for future products that utilise PGMs. • Limited capacity to service smelters and furnaces. • Lagging R&D in PGM related products. • Sibanye-Stillwater's increased focus on digitization and automation provides several points of entry for EU businesses given that these areas of innovation are not strengths of the South African economy. • The catalytic converter sector, in the long-term, is threatened by the growth of electric vehicles, this will have upstream effects on the demand for the PGMs most in demand by the sector. • Technologies and companies that can help increase local production of fertilizers to more modern methods would likely appeal to South African companies. Given the intense need for water treatment solutions in the mining sector, the potential role

CRM	Constraints to investment/ growth
	for PGMs in these solutions, and Europe's leadership in the circular economy, there is significant scope for cooperation in this area. • PGM producers are investigating green energy alternatives due to South Africa's struggles with energy supply, this provides opportunity for profitable working relationships with EU alternative energy suppliers.

The DAI Global report (2022) further identified the following general barriers to entry for CRM value chains analysed for South Africa, reflected from the Fraser Institute report 2021:

Energy Instability

Due to increased energy demand that has put stress on Eskom's (South Africa's power company) ageing coal-fired infrastructure, the country has seen energy instability since 2008. Both mining firms and the nation's economy as a whole have suffered as a result of loadshedding. Companies like Goldfields, Anglo American, Sibanye Stillwater, and Impala Platinum are evaluating their possibilities for renewable energy in response to a change in legislation that permits them to produce 100MW of their own energy needs. The nation has started putting plans into action to boost energy supply by using a diverse range of energy sources. The DMRE's goals to develop renewable energy sources and decommission coal power plants until 2030 are outlined in the most recent Integrated Resource Plan (IRP 2019). The government released its National Infrastructure Plan 2050 in 2021 for public feedback, which calls for developing affordable solar and wind technologies to improve the energy infrastructure.

Infrastructure constraints

Inadequate network coverage, inadequate maintenance, and incapacity are the key constraints on South Africa's rail and road infrastructure. Lack of spare parts, theft of copper cables, and vandalism have all negatively impacted Transnet, the nation's state-owned rail, port, and pipeline company . As a result, the country's coal and iron ore exports have suffered billions of rands in losses as they have been forced to truck and stockpile their goods. For the upcoming years, the South African government has set aside R900 billion (until 2027) to upgrade the country's transport infrastructure. Furthermore, third-party access to the goods rail network is made possible by the White Paper on National Rail Policy, which was approved by the cabinet in March 2020. Transnet has already begun to make slots on the network accessible for private train operators.

Inadequate Geoscientific Data

Precompetitive geoscientific data are few. Even with the recent growth in mapping by the CGS, just 9% of the nation is currently mapped at the 1:50,000 scale. The inability to obtain geodata impedes investment in exploratory endeavours.

Uncertainty in Policy and Poor Implementation

Although South Africa has a strong mining policy and regulatory framework, there have been implementation issues. Investment is discouraged by the burdensome administrative procedures and the occasionally contradictory policies and regulations. For instance, there are still significant backlogs and lengthy wait periods in South Africa since the country's cadastral system is still not up to date and cannot be used to manage the issuance of rights and licences. The South African Mineral Resources Administration System (SAMRAD) system is broken, and the DMRE has made several pledges to replace it with a new, functional cadastral system, but they have failed to deliver. The Mining Charter adoption has been the other major source of uncertainty. It was finally adopted in 2018 after 16 years

of debate, but not before the Minerals Council South Africa (MCSA) filed a lawsuit challenging the Mining Charter's local procurement requirements and black economic empowerment (BEE) targets. A Gauteng High Court affirmed the "once empowered, always empowered" premise in 2021 and struck down the local procurement requirements, ruling that the Mining Charter was a policy document rather than enforceable legislation or subordinate legislation. The mining sector and foreign investors now have more policy certainty thanks to this ruling.

Labour Conflicts and Social Unrest

The mining sector has frequently served as the backdrop for civic unrest and worker problems. The historical power of unions in South Africa, the expectations fostered by the country's Social and Labour Plans (SLPs), and years of steadily deteriorating socioeconomic conditions could all be contributing factors. Mining corporations may be pulling out due to investor fear caused by this political unpredictability. The present administration has made an effort to reassure foreign investors that political will exists to address the instability challenges.

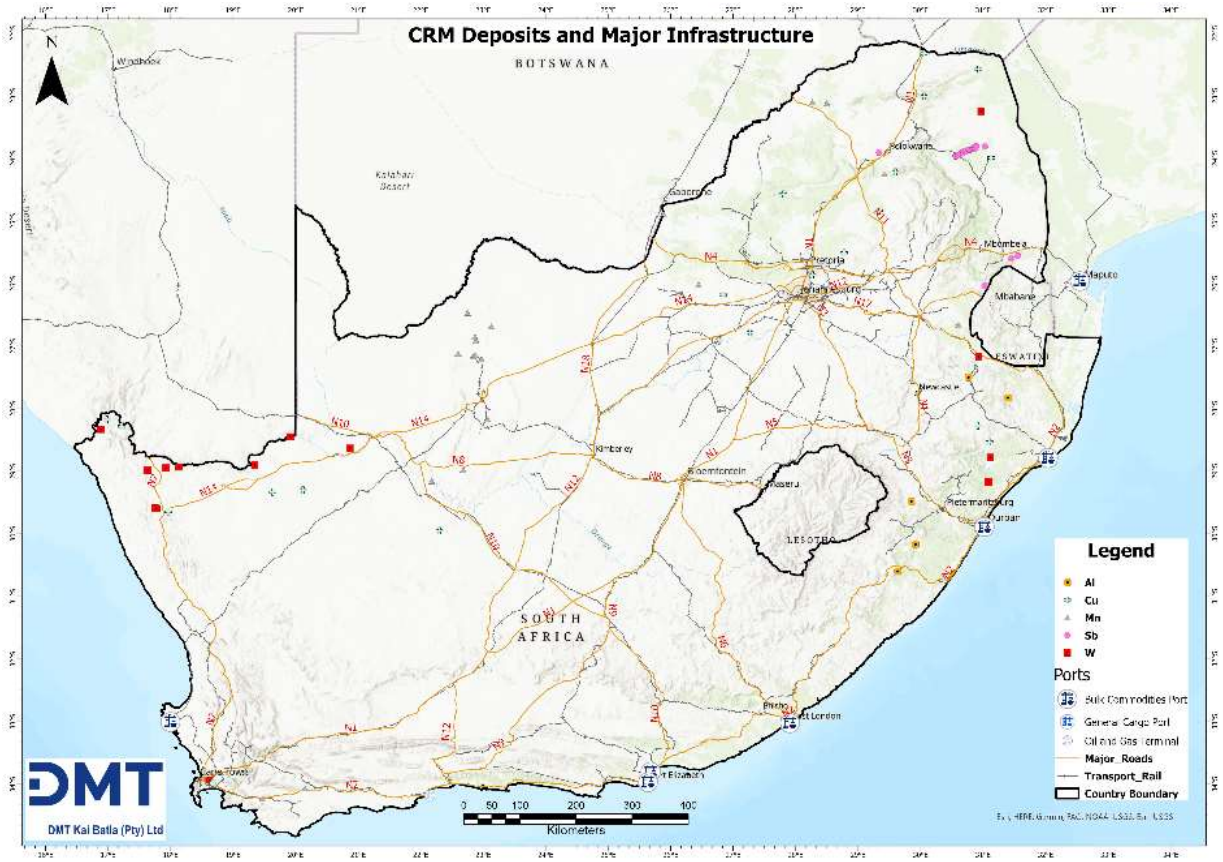


Figure 9: Map of CRM occurrences in SA, with major road, rail and port infrastructure.

3. Investment/financing prospects for ECRM projects in South Africa

3.1. Legal and regulatory context for in-country financings

Context

Ownership Requirements

South Africa's Constitution affords individuals the right to acquire and hold rights in property and, to dispose of such rights. It also affords property owners protection against arbitrary expropriation, subject to equitable compensation. Foreign investors may acquire property in South Africa but cannot register a mortgage bond exceeding the amount of capital they have introduced from offshore. Regarding business, the Companies Act does not impose any requirement for local ownership or directorship. A company must have a public officer responsible for dealings with the South African Revenue Services, who must be resident in South Africa.

A foreign company looking to establish a business in the country generally incorporates a private company as it provides the benefits of limited liability, separate legal personality and perpetual existence despite changes in shareholding, with less stringent requirements than those required of a public company in relation to corporate governance and financial reporting. If the foreign company does not wish to incorporate a separate legal entity it can register as an external company or branch office in South Africa which will be registered by the Companies and Intellectual Property Commission of South Africa (CIPC) and will be governed by the same founding documents by which its foreign head office is governed. Partnerships can be created by contractual agreement under common law and so too can unincorporated joint ventures (regulated by contract law) which may or may not be partnerships. Incorporated joint ventures are incorporated in the form of companies in which the joint venture partners each hold shares. A joint venture company, like any other company, is regulated by the Companies Act but a joint venture agreement is usually concluded to record any additional terms governing the relationship between them.

Foreigners are entitled to hold shares in companies in South Africa. However, in sectors where the company requires certain licenses and permits to operate that require a percentage of shares to be held by South Africans, specifically Black South Africans, there are restrictions on the percentage of shares that can be held by foreign nationals. Mining is one of the affected sectors. Furthermore, if the foreign-owned company wishes to conduct business with the state or with state-owned companies in South Africa, it must comply with the Broad-Based Black Economic Empowerment Act, No.53 of 2003. The Broad-Based Black Economic Empowerment Amendment Act, No.46 of 2013 reinforced provisions for the publication of sectoral Codes of Good Practice and transformation charters for different sectors of the economy to promote black economic empowerment[6]. The Amendment Act imposed an absolute obligation on Government and public entities to apply the Broad-Based Black Economic Empowerment (B-BBEE) Codes in their procurement policies and in issuing licenses and authorisations in sectors such as mining. It also obliged listed entities to report to the B-BBEE Commission on their compliance with B-BBEE law and regulations.

In mining, the preamble to the *Mineral and Petroleum Resources Development Act (MPRDA) No.28 of 2002* reaffirms the State's commitment to bringing about equitable access to South Africa's mineral

[6] Codes of Good Practice for the Minerals Industry were published in the Government Gazette (No.32167) on 29 April 2009

and petroleum resources. Section 100 (2)(a) of the MPRDA required the Minister to "develop a broad-based socio-economic development Charter that will set the framework, targets, and timetable for effecting the entry of Historically Disadvantaged Individual (HDI) South Africans into the mining industry…". Furthermore, Section 100 (2)(b) required that the Charter set out how equitable access to, benefit from and the development of mineral and petroleum resources of the Republic would be promoted. It also required disclosure into how "the holders of mining and production rights would contribute toward the socio-economic development of the areas in which they are operating". Since the commencement of the MPRDA in 2004, there have been four iterations of the *Broad-Based Socio-Economic Empowerment Charter for the South African Mining Industry* (the Mining Charter). In each instance the Mining Charter set compliance targets for: Black ownership[7]; procurement, supplier and enterprise development; local content; employment equity; human resource development; mine community development; workforce housing and living conditions; and sustainable development. In the most recent version of the Mining Charter, non-compliance with the ownership requirements constitutes breach of the MPRDA and subject to the provisions of Sections 94, 47, 98 and 99 of the Act may, amongst other penalties, result in the suspension or cancellation of rights, permits or permissions held.

Critics of the Mining Charter have argued that its frequent revisions have contributed to a protracted period of uncertainty and regulatory instability that may have deterred investment in the mining industry.

On 21st September 2021, the Gauteng Division of the High Court various parts of the Charter, ruling that it provides only policy guidelines and cannot be regarded as subordinate legislation (to the MPRDA). Its provisions are therefore not legally binding, and the Charter should be seen rather as an instrument of policy. This means that non-compliance with the Charter cannot be used by the DMRE to revoke a mining right. However, section 107(1)(I) of the MPRDA still empowers the Minister to make regulations regarding "any other matter the regulation of which may be necessary or expedient in order to achieve the objects of this Act"[8]. While the DMRE has indicated that this may be the way they will proceed, there has not been an amendment of the Mining Charter or the Regulations to the MPRDA since the High Court ruling. In effect, regulatory uncertainty remains, and investment continues to be constrained.

South Africa's commitment to international treaties

South Africa worked hard to achieve the country's diplomatic, political and economic reintegration into the global community following decades of isolation prior to its liberation from Apartheid. Giving expression to the values of equality, nonracialism, non-discrimination, liberty and peace enshrined in the country's constitution were essential for the development of its fledgling democracy.

South Africa's foreign policy approach was characterised by cooperation, collaboration and the building of partnerships. South Africa has traditionally advocated multilateralism through the United Nations and in addition to advocating reform of that organisation's primary structures, South Africa has consistently engaged the north on reforming global economic rules through the World Bank, the International Monetary Fund, the World Trade Organisation and the United Nations Conference on Trade and Development.

[7] Initial compliance targets for Black ownership were 26% shareholding (with no free-carry) within 5 years (i.e. by 2015). Controversially Mining Charter III raised this to 30% in respect of new mining rights (including a 5% carried interest each for employees and host communities) and a minimum 20% effective ownership by historically disadvantaged persons, 5% of which must preferably be for women.

[8] Mineral and Petroleum Resources Development Act, No.28 of 2002

The country has also been a strong advocate for the interests of the African continent. It has supported the development of the African Union (AU) and has nurtured regional integration through the Southern African Development Community (SADC), the Southern African Customs Union (SACU) and the Tripartite Free Trade Area between COMESA, the EAC and SADC. It is also a strong advocate of the African Continental Free Trade Area (AfCFTA). South Africa is a member of the Non-Aligned Movement and in 2011 joined the Brazil, Russia, India and China (BRIC) grouping to form the BRICS. Since 2007, the country enjoys "enhanced engagement" status with the Organisation of Economic Cooperation and Development (OECD) and concluded the Trade and Development Cooperation Agreement (TDCA) with the 28-member European Union (EU) in 2004.

Anti-corruption

In 2001, South Africa adopted the SADC Protocol against Corruption which aims to promote and strengthen the development, within each Member State, of mechanisms needed to prevent, detect, punish and eradicate corruption in the public and private sector. Thereafter, Thabo Mbeki signed the United Nations Convention against Corruption soon after its adoption by the General Assembly of the United Nations in 2003. This convention is the only legally binding universal anti-corruption instrument covering five main areas: preventive measures, criminalization and law enforcement, international cooperation, asset recovery, and technical assistance and information exchange. It covers many different forms of corruption, such as bribery, trading in influence, abuse of functions, and various acts of corruption in the private sector. Since 2007 South Africa is also one of six non-OECD signatories to the OECD Anti-Bribery Convention which establishes legally binding standards to criminalise bribery of foreign public officials in international business transactions, and the country is also a signatory to the United Nations Convention against Transnational Organized Crime adopted by General Assembly in November 2000.

Domestically, the Prevention and Combating of Corrupt Activities (PRECCA) Act, No.12 of 2004 is the country's main anti-corruption and anti-bribery legislation[9]. It creates an offence of corruption that is broadly defined and imposes a statutory reporting obligation in instances where suspicion exists that an offence in terms of the Act has been committed (including bribery). The Act places the responsibility to investigate bribery and corruption on the South African Police Service as the authority with the constitutional mandate to investigate crime in South Africa. However, while there are several public interest groups which take the prevention and combating of corruption and bribery very seriously, the South African government has achieved very few successful prosecutions, particularly in respect of those allegations of corruption and bribery involving high profile individuals or politicians. In short, there is a wide gulf between the government's anti-corruption rhetoric and the reality of its commitment and capacity to prevent bribery and corruption on the one hand, and to prosecute those suspected of it on the other.

Protection of Investment

South Africa's efforts to grow its economy to address the economic and social challenges it faces depend in part on its ability to attract foreign direct investment. As part of that effort, affording investors protection for their investments, particularly against expropriation has typically been through bilateral investment treaties (BITs). They have also been protected by South African common law, local legislation and the South African Constitution. In 2010, following a review of the country's BIT obligations, the South African Cabinet took a decision to develop new legislation to: codify typical

[9] Together with the Prevention of Organised Crime Act, 1998; the Protected Disclosures Act, 2000; the Financial Intelligence Entre Act, 2001; the Protection of Constitutional Democracy Against Terrorist and Related Activities Act 2004; and the Competition Act, 1998.

BIT provisions into domestic law, and strengthen investor protection; terminate first-generation BITs; and refrain from entering BITs in the future unless there are compelling economic and political reasons for doing so[10]. In June 2018, the Protection of Investment Act, No.22 of 2015 was signed into law by President Ramaphosa.

Although the stated purpose of the Act is to protect foreign investors in South Africa, overall, the protections offered in the Act are substantially diminished by amongst others: the removal of investor-state dispute settlement i.e., the right of the foreign investor to directly approach international tribunals in the event of a dispute with the SA government; the omission of a most favoured nation treatment standard; the lack of a "fair and equitable treatment" standard; etc. Whether the Act satisfies its stated objective of providing protection to investors some of whom bemoan the current political uncertainty and populist rhetoric that prevails in relation to matters of nationalization and expropriation, will depend on how it is implemented. Investors should derive some comfort that the Act will be subject to the supremacy of the South African Constitution which prohibits any form of expropriation without just and equitable compensation. Consensus appears to be that a single piece of legislation aimed at all investors offers a more transparent and equitable approach when compared to the conditions under various disparate BITs.

Review of liquidity pockets

In a recent editorial, the President of the South African Institute of Mining and Metallurgy (SAIMM), Ms. Z Botha, gave an overview of the investment climate for exploration in South Africa.

South Africa's development is immediately impacted socio-economically by exploration. Mining companies can potentially add roughly R1.2 billion to the GDP through direct, indirect, and induced impacts for every R1 billion they spend on exploration. For instance, mining generated the most foreign exchange earnings in 2019, directly employed 454 921 people, and contributed 7.8% of the GDP. In March 2022, employment in the mining sector increased by 2%, making it the second most significant quarter-over-quarter increase. According to commentary in the literature, mining activity directly supports ten people for every mineworker employed.

She also quotes Roger Baxter, the former CEO of the Mineral Council, who stated that:

> *'In the Toronto stock market, they've got 1600 listed junior resource companies. On the Sydney stock market, they've got about 600, and on the JSE, there are only about 12. Why the difference? Canadians have got a set of specific incentives that encourage the flow-through of venture capital funding from people from a tax perspective to invest in junior resource mining and their listing requirements are generally small and they raise capital, and they go and find deposits. In South Africa, our investment community are generally conservative and favour big mutual funds. Our return on a liquidated company is about 20c in the rand, whereas in a country like Canada, their liquidation and business rescue rules are quite different, so you get a much higher rate of return if you go into a failed company, even if it's a junior resource company, which is venture capital funded. For some of the smaller companies, to list on any stock exchange is a very expensive business and the cost-benefit of listing on a stock exchange versus raising private equity capital may be a lot more to do on a stock market, so that's why many are going the private route, but I think there are lessons we can learn from both Canada and Australia. South Africa's fiscal framework still does not have the same incentives around*

[10] UNCTAD reports that South Africa retains 12 BITS in-force, has terminated 12 others (mostly with EU countries) and has signed 26 others that are not in force). The country is also signatory to 11Treaties with Investment Provisions, see https://investmentpolicy.unctad.org/international-investment-agreements/countries/195/south-africa

encouraging junior resource companies to set up in South Africa or to look for capital in South Africa.'

These claims are supported by the literature, which frequently cites a major obstacle to greenfield exploration activities in South Africa as being a lack of exploration investment. In particular, that access to resources supporting exploration activities is restricted due to the absence of exploration companies listed on the Johannesburg Stock Exchange (JSE). One significant risk for junior miners is the lack of diversity in the fiscal and financial instruments available to them. A lot of commentary has also been written in the literature on regulatory and policy issues, with particular reference to the barriers of the current exploration timeframes and the "first come, first served" principle. What then needs to happen in order to advance and increase the opportunities and backing for greenfield exploration in South Africa?

Gaining a larger portion of the world market by implementing a cadastral system that would facilitate the application process for the pertinent rights listed in the Mineral and Petroleum Resources Development Act (MPRDA). In order to replace the SAMRAD system, the Department of Mineral Resources and Energy (DMRE) and the State Information Technology Agency jointly released a Request for Bids in March 2023 regarding the design, implementation, upkeep, and support of an online mining licencing system. If this system is successful, it could improve regulatory certainty regarding applications, as well as the speed and effectiveness of processing and resolving issues related to overlapping applications.

To entice investors to participate in exploration projects, tax incentives are required. The development of these specialised junior exploration companies has been extremely successful in Canada, primarily due to the use of the flow-through share tax incentive model to draw in equity investors. The Minerals Council submitted a proposal to the National Treasury in October 2020, proposing tax incentives for the purchase of equity in entities engaged in exploration activities. The proposal was based on the Canadian flow-through shares model and was prepared in conjunction with advisors such as Fasken, one of the biggest business law firms in Canada.

There are recommendations for suitable changes to the regulatory framework to enable sufficient data collection to enable a qualitative-based system (as opposed to "first come, first served"), where application processing will be decided based on how best applicants will achieve the MPRDA's objectives, in order to address regulatory barriers.

The mining sector in South Africa is currently experiencing a lot of positive activity. The JSE's junior, emerging, and exploration members and associations have been able to interact more frequently thanks to the active efforts of the Minerals Council. The JSE's Samuel Mokorosi is working to make it simpler for businesses to join and stay on the exchange while maintaining the highest standards of investor protection. One initiative that aims to simplify the process of listing on the JSE and expose smaller companies to financial markets is the Junior Mining Accelerator Programme. Already enrolled in the programme are two small, black-owned exploratory businesses, and both have expressed how helpful it has been.

Published by the DMRE on April 14, 2022, the Exploration Strategy for South Africa's Mining Industry (Exploration Implementation Plan) serves as a road map for us to accomplish our goal of restoring South Africa's attractiveness and market share in the international minerals sector. South Africa used to account for 5% of all exploration activity worldwide, but that percentage is now less than 1%. This coincides with a critical juncture in the race for rare earth minerals and future minerals, underscoring the importance of strategically positioning mineral-rich nations.

Some significant new initiatives are in the works. For instance, Hive Hydrogen, a collaboration between South Africa's Built Africa and UK-based Hive Energy, aims to build an environmentally friendly ammonia export facility. The Coega Special Economic Zone in the Eastern Cape will host the plant, which is expected to be developed for an estimated US$4.6 billion (R70.5 billion). The facility will use renewable energy to process hydrogen and an air separation unit to extract nitrogen, resulting in an annual production capacity of about 780 000 t of green ammonia. With full operation scheduled for 2026, the first phase is expected to begin operations in 2025. An underground gold mine in Gauteng is being investigated by West Wits Mining, an Australian exploration and development mining company.

In July 2021, the DMRE granted approval for the mining right application. A scoping study places the estimated total resources at approximately 29.1 million tonnes, with a 22-year life-of-mine and an average steady-state annual production of 80,000 ounces for 18 years. There will be five phases to the project's implementation. The first is the Qala Shallows mining area, which is currently being developed after a feasibility study was finished in September 2021. It is anticipated to contribute 40% of the overall production. This stage is expected to require a peak funding requirement of US$50 million (R767 million). Under the Renewable Independent Power Producer Programme (REIPPP), the DMRE has selected 25 renewable energy projects as preferred bidders, of which 19 are either led by or involve foreign investors. The total estimated investment value of the projects is R38 billion, involving four major foreign firms.

Mapping of Financing and Investment Instruments

Table 10: Mining, energy, renewable and other financial instruments and entities in South Africa

Entity	Description	Contacts
Johannesburg Stock Exchange (JSE)	The JSE is a multi-asset class stock exchange that offers listings, trading clearing and settlement, information services and issuer services. Founded in 1887, the JSE is Africa's largest stock exchange by market capitalisation. It is the 16th largest stock exchange in the world. The JSE's primary function is to provide facilities for the listing and trading of securities. It contributes to economic growth and value creation, which are critical to resolving South Africa's challenges. It is the interface between those who provide capital and those who need capital. The JSE promotes sustainable, transparent business and responsible investment. The JSE is a licensed exchange in terms of the Financial Markets Act, which describes its regulatory duties, powers and functions. The Financial Sector Conduct Authority is the lead regulator of the JSE. The JSE offers a wide variety of investment and listing instruments, on its main and Alt-X boards, many of which are tailored to mining, exploration, venture capital and renewable energy projects.	https://www.jse.co.za/
Development Bank of Southern Africa (DBSA)	Development Bank of Southern Africa (DBSA): DBSA was originally formed in 1983. by the South African Government. Today DBSA mobilizes and provides loan finance and technical assistance for major development projects in South	www.dbsa.org.za

Entity	Description	Contacts
	Africa and in neighbouring Southern African countries. DBSA membership is open to any country in Southern Africa. It functions as a "banker's" bank, providing soft loans to governments, local authorities, development corporations, and non-governmental organizations, which in turn make loans to individuals in bank-approved projects. DBSA's financial resources include share capital contributions from its members and loans obtained from financial markets. Grant aid from the South African Government comprises an important source of DBSA's funding.	
Industrial Development Corporation - (IDC)	The Industrial Development Corporation of South Africa Ltd (IDC) is a self-financing, national Development Finance Institution that promotes economic growth and industrial development in South Africa. IDC Gro-E Scheme: The IDC is investing R10-billion over the next five years through its Gro-E Scheme. It offers financial support to start-up businesses, including funding for buildings, equipment and working capital. It also funds companies wanting to expand provided that they show an ability to create jobs and operate in sectors supported by the IDC which include: • Green industries, which include renewable energy, energy efficiency, pollution mitigation, waste management and recycling, and biofuels • Mining value chain, including downstream mineral beneficiation, mining and mining technologies	https://www.idc.co.za/
Anglo-Khula Mining Fund	Anglo-Khula Mining Fund is a joint venture between Anglo American plc and Khula Enterprise Finance to provide financial assistance to junior mining projects. • Equity and or debt instrument with individual investments between R1m and R20m per project • Equity stake will not exceed 49% of the issued share capital of the investee company.	https://www.experthub.info/launch/funding/anglo-khula-mining-fund/
Commercial Banks	The commercial banks have specialist SME divisions, providing finance for qualifying entrepreneurs. Visit the banks' websites to find out about their products and services, and their criteria to obtain finance.	ABSA Bank: www.absa.co.za First National Bank: www.fnb.co.za Nedbank: www.nedbank.co.za Standard Bank: www.standardbank.co.za
Business Partners Limited	Business Partners is an investment company for small and medium enterprises. The company invests between R250 000 and R15 million in SMEs across all sectors, with the exception of farming, on-lending and non-profit organisations.	E-mail: enquiries@businesspartners.co.za Web: www.businesspartners.co.za
Khula Enterprise Finance	Khula Enterprise Finance Limited is an agency of the Department of Trade and Industry (DTI) established in 1996 to facilitate access to finance	E-Mail: helpline@khula.org.za Web: http://www.khula.org.za

Entity	Description	Contacts
	for SMMEs. It is one of the funds being transferred to the Department of Economic Development. Khula provides assistance through various delivery channels. These include commercial banks, retail financial intermediaries (RFIs) and micro credit outlets (MCOs).	
Small Business Growth Trust Fund	This non-sector specific fund is a partnership between Khula and Fabvest Investment Holdings (FABCOS). It provides: • Finance start-ups, expansions, bridging finance and asset-based finance to qualifying SMEs • Qualifying SMEs with the necessary infrastructural support and resources • Fosters entrepreneurship within the SME sector and • Reaches out to SMEs in priority provinces of South Africa •Migrates Black businesses from the informal sector to formal sector	Email: info@sisonkefund.co.za
Identity Development Fund (IDF)	This non sector – specific fund is a partnership between Khula and Identity Development Fund (Pty) Ltd (IDF). Its objectives are to: • Create long-term growth from profitable portfolio investments in SMEs • Promote BEE (black women and youth) • Provide both debt and or equity funding (50%/50%)	Tel: (011) 351 2900
South African Investment Network	This is an online platform that connects entrepreneurs seeking business funding with "angel" investors looking for investment. They maintain that they have access to R83 billion to invest. They connect global and local investors and entrepreneurs.	Web: www.investmentnetwork.co.za
Sasfin Private Equity	Sasfin provides private equity funding for entrepreneurs. It is a versatile form of funding that allows enterprises of any size to unlock their potential without burdening them with excessive debt. Sasfin Private Equity invests its own capital in the client's business and also provides support and guidance to grow the value of the companies in which they invest in the form of strategic insight and, where necessary, operational, financial and governance input.	Web: www.sasfin.com
National Empowerment Fund (N.E.F)	The NEF's is a DTI initiative in 2004 to support the BEE Act 53 of 2003, the South African Government's Broad Based BEE Strategies and related scorecard. The Group and Entrepreneurial Scheme Division of the NEF aim to deliver support to entrepreneurs in the small and medium-sized enterprise sector and to foster business development. In addition, it provides capital to assist in the development of community and rural projects. Furthermore, it seeks to promote a culture of equity investment	Web: www.nefcorp.co.za

Entity	Description	Contacts
	and savings among Historically Disadvantaged Persons (Hips) through various programmes.	
Zimele Investments (Pty) Ltd	Zimele Investments (Pty) Limited is an enterprise development and an empowerment initiative of Anglo America. In line with Anglo American's commitment to South Africa's socio-economic growth, Zimele concentrates on the establishment and promotion of small and medium enterprises (SMEs). Zimele, derived from Zulu and Xhosa meaning, "to be independent", invests in the enterprises through its investment fund and holds minority stakes of up to 20%.	Email:nhiralal@angloamerican.co.za

3.2. Macroeconomic context for in-country financings

State of the Economy

In recent years, the South African economy, Africa's second largest, has faced numerous external and domestic challenges including slowing global growth, geopolitical tensions, an acute power shortage, inefficiencies in several key state-owned enterprises, and increasingly binding infrastructure and logistics bottlenecks. A strong rebound in economic activity in 2021 following the Covid-19 pandemic has not been sustained due in large part to the energy crisis which has seriously retarded the recovery of the energy intensive mining and manufacturing sectors. Predictably, unemployment is close to record highs, particularly amongst the youth and poverty is deep, structural and worsening. Over 18 million South Africans receive poverty-alleviating social grants from the government and South Africa now ranks as one of the world's most unequal countries.

The country's economy remains exposed to global external shocks and cyclical changes and volatility in commodity markets as well as instability in capital flows. Furthermore, in its *Staff Concluding Statement of the 2023 Article IV Mission to South Africa*, the International Monetary Fund (IMF) noted that "… elevated public debt significantly limits the fiscal space available to respond to economic and climate shocks and meet social and developmental needs. Long-standing rigidities in product and labour markets, and governance and corruption vulnerabilities also weigh on growth and employment prospects, threatening social cohesion". In its 2022 Global Risks Report, the World Economic Forum (WEF) observed that "Social cohesion erosion" is a top short-term threat in 31 countries—including Argentina, France, Germany, Mexico and South Africa from the G20. In its 2021 and 2022 Executive Opinion Surveys, in which a sample of leaders were asked "What five risks will pose a critical threat to your country in the next two years?", prolonged economic stagnation, employment and livelihood crises, failure of public infrastructure, the proliferation of illicit economic activity and state collapse were the top responses.

Overcoming the threat of the erosion of social cohesion and the instability that this may bring is of critical importance but will require a multi-pronged approach to address South Africa's long-standing structural impediments to growth. Urgent reforms are needed to restore energy security, alleviate transport and logistics bottlenecks, overhaul underperforming State-owned enterprises and reduce their contingent liabilities, promote private investment, address labour market rigidities, promote and achieve good governance and tackle high structural unemployment. Undertaking them while maintaining macro-economic and financial stability will be challenging, requiring prudent and disciplined fiscal and monetary policy, continuing financial sector development, implementing an

agreed action plan to be removed from the Financial Action Task Force "grey list", and improving South Africa's "junk" (below investment grade) status credit ratings.

On a positive note, the IMF also reported that South Africa's "large external asset position, low levels of foreign currency debt, diversified economy, sophisticated financial system, and flexible exchange rate regime are sources of strength, supported by the South African Reserve Bank's (SARB) pro-active monetary policy that has kept inflation expectations anchored". Subject to the country successfully addressing the structural impediments to growth mentioned above and to reigning in public sector corruption through the implementation of the Zondo Commission's recommendations, growing the economy, creating enough jobs to reduce employment, poverty and inequality may be possible. Doing so will be a necessary pre-requisite for building confidence among consumers, business, and the broader international investment community without whom it will be difficult to secure the capital needed to rejuvenate the mining sector and grow the economy more widely.

In 2022 South Africa's mining industry production was worth R1.18 trillion, employed 475 561 people, exported R877.6 billion and contributed 7.53% directly to GDP. (Minerals Council, 2023). The main commodities mined with their shares of output are shown in Figure 9. The mining industry is highly concentrated with the bulk of output produced by large mining companies.

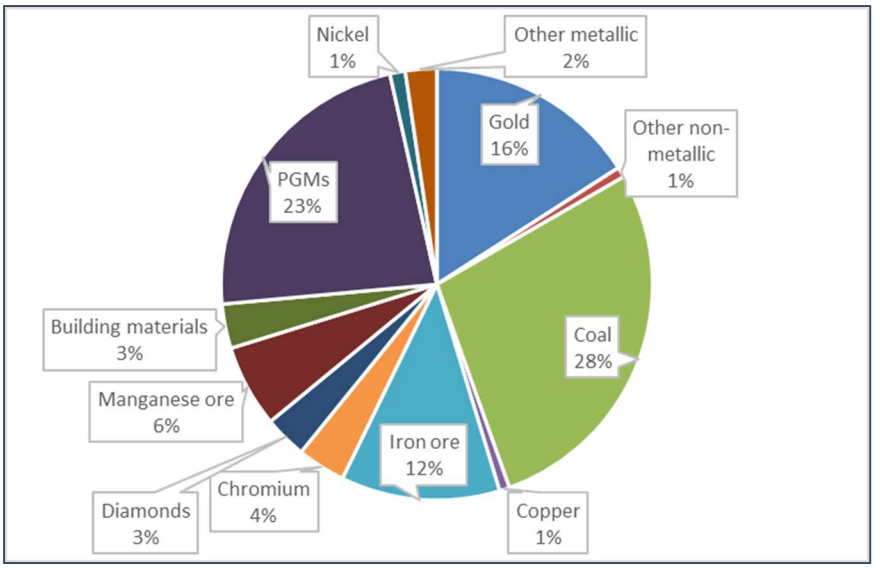


Figure 10 Commodity shares of mining production[11]

Extensive merchandise minerals trade takes place with the EU. Trade is conducted under the EU-SADC Economic Partnership Agreement (EPA) that came into force in 2016. Mineral products are trade duty and quota free under the EPA except petroleum oils. In 2022 South Africa exported goods to the value of 26.8 billion US$ to the EU, 51.14% by value were minerals, metals, ores, basic iron and steel and base metals, shown in Table 1. South Africa contributed 0.37% to all goods imported by the EU which made up 21.75% of total RSA exports. Imports from the EU totalled 24.5 billion US$, representing 0.35% of total EU exports and 21.93% of all RSA imports. Mineral product categories made up 10.96% of imports whereas commodities not elsewhere specified, machinery, vehicles, pharmaceuticals and chemicals make up most of the value of the products imported from the EU by South Africa.

[11] Source: StatsSA P2041, 2023

Table 11 South Africa – EU merchandise minerals trade: products and shares 2022[12]

	PRODUCT DESCRIPTION	RSA EXPORTS			RSA IMPORTS		
HS		Value MUS$	SA % of EU imports	EU % in SA Exports	Value MUS$	SA % in EU exports	EU % in SA Imports
	All products	**26 888**	**0.37%**	**21.75%**	**24 530**	**0.35%**	**21.93%**
'27	Mineral fuels, oils, bituminous substances;	4 300	0.34%	25.23%	1 438	0.24%	5.64%
'26	Ores, slag and ash	3 496	8.22%	21.45%	8	0.06%	14.50%
'71	Precious metals, gemstones	3 345	3.03%	12.44%	51	0.05%	3.37%
'72	Iron and steel	1 129	0.52%	17.02%	509	0.26%	27.96%
'76	Aluminium and articles thereof	553	0.52%	27.56%	102	0.11%	13.97%
'75	Nickel and articles thereof	465	3.61%	41.76%	9	0.11%	49.57%
'25	Salt; sulphur; earths & stone; lime, cement	273	1.60%	33.55%	25	0.18%	6.99%
'74	Copper and articles thereof	80	0.13%	7.78%	97	0.16%	10.25%
'81	Other base metals; cermets; articles thereof	56	0.61%	26.67%	14	0.23%	14.93%
'73	Articles of iron or steel	43	0.03%	3.33%	316	0.22%	25.56%
'83	Miscellaneous articles of base metal	8	0.03%	4.80%	117	0.37%	32.75%
'78	Lead and articles thereof	5	0.16%	12.38%	1	0.04%	3.57%

AfricaMaVal's focus is on the current and future potential for mutually productive relationships in the raw materials sector. Past developments, however, that have a bearing on the capacity, corporate strategies and operating environment do need to be taken into account. Four important themes, not strictly sequential, are set out below in a highly summarised form.

End of the mining house era. South Africa's mining industry, especially gold mining, was developed under a form of mining company ownership led by a few major mining houses (Gencor, Rand Mines, Gold Fields, Anglo American, Union Mines, The Corner House) that were characterised by cross holdings, extensive inter-company cooperation, monopsonistic procurement of inputs through the Chamber of Mines (forerunner to the current Minerals Council) and investment into secondary industries to supply critical inputs such as timber, steel, explosives and mining equipment. Dismantling the mining house structure in the 1980s to focus on core mining competencies also resulted in a pullback from investment in downstream processing.

Divestiture. In the early 1990s Anglo American and Billiton moved their primary listing from the Johannesburg Stock Exchange to London (along with several non-mining conglomerates) arguing they needed to access deeper capital markets. Further mining divestitures have followed, reducing ties to

[12] Source: (ITC TRADE MAP, 2023) Note HS: Harmonised System chapters, EU (27)

South Africa with the commensurately loss of a head office presence, locally based R&D activity and avenues for South Africans to develop careers in the minerals industry, amongst other impacts.

Black Economic Empowerment. Among the many crimes against humanity Apartheid visited on black people of South Africa were racial restrictions in ownership of mineral rights. Major reforms in the mining industry were brought about by the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA). The Act converted privately held mineral rights to state ownership and established a Mining Charter setting out development obligations for mine adjacent communities, targets for the advancement of black owned businesses and transfer of ownership to black shareholders. Deficiencies in the practical application of the Mining Charter regarding ownership undermined the objectives of spreading ownership to broader groups of historically disadvantaged South Africa, resulting in a narrower group of politically connected individuals reaping most of the benefits.

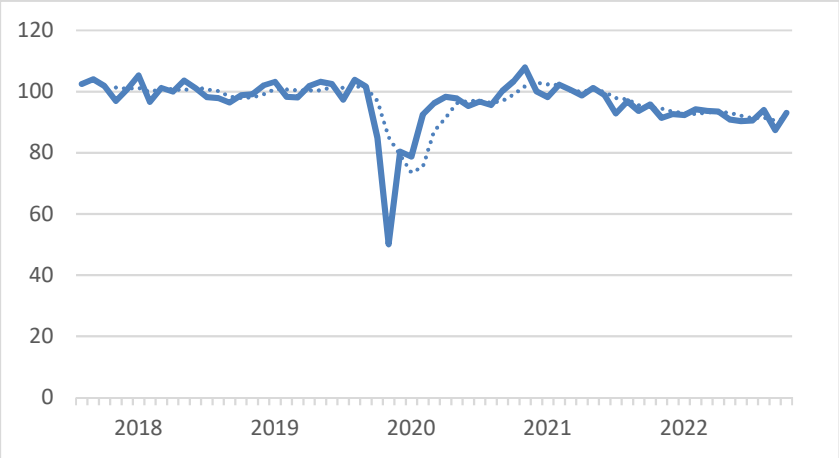


Figure 11 Physical volume of mining production: seasonally adjusted (Base: 2019=100)[13]

Decrease in mining investment. Figure 10 shows the downward trend in output from the mining sector from 2021 onwards compared to the pre Covid-19 period. Net fixed investment has declined as capital has been deployed to maintain current operations and not develop new assets. Factors contributing to this trend are discussed below. If these investment trends are not reversed future mining production will be curtailed.

[13] Source: StatsSA P2041, 2023

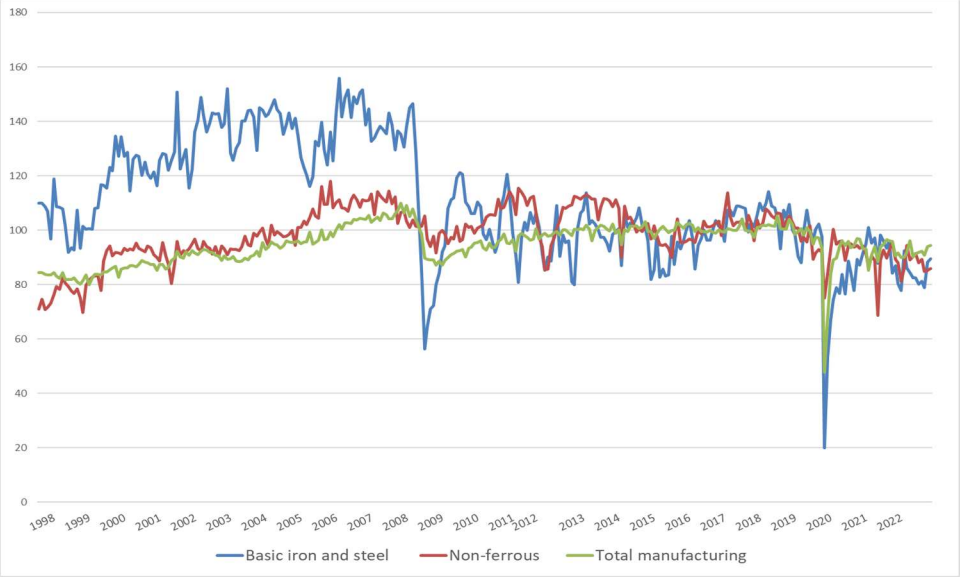


Figure 12 Physical volume basic iron & steel and non-ferrous production: seasonally adjusted[14]

Long-term trends in output from iron & steel and non-ferrous metals production, shown in 11, depicts the contraction in smelting and steel making South Africa has witnessed since 2008, the start of problems with national power company Eskom. Although the metals sector was negatively affected by the 2008 financial crisis, electricity prices that quadrupled in real terms between 2007 and 2022, coupled with power shortages have forced the closure of several ferrochrome and ferro vanadium smelters. Costly and unreliable power has forced mining companies to accelerate the incorporation of renewable energy to their power sources. As of February 2023, the mining industry had clean energy projects for 6.5 GW of electricity on the go, a positive development for the country's energy and carbon intensive minerals industry.

3.3. Political context for in-country financings

Since the advent of non-racial constitutional democracy in South Africa in April 1994, the country can best be described as a parliamentary republic characterised by the separation of functions and powers between its three branches of state namely, the executive, the legislature and the judiciary. The executive, led by the President of South Africa who is head of State and head of government, and his Cabinet is empowered to develop and implement national policy and coordinate the functions of government. It also has the power to propose changes to existing legislation and initiate new policies. Legislative authority is vested in the Parliament of South Africa which elects the President, provides a forum for the consideration and the passage of legislation, and oversees executive action. An independent judiciary is tasked with interpreting and applying the laws of the country. Constitutionally[15], South Africa is a unitary state, but with a three-tier system of government in which national, provincial and local levels of government all have legislative and executive authority. Because of their interdependence and interrelatedness, the Constitution requires the three spheres of government to exercise that authority in a manner consistent with clear principles of cooperative governance.

Since 1994, the African National Congress (ANC) has dominated South Africa's politics, ruling uninterrupted in the national legislature as well as in eight of the country's nine provinces since then.

[14] (Base: 2019=100). Source: StatsSA P3041.2, 2023

[15] The Constitution of the Republic of South Africa, Act No.108 of 1996, was approved by the Constitutional Court (CC) on 4 December 1996 and took effect on 4 February 1997

Nelson Mandela presided over the democratic transition in South Africa winning international respect for his advocacy of national reconciliation, but also focusing domestically on addressing the immense socio-economic problems that were the legacy of Apartheid. This necessitated a profound process of public policy and legislative reform that has fundamentally reshaped the political, constitutional and socio-economic landscape. Over the years and through the Presidencies of Thabo Mbeki (June 1999 to September 2008), Kgalema Motlanthe (September 2008 to May 2009), Jacob Zuma (May 2009 to February 2018) and Cyril Ramaphosa (February 2018 to the present), a succession of national development strategies[16] has provided the policy context and strategic direction for public sector led efforts to give effect to the objects of the Constitution. However, while the ANC's dominance has provided political stability and for the most part, macro-economic stability, the national economy has consistently underperformed and the lasting socio-economic transformation that was anticipated by so many has not materialised.

The state of politics

Despite the dominance of the African National Congress (ANC) in South African politics, the political environment is generally free from formal constraints and opposition parties are permitted to participate in political activity. Women are well represented in government. Voters' individual political choices are largely free from influence by external actors and the military has historically stayed out of politics. The Independent Electoral Commission (IEC) is largely regarded as being independent and the electoral framework is fair. In short, in terms of the formal requirements for democracy South Africa performs well. However, democracy can also be defined by its quality or the degree to which it serves the will and needs of the people. After 29 years and six free and fair national elections it is becoming increasingly apparent that democracy has failed to meet the expectations of the electorate.

A combination of a loss of trust in politicians and institutions, economic stagnation, high unemployment and the desperate and vulnerable living conditions in which most South Africans find themselves are eroding South Africa's political culture, threatening instability. Dissatisfaction and disillusionment about what democracy has delivered is reflected in a decline in voter turnout, which fell from 86.7% in the 1994 national elections to just 65.9% in 2019 (to 46% for the 2021 local government elections)[17] and the fact that increasing numbers of young people eschew voter registration. The 2021 Afrobarometer[18] survey results indicated that 67% of those surveyed were not satisfied with the way democracy works in South Africa. Fully 88% of respondents said that South Africa's democracy had minor or major problems or could not be regarded as a democracy at all. In concluding its 2021 Voter Participation Survey, the IEC noted that political discontent and a loss of political faith "appears to be driven by a perceived unhappiness with the instrumental returns to democracy", and "is undermining mass views of democracy in the country". It also noted that "many citizens do not believe in the duty to vote, do not believe voting makes a difference or that the elected are accountable to the electorate". Growing apathy and declining political participation in the country's democratic system, especially in a young democracy like South Africa's with its undemocratic past, undermines its very legitimacy.

[16] These include: the Growth, Employment and Redistribution Strategy (GEAR); the Accelerated and Shared Growth Initiative for South Africa (ASGISA); the New Growth Path (NGP); and most latterly, the National Development Plan – Vision 2030 (NDP).

[17] IEC, 2021

[18] Afrobarometer is a pan-African, nonpartisan survey research network that provides reliable data on Africans' experiences and evaluations on democracy, governance, and quality of life.

More objectively perhaps, the Economist Intelligence Unit calculates a *Democracy Index* in 167 countries around the world to measure the state of democracy using 60 indicators grouped into five categories: political pluralism, civil liberties, political participation, the functioning of government and political culture[19]. Depending on the score achieved a country is categorized into one of four regime types: full democracies, flawed democracies, hybrid regimes and autocratic regimes. Since measurement on this index began in 2006, South Africa has been classified as a flawed democracy. This is defined as a country where elections are fair and free, and basic civil liberties are honoured but may have issues (e.g., media freedom infringement and minor suppression of political opposition and critics). These nations can have significant faults in other democratic aspects, including an underdeveloped political culture, low levels of participation in politics, and issues in the functioning of governance. In 2022, South Africa ranked 45th out of the 167 countries surveyed, with its index score having declined steadily from 7.91 in 2006) to 7.05 in 2022. Notably, considering the evidence of the erosion of political culture in South Africa presented above, the country's score on this metric of 5.0 (compared to scores of 7.42, 7.14, 8.33 and 7.35 for electoral processes and pluralism, functioning of government, political participation and civil liberties respectively) is telling.

The erosion of South Africa's political culture, and the disillusionment with democracy and government's failure to deliver anticipated socio-economic development for the benefit of the historically disadvantaged, is reflected in the political performance of the ruling party. Since the 2004 national elections when the ANC garnered 69.7% of the popular vote, it has lost ground to opposition parties at every election since then, managing to secure only 57.5% in the 2019 elections[20]. At the 2021 municipal elections the ANC only managed to win 45.6% of the vote amidst a record low voter turnout. This has given rise to a widely held belief that the ANC faces the prospect of losing its majority in the forthcoming 2024 national elections and the party therefore faces an increasingly uncertain future that could further undermine party discipline. Incidents of political violence that have occurred in recent times are widely attributed to factional disputes within the ruling party and this may intensify as more and more ANC politicians perceive a widening gap between their own interests and those of the party.

Corruption and State Capture

The spectre of corruption first came to prominence in post-Apartheid South Africa at around the time of the then R30 billion defence procurement "Arms Deal" in 1999. Events would see businessman and adviser to then Deputy-President Jacob Zuma, Schabir Shaik jailed on corruption and fraud charges, President Thabo Mbeki "recalled" by the ruling party following Zuma's election to the position of president of the ANC at its 2007 Polokwane conference, and thereafter Zuma's ascent to the Presidency of the Republic of South Africa in 2009[21]. Significantly, the arms deal would portend the development of a pervasive culture of corruption within all three spheres of government and in many state-owned enterprises, often encouraged by widespread corporate collusion.

Corruption was at its highest during the period of Jacob Zuma's tenure as president when he and his broad network of supporters, manipulated and altered the structures of many of South Africa's democratic institutions to conceal wholesale corruption and the theft of state monies. A succession of well publicised corruption scandals and so-called "State Capture" (a network of patronage and clientelism) have enabled political elites to accrue tremendous power and wealth.

[19] The Democracy Index or country score is a weighted average of the five category indices.
[20] IEC Election results dashboard
[21] First indicted in 2005, Zuma himself still faces criminal charges relating to alleged corruption relating to the arms deal.

The Zondo Commission[22] appointed by President Ramaphosa in January 2018 on the recommendation of the Public Protector, Thuli Madonsela, was tasked to investigate "matters of public and national interest concerning allegations of state capture, corruption and fraud". Nearly four and a half years later in June 2022, the Commission tabled its final report to the Presidency.

The Commission estimated the total amount of money spent by the state which was 'lost' to state capture was around R57 billion. More than 97% of that was 'extracted' from Transnet and Eskom. The total loss to the state is difficult to quantify but a culture of corruption has spread throughout the public service. Over a period of around a decade, significant damage has been done to state institutions whose capacity to provide public goods and services has been hugely diminished, leaving some of them unable to fulfil their mandates. The most extreme and topical examples of this are the destruction of capacity at the state-owned power utility Eskom, leading to severe shortages of power and daily power outages euphemistically referred to as "load-shedding", and the state-owned rail, ports and pipeline company Transnet, leading to greatly reduced logistics capacity. Unsurprisingly, both have come at great cost to an already underperforming national economy, South Africa as a whole and to the lives of her people.

Although the South African Parliament accepted President Ramaphosa's implementation plans for the Zondo Commission's report 16 recommendations in November 2022, little progress has been made implementing them and widespread corruption continues. At the same time, President Ramaphosa himself was implicated in an alleged corruption case involving an attempt to cover up the theft of around US$4 million in cash, the origin of which is unknown, at Phala Phala, his private game farm. An independent panel appointed by the National Assembly speaker found "prima facie" evidence that the President had breached anti-corruption laws. However, Ramaphosa would later be cleared by the Public Protector[23] of any wrongdoing. Inevitably the uncertainty created around the case was destabilising, causing the South African currency and bond markets to fall.

Economic and political outlook

The persistence of deep-rooted corruption at the highest political level, poor governance and a stagnating national economy have eroded the trust of citizens as poverty deepens and inequality widens.

The mining sector remains one of South Africa's most important economic sectors but is proving vulnerable to limited foreign direct investment into greenfield projects, marginal deposits, ongoing unpredictability in the regulatory landscape, fears amongst investors of resource nationalism, and difficulty in maintaining a social license to operate. The poor performance of state-owned enterprises responsible for energy supply, transport and logistics is another major factor contributing to operational instability and low levels of long-term investment attractiveness in the mining industry. South Africa's reputation as a top-tier mining jurisdiction is under threat and concerns about the real prospect of mining sector reform being conducted with transparency and integrity cannot be discounted.

Pressure is mounting for President Ramaphosa's government to act decisively to restore the global competitiveness of the country's mining sector. In February 2019, speaking at the Investing in African Mining Indaba in Cape Town, Ramaphosa said that he and his government colleagues were "firm

[22] A judicial commission of inquiry to inquire into allegations of state capture, corruption and fraud in the public sector including organs of state chaired by Deputy Chief Justice of the Republic of South Africa, Raymond Zondo

[23] The Public Protector in South Africa is one of six independent state institutions set up by the country's Constitution to support and defend democracy, and has the power to investigate, report on and remedy improper conduct in all state affairs.

believers that the South African mining industry is a sunrise industry". Three years later at the 2022 event, he clung to this notion saying that despite its 150-year history, South Africa's mining industry is a "continuous sunrise industry", while in the same speech acknowledging that the mining industry faces significant challenges. He also lamented that "It is a matter of grave concern that South Africa has fallen into the bottom 10 of the Fraser Institute's Investment Attractiveness Index rankings. We are currently standing at 75th of 84 countries our worst ever ranking." One year on, and South Africa's ranking has fallen further to 57th out of 62, leaving the country in the bottom ten global mining jurisdictions.

The Fraser Institute's annual survey of mining and exploration companies is an attempt to assess how mineral endowments and public policy factors such as taxation and regulatory uncertainty affect exploration and mining investment. It produces an overall Investment Attractiveness Index by combining the Best Practices Mineral Potential index, which rates regions based on their geologic attractiveness, and the Policy Perception Index, a composite index that measures the effects of government policy on attitudes toward exploration investment. In its disaggregated analysis of the most recent results, the Minerals Council of South Africa reported that ''The survey noted South Africa slipped sharply in its policy score because of concerns about infrastructural constraints (electricity and rail) and the availability of skilled labour. Respondents flagged regulatory duplication and worries about the administration and enforcement of existing regulations to also be a deterrent to investment''.

On a positive note for the mining sector, signs that government has recognised the seriousness of the situation include: the establishment of the National Electricity Crisis Committee (NECOM) and the implementation of significant reforms to enable greater private sector investment in electricity generation; the establishment of the National Logistics Crisis Committee (NLCC) to address the rail and ports crisis; and the DMRE having issued a request for proposals for a new cadastral system to replace its dysfunctional SAMRAD system. However, policy and legislative reform that establishes a framework for mining regulation consistent with international best practice is needed as is a commitment to policy clarity and certainty. Rejuvenating the mining industry and maintaining the supply of critical minerals also requires that the structural impediments to growth mentioned above are successfully addressed, that public sector corruption is reduced, and that significant improvements in government's stewardship of the economy more broadly are achieved. These are prerequisites for restoring social cohesion, improving the country's political culture and rebuilding South African's faith in the ability of the country's fledgling democracy to deliver for all its people.

International agreements

International agreements become law in the Republic only after enactment into law by national legislation, but a self-executing provision of an agreement that has been approved by Parliament is law in the Republic unless it is inconsistent with the Constitution or any other Act of Parliament. Customary international law is also law in the Republic unless it is inconsistent with the Constitution or any other Act of Parliament. The South African Treaty Section of the Office of the Chief State Law Adviser is the central record-keeping authority and custodian of all international agreements that South Africa is a party to. That office provides legal advice on South African treaty practice, procedural matters relating to the conclusion of agreements, including instruments of ratification/accession, full powers, president's minutes and certifies agreements. The country is not a party to the Vienna Convention on the Law of Treaties but because the convention is regarded as declaratory of customary international law it binds all states regardless of whether they are a party to it or not.

Extractive Industries Transparency Initiative

Globally, over 50 countries (including 24 in Africa) have committed to strengthening transparency and accountability of their extractive sector management by implementing the Extractive Industries Transparency Initiative (EITI) Standard. Countries are assessed periodically on their progress in meeting the requirements of this standard, including to disclosing information along the extractive industry value chain from how mining rights are awarded, to how revenues make their way through government and how they benefit the public, through validation, the EITI's quality assurance mechanism. Although it has engaged extensively with the EITI Secretariat, South Africa is not a member of the initiative. The main reason advanced for its position is that the country has been extracting minerals and metals on an industrial scale for some than 150 years, and its domestic regulations and processes are adequately transparent, i.e., South Africa does not need to be part of EITI. Nevertheless, the EITI Secretariat has stepped up its outreach efforts to South Africa to prepare the country for a potential candidature application.

Arguably, South Africa's support would add considerable impetus and cachet to the initiative on the African continent and among developing countries endowed with significant natural resources. The EITI International Secretariat has therefore engaged in preliminary discussions with various stakeholders in South Africa on the prospects for EITI implementation in the country although some have indicated the need for a clear indication of the areas in which EITI would add value. South African law already requires disclosure of significant information in the extractive sector and therefore the EITI Secretariat has recently commissioned a disclosure mapping in South Africa to assess the extent to which the EITI implementation could complement current disclosures or address existing gaps in transparency and accountability.

4. Assessment of social, environmental, and governance challenges

4.1. Country-level assessment and context

4.1.1. Mineral/mining policies, industry policies

The South African Mining legislation is premised on a system of state custodianship of mineral resources, whereby the state, through the Minister of Mineral Resources and Energy, issues licenses and rights to applicants on a "first come, first served" basis and when the applicant can demonstrate ability to comply with technical, financial, environmental and socio-economic requirements as prescribed by the minerals and mining legislation. In terms of Section 104 of the MPRDA, the Minister has the right to invite applications from communities in an attempt to address the imbalance in the sector.

The DMRE is responsible for the minerals and mining legislation and their head office is in Pretoria, with regional offices in all the nine provinces. There is also the mine health and safety inspectorate which falls under the auspices of the DMRE. There are various pieces of legislation for the minerals and mining sector and the most important one is the Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA), which came into effect 01 May 2004. Other important legislation includes, the Minerals and Petroleum Resources Royalty Act, 28, of 2008, the Mining Titles Registration Act, 16, of 1967, the Mine Health and Safety Act, 29, of 1996, the National Water Act,36, of 1998, the Precious Metals Act,37, of 2005, the National Environmental Management Act,107, of 1998 (NEMA) and the Diamonds Act,56, of 1986.

There are various rights, licenses and permits under the MPRDA, which include: **reconnaissance permit**, **prospecting rights**, **mining permits** and **mining rights**. According to South African law, reconnaissance is defined as "any operation carried out for or in connection with the search for a mineral or petroleum by geological, geophysical and photo geological surveys that includes any remote sensing techniques but does not include any prospecting operations other than acquisition and processing of new seismic data." (Werkmans Attorneys, 2017) To apply for a reconnaissance permission the applicant needs to demonstrate technical and financial ability, also lodge a reconnaissance work programme. A reconnaissance permit is valid for one year and it is not renewable or transferable. The permit does not give exclusive rights to apply for or be granted a prospecting or mining right.

Prospecting rights and **mining rights** are obtained by means of an application submitted in a prescribed form to the Regional Manager of the DMRE in the province or region where the mining operation is to take place. The application must be submitted online, must be accompanied by the prescribed application fee and must be motivated by means of detailed documents describing the manner in which the applicant proposes to conduct the prospecting or mining operations in question and comply with the other requirements set out in the legislation.

The **required documents** include:

- a prospecting or mining works programme containing a detailed description of the geology of the resource being mined, the method and time schedule according to which the resource will be mined and a financing plan setting out the economics of the operation and the proposed method in which it will be financed;
- documents demonstrating how the applicant will comply with black economic empowerment requirements;

- a social and labour plan, indicating how the mine will contribute to the sustainable socio-economic development and empowerment of its workers, surrounding communities and labour-sending areas; and
- an application for environmental authorisation, which is prepared in accordance with National Environmental Management Act (NEMA) regulations but submitted to the Regional Office of the DMRE for processing and approval. The prospecting right is granted for up to 5 years and can be renewed for up to 3 years. The holder of a prospecting right has exclusive rights to apply for a mining right. The mining right is granted for a period of up to 30 years renewable for unlimited times for a period of up to 30 years each.

A **mining permit** is commonly issued to **artisanal and small-scale miners** and it covers an **area not in excess of 5 hectares**. The permit is **valid for 2 years** and can be **renewed for three times**, for a period of 1 year each. Artisanal and small-scale mines are subjected to the same requirements as large mines regarding, health and safety, environmental management, etc. In 2022, the DMRE has published a policy specifically for the ASM sector to support its growth. The policy is also aimed to eradicate the problem of illegal mining, which is widespread in the Country.

In terms of Section 5 of the MPRDA, prospecting rights and mining rights are limited real rights in respect of the land to which they relate. Section 5 expressly authorizes the holder of a prospecting right or mining right to enter the land in question together with his or her employees, and to bring on to that land any plant, machinery or equipment and build, construct or lay down any surface, underground or undersea infrastructure that may be required for the purpose of prospecting, mining, exploration or production, as the case may be. (Hayes, E, 2022) Prospecting and mining rights constitute limitations of the rights of ownership of the landowner. “An emphasized recognition of the tension between rights of mineral right-holders in terms of the MPRDA and informal land-right holders (customary title holders) in terms of the Interim Protection to Informal Land Rights Act, 31, of 1996 (IPILRA) has brought about an increase in recent litigation.” (ibid)

According to the recent High Court ruling, “…where land is held on a communal basis by a community that is subject to IPILRA, a mining right can only be granted if that community provides its full and informed consent thereto, through a majority decision at a meeting convened for the purpose of considering such a disposal and of which they have been given sufficient notice, and in which they have had reasonable opportunity to participate.” (ibid) The MPRDA provides that the prospecting right or mining right holder can compensate the landowner or lawful occupier for any loss or damage suffered as a result of the prospecting or mining activities even though such payment of compensation will not serve as a prerequisite for access to land for purposes of prospecting or mining.

For the duration of the mining right the right-holder is practically the owner of the mineral in question. Prospecting and mining rights can be transferred subject to the consent of the Minister of Minerals and Energy. Except in the case of listed business entities, the Minister’s consent is required for the transfer of a controlling stake in a business that holds the mining right, in terms of section 11 of the MPRDA.

Mining rights are protected by the MPRDA and the Constitution. “…interfering with the lawful mining activities of the holder of a valid mining right constitutes an offence under the MPRDA and may be punished by imprisonment or the imposition of a fine or both. In civil law, the holder of a mining right may obtain an interdict (injunction) prohibiting all third parties, including a landowner from hindering or interfering with its mining activities and may enforce its rights against any third parties.” (ibid) However, the recent decision by the Constitutional Court has put the responsibility on to the Regional Manager of the DMRE, in terms of Section 54 of the MPRDA to resolve disputes between the right-holder and the landowner or lawful occupiers. The South African Constitution protects property rights and that includes prospecting rights and mining rights.

In addition to the mining right, a person wishing to conduct mining activities requires the following additional permits or licenses:

1. a further environmental authorisation authorising in detail the listed activities that will form part of the mining and mineral processing activities, should these listed activities incidental to the operations not be covered by the environmental authorisation forming part of a mining right;
2. a waste management license in respect of, inter alia, management of tailings;
3. a water use license in respect of use of any natural water sources, as well as to make provision for treatment, storage and disposal of water in the mine itself and in tailings dams, etc, and
4. air quality licenses, if required

Other licenses depend on the nature of mining activities to be undertaken, or the natural, social and cultural environment where the mining activities are to take place. The most important and most common licenses would be:

1. licenses for the possession, processing and beneficiation of precious metals;
2. licenses for the possession, processing and beneficiation of uncut diamonds;
3. licenses for the possession, beneficiation, transportation and exporting of nuclear materials and radioactive materials;
4. licenses for the destruction or relocation of archaeological sites or graves; and
5. zoning of land for mining purposes in areas subject to town planning schemes.

The South African minerals and mining legislation does not discriminate against foreign investors. When a foreign company conducts business in South Africa it would need to register as an external company in terms of the Companies Act. There are numerous tax incentives enjoyed by foreign companies holding prospecting rights or mining rights, in terms of the MPRDA and specific tax laws. South Africa implements a system of exchange control in terms of which approval is required from the South African Reserve Bank to transfer sums of money to and from South Africa.

The Mine Health and Safety Act (MHSA) 1996 prescribes health and safety requirements in the mining industry of South Africa. The act aims to hold the employer primarily responsible for the health and safety of all persons at the mine, including employees, contractors and visitors. The MHSA places detailed obligations on the employer to provide sufficient training regarding the health and safety hazards and risks encountered at the mine, and how to deal with such situations. The employer is also required to provide personal protective equipment to all persons at the mine. It is further required that the employer keeps record of the health of employees including establishing baseline each employee's baseline from when they commence their employment, undertaking annual health assessments for all employees, and performing final exit assessments when they terminate employment. Failure by an employer to take reasonable steps to ensure health and safety conditions for its employees constitutes an offence according to MHSA. The Chief Inspector of Mines or his/her delegates are empowered by law to cease all activities at a mine until an identified risk is sufficiently addressed. The new Broad-Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry, 2018 (the Mining Charter, 2018), came into effect on 01 March 2019. The Mining Charter introduced a number of socio-economic empowerment compliance criteria on holders of new and existing mining rights. The Mining Charter also introduced additional socio-economic requirements to which holders of mining rights must comply. The six requirements are: 1. Ownership by Historically Disadvantaged South Africans (HDSA), which includes procurement, supplier and enterprise development; 2. Human resource development; 3. Employment equity; 4. Mine community development; 5. Housing; and 6. Living conditions. Although the High Court ruled against the DMRE developing a subordinate law and set aside some of the requirements of the Charter, employment equity, human resource development, mine community development, housing and living conditions are still a requirement. Again, 30 percent of black economic empowerment is still a requirement,

though according to the Court's ruling, the DMRE can no longer dictate how it should be split, in terms of HDSAs, employees and communities.

The DMRE has developed Codes of Good Practice for the minerals industry, in 2009. The Codes cover the following aspects: ownership; management control; employment equity; human resource development; preferential procurement; mine community and rural development; beneficiation; housing and living standards. The codes use specific scorecards for each of the eight elements to measure performance.

4.1.2 Mining regulations

MPRDA regulations (2004) were recently amended in 2020. They specifically guide the implementation of the MPRDA. The regulations provide clarity on how to comply with the MPRDA. Part I of the regulations deals with minerals and petroleum regulation, which covers applications for reconnaissance permits, prospecting rights, mining rights and mining permits and other related rights and permits, the processes of which were described in detail in 4.1.2. Part II deals with social and labour plans and all the processes involved. Part III deals with environmental regulations for mineral development, petroleum exploration and production, which covers the application process for environmental authorization through to the contents of the closure plan. Part IV deals with pollution control and waste management, which covers aspects such as, principles of pollution control and waste management, air quality management and control, fire prevention, noise management and control, blasting, vibration and shock management and control, etc. The regulations further provide clarity on appeals against administrative decisions.

The amendments introduce regulations dealing with the lodgement of applications under sections 52 and 53 of the MPRDA and amend regulations dealing with internal appeals under the MPRDA. The Amendment Regulations repeal certain regulations relating to environmental matters. They provide various amendments to the Mineral and Petroleum Resources Development Regulations, 2004, which include amendment on consultation with interested and affected persons and amendments to the provisions on social and labour plans. Under the Amendment Regulations the definition of 'interested and affected persons' has been extended to mean a natural or juristic person or an association of persons with a direct interest in the proposed or an existing operation or who may be affected by the proposed or existing operation, including: mine communities (as defined by the Amendment Regulations), landowners, Traditional Council, land claimants, lawful occupiers, holders of informal rights, any other person whose socio-economic conditions may be directly affected by the proposed or existing prospecting or mining operation.

The Amendment Regulations provide for the term 'meaningful consultation' which means that the applicant has in good faith facilitated participation in such a manner that reasonable opportunity was given to provide comment by the landowner, lawful occupier or interested and affected party in respect of the land subject to the application about the impact that the prospecting or mining activities would have to his right to use of the land by availing all the information pertaining to the proposed activities enabling these parties to make informed decision regarding the impact of the proposed activities. In terms of the Amendment Regulations, meaningful consultation must be conducted in terms of public participation process prescribed in the Environmental Impact Assessment (EIA) Regulations. The Social and Labour Plan (SLP) process was also expanded to include labour-sending areas.

The prospecting or mining right holder is required to publish the SLP in English and the dominant language in the community. In addition to submitting the annual report on compliance with the SLP to the Regional Manager, a mining right holder is required to convene 3 meetings per annum with mine communities, interested and affected persons, to update them about the progress made on the implementation of the approved SLP. The outcome of such meetings will form part of the annual report (Fasken Attorneys, 2020).

The 2004 Regulations did not prescribe the form or content in which a section 52 notice is to be made to the Minister. The Amendment Regulations introduced regulations dealing with the manner and form in which such notice is to be made to the Minister. According to the Amendment Regulations, a mining right holder must submit a notice in respect of section 52 (1) of the MPRDA to the Minister after consultations with registered trade union/s, affected employees or their nominated beneficiaries are concluded. The notice must include details of prior consultations such as dates, times, attendance registers, minutes, considerations, proposals resolutions, agreements, recommendations, reports and records. An affidavit is also required to confirm that the factors contemplated in section 51 (1) or (2) of the MPRDA exist.

The Amendment Regulations further provide a template for section 53 applications and set out specific information that applicants will need to provide if they intend to use the surface of any land for purposes contrary to any object of the MPRDA. The information required include: the type of approval applied for; motivation for the proposed use; a report on meaningful consultation with interested and affected persons in the mining industry; a report on meaningful consultation with the Council for Geoscience regarding both the mineral potential of the land concerned and the possible presence of dolomitic formations thereof; comments and concerns raised by parties with interest in prospecting, mining, exploration and production in the area; and a geological map of the area applied for. The applicant is also required to confirm whether the holders of prospecting, mining, exploration and production rights within a two (2) kilometre radius have been identified and meaningfully consulted with and whether they have objected to the proposed land development. (Ibid)

Regulation 38 of the Amendment Regulations sets out a number of amendments to Regulation 74 of the 2004 Regulations dealing with appeals against administrative decisions taken under the MPRDA. In terms of the Amendment Regulations, any person who appeals against an administrative decision must lodge a written notice of appeal to the Director General or the Minister. The notice of appeal must be submitted within 30 days of the date the appellant becomes aware of the decision in respect of which the appeal is made.

The Amendment Regulations provide for the repeal of certain environmental regulations for mineral development, petroleum exploration and production (regulations 48 to 55, regulations 63 to 73), save for regulations 56 to 62, which deal with mine closure and transfer of environmental liabilities. Clarification amendments have been incorporated to the principles of mine closure to provide that: 1. The risks pertaining to environmental impacts are to be quantified and managed proactively, in accordance with the provision of NEMA, Financial Provision Regulations, 2015 and the EIA Regulations; 2. The residual possible latent environmental impacts are to be identified and qualified in accordance with NEMA, Financial Provision Regulations and EIA Regulations; and 3. The land is to be rehabilitated as far as practicable to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development in accordance with the provisions of NEMA, Financial Provision Regulations and the EIA Regulations.

Regulation 58 has been amended to provide that the Minister may transfer liabilities and responsibilities identified in the environmental authorization and the required closure plan to a competent person. Consequential amendments have also been made to Regulation 59 which deals with the qualifications of the person to whom responsibilities can be transferred to and Regulation 61 which deals with closure objectives. Clarification amendments have also been incorporated to Regulation 61 to provide that among others, the objectives of a mine closure are: 1. The identification of key objectives for mine closure to guide project design, development and management of environmental impacts which must be in accordance with NEMA and the EIA Regulations; and 2. To provide proposed closure costs in accordance with NEMA and Financial Provision Regulations.

4.1.3. Taxation and royalties

South African mining companies are subject to normal taxes, such as standard income tax on companies, withholding taxes on dividends to shareholders, value added tax (where applicable), transfer duties in respect of transfers of land or prospecting and mining rights, and carbon tax in the event that the taxpayer conducts a prescribed listed activity, and such activity exceeds the prescribed greenhouse gas emissions threshold. However, mining companies may deduct large portions of capital expenditure against their taxes and may ring-fence capital expenditure and taxable income in respect of distinct mining operations (redemption allowance).

Mining companies are also subject to royalty payment over and above the taxes referred to above. This is in terms of the Minerals and Petroleum Resources Royalty Act, 28, of 2008. In terms of the Act, "a person who wins or recovers a mineral resource in South Africa (an extractor) must pay a royalty for the benefit of the National Revenue Fund in respect of the transfer of that mineral resource to another party. Under the terms of Section 4 of the Royalty Act, a formular is prescribed for calculating the extent of the royalty, based on the earnings before interest and taxes from gross sales of refined or unrefined mineral resources. …The maximum royalty in respect of refined mineral resources is 5 percent, and the maximum royalty in respect of unrefined mineral resources is 7 percent." (Hayes, E, 2022)

4.1.4 Land-use and mineral rights

The question of land-use and the impact on mineral rights is covered by the MPRDA and other legislation such as, the Municipal Systems Act, 32 of 2000, Spatial Land-Use Management Act, 16 of 2013 and the Interim Protection of Informal Land Rights Act, 31 0f 1996. In terms of the MPRDA, prospecting and mining right-holders are supposed to consult with interested and affected parties, including landowners and lawful occupiers before they commence with their operations. The consultation process is outlined in the Environmental Impact Assessment Regulations, 2014. The Mining Charter 2018 and its Implementing Guidelines are specific as to how consultations in respect of social and labour plan (SLP) are to be conducted. The applicant or prospecting right and mining right holder is required to consult with the local municipality, traditional leaders, community, community-based organisations, etc. The obligations on the applicant or mining right holder to consult with communities are more extensive than other landowners because of recent court decisions, which have held that the consent of the community must be obtained before mining can commence. (Werkmans Attorneys, 2017)

Where the landowner or a community denies the prospecting right or mining right holder access to the land the matter should be referred to the Regional Manager of the DMRE before the courts can be approached. There is mounting pressure on the DMRE to consider other land-use options when granting prospecting rights, mining rights and mining permits. The Human Rights Commission has found that the DMRE disregarded the Municipal Systems Act, Spatial Land-Use Act, and the Interim Protection of Informal Land Rights Act in granting mining rights. The Commission recommended that, "Such land-use approvals must be secured from the applicable municipalities prior to the DMRE granting the licenses and permits. (The South African Human Rights Commission, 2019)

The apartheid system prevented rural communities and individuals from holding land in their own names, giving these rights and additional powers to selected traditional authorities. As a result, there is tenure insecurity, which affects millions of rural communities who do not have recorded rights to their land. Traditional authorities took advantage of this situation and started negotiating mining deals without the consent of communities. Members of the Wilgespruit Farm in the North West Province, approached the Constitutional Court to challenge their chief for granting the mining company permission to mine their land without their consent. The Constitutional Court ruled in the community's favour and confirmed that their consent for both mining activities and relocation was needed. After the judgement and subsequent negotiations, the settlement compensation agreed by

the mining company was significantly greater. The judgement is so important because its findings apply to all communities in South Africa. (du Plessis, L, 2022)

In the event that communities are to be relocated for the purposes of mining, "…the MPRDA has no explicit provisions for resettlement of landowners, lawful occupiers, holders of informal and communal land rights, mine communities and host communities…"(Mine Community Resettlement Guidelines, 2022) The Mine Community Resettlement Guidelines are intended to outline the process and requirements to be complied with by the applicant or the holder of a prospecting right, mining right or mining permit when such an application or right will result in physical resettlement of landowners, lawful occupiers, holders of informal and communal land rights, mine communities and host communities, from their land.

The Mine Community Resettlement Guidelines provide for the development of the Resettlement Plan, Resettlement Action Plan and Resettlement Agreement. According to the Guidelines, a Resettlement Plan is a broader consultative document which is concerned with project description; impact analyses; costs and budgetary considerations and consultation mechanisms. The Resettlement Action Plan lists the steps to be taken in order to achieve the goals set out in the resettlement plan. The Resettlement Agreement serves to record the commitments made by the mining right holder in the resettlement plan and the resettlement action plan. The agreement must be signed by all the relevant stakeholders and submitted to the Regional Manager.

In South Africa, the question of land use post mine closure is being investigated by university students and professional mining institutes such as the Southern African Institute for Mining and Metallurgy (SAIMM). "Mining as a temporary land use often leaves behind a negative legacy particularly to the mine host communities, who are left behind with no alternative use of the land and any economic prospect. Therefore, by planning for mine closure with the 'end use' of the land in mind, the mining industry in South Africa has the opportunity to realise innovative sustainable land uses and create functioning ecosystems post mine closure." This is according to GCI PhD student Ntombifuthi Monedi-Noko. (Global Change Institute, 2023) The President of the Southern African Institute of Mining and Metallurgy, Mr Mthenjane M I, vowed that the issue of post-mining use of rehabilitated land would constitute the primary focus of his tenure. (Mthenjane M I, 2019).

The Mining Charter comprises of six elements, which are: ownership; inclusive procurement, supplier and enterprise development; human resource development; employment equity; mine community development; housing and living conditions. Since the SLP is a five-year plan, the mine is required to make commitments with regard to each of the six elements and on an annual basis decide, in consultation with the beneficiary communities, how they will implement the plans. The purpose of the SLP is to promote employment, advance social and economic welfare, contribute to transforming the mining industry, and ensure that mining companies contribute to the development of the areas where they operate. (Center for Applied Legal Studies, 2016) According to the Mining Charter, 2018, mining right holders operating in the same area, may collaborate on identified projects to maximize the socio-economic developmental impact, in line with their SLPs. A mining right holder must implement 100 percent of SLP commitments in any given financial year and any amendment/variation of the SLP, including the budget, requires the approval of the Minister, in terms of Section 102 of the MPRDA.

4.1.5. Environment

Protection of the environment is of cardinal importance to the mining industry and the people of South Africa as it is anywhere else in the world. The South African Constitution provides that the environment generically is a functional area of concurrent national and provincial legislative competence, while some aspects of more specific environmental aspects (such as air pollution, potable water supply systems, domestic wastewater and sewage disposal systems) are within the executive and administrative authority of local government. The mining industry is required to comply

with provisions of NEMA and other environmental statutes when applying for prospecting rights, mining rights and throughout the lifespan of their operations. NEMA sets out a number of core principles, aimed at sustainable development, sustainable exploitation of natural resources, management of environmental impacts from economic activities and emphasizing the right of people to live in an environment that is not harmful to their health and wellbeing.

According to Section 2(2) of NEMA: environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. In addition to NEMA, there are several specific environmental management Acts such as: the National Water Act, 36, of 1998; the National Environmental Management: Waste Act, 59, of 2008; the National Environmental Management: Air Quality Act, 39, of 2004; the National Environmental Management: Biodiversity Act, 10, of 2004; the National Environmental Management: Integrated Coastal Management Act, 24, of 2008; and the National Environmental Management Act: Protected Areas Act, 57, of 2003. There are various regulations as well as norms and standards accompanying the Acts. Other legislation dealing with environmental issues both at national and provincial levels include: the MPRDA (in the context of prospecting and mining, and exploration and production activities); Water Services Act, 108 of 1997; National Forests Act, 84, of 1998; National Heritage Resources Act, 25, of 1999; Marine Living Resources Act, 18, of 1998 (Bowmans Attorneys, 2020).

The key government departments and agencies involved in the administration and enforcement of environmental laws are: the Department of Forestry, Fisheries and Environment; the DMRE; the Department of Water and Sanitation; South African Heritage Resources Agency; the Department of Agriculture; Metropolitan, District and Local Municipalities. Environmental directorates in the nine provinces are also responsible for the administration and enforcement of environmental laws in their respective provinces. In order to obtain a prospecting or mining right, the applicant will need to perform either a basic assessment or an environmental impact assessment that incorporates an environmental management plan or programme.

According to the Environmental Impact Assessment Regulations, 2014, the applicant should appoint an Environmental Assessment Practitioner (EAP) and, where necessary, a Specialist as well, who are independent. The EAP must have the expertise to conduct environmental impact assessment and inform the applicant of all registered interested and affected parties. The EAP must identify whether a basic assessment or Scoping and Environmental Impact Reporting (S&EIR) process must be applied to the application. If S&EIR is applied to the application, a scoping report will have to be submitted to the relevant office of the DMRE, followed by the environmental impact assessment (EIA) report. Both reports require a public participation process of at least 30 days each. The environmental impact assessment report must be accompanied by the specialist' report, environmental management plan and closure plan. Authorization based on the basic assessment takes up to six months while EIA authorization could take up to a year. There is an appeal process against administrative decisions which should be exhausted before approaching the courts.

Financial Provisioning Regulations, 2015, require that an applicant or right holder should make financial provision for rehabilitation and remediation; decommissioning and closure activities; as well as remediation and management of latent or residual environmental impacts which may become known in future, including the pumping and treatment of polluted or extraneous water. The applicant or right holder must use one or a combination of the following methods for financial provisioning: 1. A financial guarantee from a bank registered in terms of the Banks Act, 1990 or from a financial institution registered by the Financial Services Board as an insurer or underwriter; 2. A deposit into an account administered by the Minister of Mineral Resources and Energy; or 3. A contribution to a trust fund established in terms of applicable legislation. (Financial Provisioning Regulations, 2015)

Failure to adhere to license, permit or authorization conditions constitute an offence and may lead to the withdrawal or suspension of the license, permit or authorization. The South African National Environmental Compliance and Enforcement Reports are prepared on an annual basis, covering all the nine provinces and various sectors. The reports show an upward trend in enforcement efforts judging by an increase in the number of criminal dockets and admission of guilt fines issued. In 2017/18, the total amount of administrative fines paid in respect of rectification of activities undertaken without the necessary authorization was R10 million. There is also an increase in the number of non-governmental organizations, environmental associations and interest groups who monitor and report companies for environmental non-compliance. However, the DMRE does not publish its environmental compliance and enforcement reports, which conceals non-compliance in the sector.

In line with its international commitments as a member of the United Nations Framework Convention on Climate Change, South Africa has recently implemented a carbon tax regime through the Carbon Tax Act, 15, of 2019. There is mounting social pressure for lenders to disclose the climate change impacts/greenhouse gas emissions and climate change related financial risk of the projects in which they invest. The Ministry of Forestry, Fisheries and Environment has published the Climate Change Bill in 2022 to mitigate the effects of climate change while fostering climate friendly practices. The Bill involves all three spheres of government and requires them to identify how climate change affects their functions and to take steps to address them. Each sphere of government is required to conduct a climate change needs and response assessment every five years. 4.1.6. Societal and community aspects, cultural heritage

Prospecting and mining take place on land that is often occupied or surrounded by communities. In 2016, members of the United Nations Development Programme and World Economic Forum identified the global mining industry as having an unprecedented opportunity to mobilize resources to advance the Sustainable Development Goals, given their activities are often located in remote and less developed areas, and can when managed correctly, bring investment and infrastructure at scale. (BMC Public Health, 2022) The MPRDA addresses societal and community aspects relating to mining, though they are often politicised as civil society organizations and sometimes, political parties rally behind communities to hold mining companies to account.

Mining often pollutes water, air, soil, and can disrupt farming activities and community life. In order to offset these impacts, and to ensure communities share the benefits of mining, applicants of prospecting and mining rights are required to consult with municipalities, traditional authorities, and communities in order to develop SLPs showing how they intend to contribute towards the development of communities affected by their operations. Once approved by the DMRE, SLPs become binding and legal documents against which the mine’s performance will be measured.

4.1.6. Societal and community aspects, cultural heritage

Cultural heritage in South Africa is varied as there are many cultural groups, each practicing their unique culture. Thorough consultation with communities, and not desktop study, will give the mining company an understanding of the community’s cultural values and heritage. Some communities have spiritual sites, such as graveyards, mountains and so forth, which they revere. Therefore, the relocation of graves to give way to mining projects could be an insult to people’s cultural belief systems. In terms of natural heritage South Africa has 8 world heritage sites which were declared by the United Nations Educational, Scientific and Cultural Organization (UNESCO). They are: 1. Isimangaliso Greater St Lucia Wetland Park; 2. The uKhahlamba Drakensberg Park; 3. Robben Island; 4. The Fossil Hominid Sites of Sterkfontein, Swartkrans, Kromdraai and the environs; 5. The Mapungubwe Cultural Landscape; 6. Vredefort Dome; 7. The Cape Floral Region; and 8. The Richtersveld Cultural and Botanical Landscape. The Cape Floral Region makes up only 0.04 % of the world’s land area, yet contains an astonishing 3% of its plant species, making it one of the world’s richest areas for plants and one of the globe's 18 biodiversity hotspots. The protected areas include:

Table Mountain; De Hoop Nature Reserve; Boland Mountain Complex; Groot Winterhoek Wilderness Area; Swartberg Mountains; Boosmansbos Wilderness Area; Cederberg Wilderness Area; Baviaanskloof; Kirstenbosch Botanical Gardens. (South African History Online, 2023)

4.1.7. Public health and safety

Mining in South Africa poses serious health and safety problems to communities. Mining communities tend to experience an influx of people, either working for the mines and their contractors or looking for opportunities from the mines. Such an influx often presents mining communities with unprecedented health problems. Communities begin to experience high prevalence of HIV, STDs, TB[24] and other diseases because of mining in their vicinity. In a study conducted among host communities, it was found that, "at a structural level poor access to quality health care…" was the primary contributing factor to the prevalence of HIV, TB and substance abuse. (BMC Public Health, 2022)

It is estimated that South Africa has 20 000 premature deaths resulting from excessive pollution of the air and the environment by coal mining alone. The Presidential Climate Commission and the World Bank Group report shows that coal related activities pollute water and soil, with some devastating effects on health, water and food security (Embellie Advisory, 2023). As of 2014, many of South Africa's approximately 6000 abandoned mines are polluting surrounding surface waters with acidic water and dissolved heavy metals, harming the health and livelihoods of people in surrounding communities. A study led by the Council for Scientific and Industrial Research to assess health risks related to water from the Lower Olifants River found excess amounts of antimony, arsenic, cadmium, mercury and uranium in community water supply samples, elements that can be extremely harmful to human health and marine organisms. Mbere and Steenkamp have done an analysis of 9 large players in the South African mining industry to track key ESG trends. They have found, among others, that many companies have a holistic and comprehensive approach towards the health and wellness of their employees but lack the same approach for community members (N Mbere, S Steenkamp, 2022).

Basic information that communities require to understand the impacts of mines and to hold mining companies accountable for harmful activities is often not publicly available. Such information includes, environmental authorisations, environmental management programs, waste management licenses, atmospheric emission licenses, mining rights, mining work programs, SLPs, or compliance and enforcement information. The information is only accessible through a tedious process of access to information law, a procedure which the World Health Organisation has called "seriously flawed" and which the DMRE regularly flouts (Groundwork, Centre for Environmental Rights, Human Rights Watch, Earthjustice, 2019).

In South Africa, the method that is widely used for the extraction of gold is cyanidation process which uses cyanide. Cyanide is a very fast-acting poison that prevents oxygen from being used by the cells resulting in tissue hypoxia and cyanosis. This results in rapid and deep breathing followed by convulsions, loss of consciousness and suffocation. The cyanide in the spent leaching solutions is discharged into large mine tailings dams. Seepage escapes from some of the tailings dams and contaminates soil and water. Dispersion modelling indicates that tens of thousands of people that reside in areas adjacent to tailings dams within the City of Johannesburg may even be exposed to atmospheric cyanide concentrations above the international standards (W Utembe, E M Faustman, P Matatiele and M Gulumian, 2015).

[24] HIV (human immunodeficiency virus), STDs (Sexually transmitted diseases), TB (Tuberculosis)

4.2. Mining practices vs. Environmental, Social and Governance (ESG) goals

ESG is an amalgamation of three distinct disciplines, each with their own underlying knowledge base, areas of focus, and methodologies for approaching problems and solutions. There is, however, considerable overlap amongst the three disciplines with issues in the one area typically impacting on or being impacted by elements of the other two. Sustainable (or responsible) investing describes the process whereby ESG factors are incorporated into the investment of individuals when they invest in companies, organizations or funds. These investment decisions are based on the individual's real or perceived understanding of the environmental and/or social impacts (positive or negative) that will result from their investments in parallel with the expected financial returns (Steele-Schober T, 2021). Investors, regulators and other stakeholders, mostly in first world countries, are urging companies to step up their environmental, social and governance (ESG) disclosures.

SAMESG is the South African guideline for the reporting of environmental, social and governance parameters. The SAMCODES Standards Committee acknowledged that the primary reason for mining companies to adopt ESG reporting is because more investors are incorporating ESG criteria into their valuations and investment strategies (South African Minerals Reporting Codes Standards Committee, 2023). This would explain the disjuncture between what is reported and the practical experience at project level.

This chapter provides an assessment of Environmental, Social and Governance (ESG) challenges in the South African minerals and mining sector. Firstly, there will be an overview of the legislative framework followed by an assessment of compliance by the mining industry, with particular focus on ESG requirements. The chapter will further look at the government's oversight role and make recommendations for best practice based on international experience. The report is the outcome of a desktop study of research reports informed by both field studies and archival research in various fields relating to ESG. Websites of various organizations were browsed to gain their insights on the ESG issues in the South African mining industry. Since ESG is a multifaceted concept even the study approach included contributions from as many disciplines as they are relevant. The Department of Mineral Resources and Energy (DMRE) provided their reports and other relevant documents which provided much needed assistance in the compilation of the report.

4.2.1 Environmental challenges

Mining in South Africa has a history of disregard for the environment due to lack of legislation in the past. As Makua and Kola stated, "Since the late 19th century South Africa has exploited its mineral wealth with little or no regard to the environment." (Makua, M. Pretty, Kola O. Odeku, 2017) Since the dawn of democracy, there has been an improvement in environmental legislation. However, there are still practices of non-compliance by some companies, large and small. According to the Bench Marks Foundation, there are too many loopholes in the legislation governing the mining sector. The problem is further complicated by the involvement of current and former government officials as shareholders, board members or managers in mining companies. (Bench Marks Foundation, 2017)South African artisanal miners are reportedly using mercury for the extraction of gold, which the Artisanal and Small-Scale Mining Policy, 2022, aims to abolish. The Country is ranked second in the world in terms of Hg emissions to the environment. Inhalation, ingestion or dermal absorption of Hg can result in neurological and behavioural disorders, tremors, insomnia, hallucinations, memory loss, neuromuscular effects, headaches and cognitive and motor dysfunction. Acid mine drainage from mining operations and mine tailings dams and dumps contains a variety of toxic metals, some of which are found in high concentrations in soils surrounding mining areas in South Africa.

In its report, the Human Rights Commission mentioned, "Submissions to the National Hearing revealed that there is significant non-compliance with various environmental laws and regulations by mining

companies." The Commission indicated that the problem was amplified by capacity constraints of compliance and regulatory bodies. For instance, for the 1,757 authorised mining operations in 2016, there were only 96 Environmental Mineral Resource Inspectors (EMRIs) employed by the Department of Mineral Resources and an additional 30 earmarked for training. The number of EMRIs had increased to a total of 108 against 1,856 operating mines, by 31 March 2019. Majority of EMRIs are compliance officials and do not have enforcement powers.

During the financial years 2017/18 and 2018/19, there were 253 and 292 inspections prompted by public complaints. (Centre for Environmental Rights, 2020) The Centre for Environmental Rights lamented the process of obtaining environmental compliance and enforcement reports from the DMRE. They further indicated that the DMRE is reluctant to make their enforcement activities and results public. According to the Human Rights Commission, majority of non-compliance cases related to inadequate financial provision for closure and rehabilitation. Other issues included failure to submit revised Environmental Management Programmes (EMPs); failure to conduct dust fallout, noise, and groundwater monitoring exercises; inadequate waste disposal, including hazardous waste; spillages and water pollution; the release of contaminated water back into dams; impeding the flow of rivers; etc. (Human Rights Commission, 2018)

Section 93 of the MPRDA empowers any authorised person to issue compliance orders, instructions, or to order the suspension or termination of a mining license for a variety of reasons, including a breach of any material term, or condition or a contravention of any condition in the environmental authorisation. Moreover, Section 47 of the MPRDA enables the Minister to cancel or suspend mining licenses. The Commission emphasises that such a sanction is generally reserved for extremely serious contraventions because at the time of the Commission's investigation no mining license was ever withdrawn, despite the reported cases of non-compliance. In a study conducted by the Bench Marks Foundation it was found that residents of Soweto experienced respiratory problems, exposure to radioactive mine waste, acid mine drainage, unprotected mine waste sites and there was severe threat to underground water supplies resulting from mining. (Bench Marks Foundation, 2017)

4.2.2 Social and societal issues

Human rights

Human rights in South Africa are protected under the Bill of Rights that appears in Sections 7 to 39 of its 1996 Constitution which guarantees political, economic, social and cultural rights to all people in the country. This commitment is backed up by statutory oversight bodies, such as the South African Human Rights Commission, which protects the rights guaranteed under the Constitution. South Africa is a signatory to various international human rights instruments including the Universal Declaration of Human Rights; African Charter on Human and Peoples' Rights; the International Covenant on Economic, Social and Cultural Rights; and the UN declaration on sexual orientation and gender identity.

Despite these strong constitutional protections for human rights, the government continues to struggle to meet demands for economic and social rights. Issues such as unemployment, corruption, crime, gender-based violence, and threats to freedom of expression remain a concern for many citizens. Concerns also exist about the treatment of migrants, refugees, and asylum seekers, and resultant xenophobia violence. South Africa continues to play an important but inconsistent role in advancing the rights of lesbian, gay, bisexual, and transgender people.

In the mining sector, most large-scale mining companies subscribe to any one of a number of human rights conventions or protocols and the Bill of Rights contained in the South African Constitution. Many of them devote considerable attention to stakeholder engagement, communication and training and awareness building to give effect to their commitments. Despite this, the South African Human Rights

Commission released a scathing report on the damage mining in the country is posing to human rights. The Commission has found that the government is responsible for the harm done to mining-affected communities because of its failure to monitor compliance, poor enforcement, and severe lack of coordination. Although mining companies promise jobs and development, it is fairly unusual for communities affected by mining to see these benefits. Mbere and Steenkamp's analysis showed that ESG initiatives are not being sufficiently integrated into the corporate strategy of mining companies. One of the challenges for mining communities is lack of information about their rights and the law applicable to mining (Centre for Environmental Rights and Lawyers for Human Rights, 2014).

Around the country, mine-host communities often contend that mining companies' social and legal obligations towards development and environmental management are not adequately fulfilled. Where this is the case, mining companies risk failing to maintain their social license to operate or worse. The South African Human Rights Commission (SAHRC) actively engages with the mining industry and mine-affected communities to promote and protect the economic, social, environmental and cultural rights of those impacted by mining.

Labour rights

Labour rights are also guaranteed through the Constitution and various legislation such as the Labour Relations Act, No.66 of 1995, the Occupational Health and Safety Act, No.85 of 1993 and others. South Africa subscribes to the advancement of social and economic justice and has ratified 9 of the ILO's 10 "fundamental"/core conventions of the International Labour Organisation (ILO) since resumption of its membership of the body in May 1996 following the advent of democracy in the country[25].

The South African labour movement has a long and proud history in driving change in the mining industry, since 1982 when the National Union of Mineworkers (NUM) was formed and later affiliated with the Congress of South African Trade Unions[26]. Since the end of Apartheid, NUM succeeded in gaining improvements in workers' rights and on issues of health and safety. However, issues remain, including with housing and living conditions, workers pay, mine modernisation (mechanisation) and the changing nature of work in the industry. The Marikana massacre in 2012 in which 34 mineworkers were killed by police during a wildcat strike indicated problems with the collective bargaining system and amongst other factors led to the rise to prominence of the Association of Mineworkers and Construction Union (AMCU), a previously little-known union. Since then, a protracted period of rivalry between NUM and AMCU saw a violent turf war that claimed many lies and sparked waves of labour unrest. Increasingly though, these two major labour formations have recognised the need to put differences aside in the interest of worker's rights and protection, especially in the context of mounting pressure on workers brought about by deteriorating mining sector performance and stagnation in the economy as a whole/

Socio-Economic issues

Mining in South Africa has both a positive and negative impact on communities. On the positive side the industry contributes to the livelihood of communities in terms of jobs and compensation for the loss of land-use. It is reported that, in 2013 South African mining companies spent R2.7 billion on corporate social responsibility. The report further stated that in the Northern Cape province, 26 mining companies spent R500 million in 2015 alone, on various socio-economic development initiatives. (Minerals Council, 2022) The annual reports of many mining companies reflect spending on community development initiatives such as, the building of schools, clinics, income generating projects and infrastructure. However, such contribution is overshadowed by the general reluctance of

[25] More information on which conventions have been ratified and those which have not can be obtained at https://www.ilo.org/dyn/normlex/en/f?p=1000:11200:0::NO:11200:P11200_COUNTRY_ID:102888

[26] Before 1982 black mineworkers were not allowed to form trade unions.

mining companies to incorporate community development in their corporate strategy. As the Minerals Council observed, there has been an increase in community protests, which often turn violent, against mining companies. Communities complain, among others, about mining companies failing to fulfil their SLP commitments.

The Mining Charter has been in existence for nearly 20 years, but most communities affected by mining are still living in abject poverty. This is partly because the SLPs are often developed without consultation with the people who should benefit from them, and so they may not effectively respond to the challenges experienced by people in communities. It is also partly because not everything that is promised in the SLPs is delivered, and the DMRE does not always check if mining companies fulfil their SLP commitments. (Centre for Applied Legal Studies, 2018) In a question-and-answer session of Parliament, the Minister of Minerals and Energy said, "as of 31 March 2015, a total of 240 mining right holders failed to comply with their SLPs". (National Council of Provinces, 2020) On their website, the Minerals Council acknowledges that "the prevailing socio-economic conditions in host communities, however, do not always reflect the positive contributions that the industry makes nor the outcomes that the industry is striving to achieve." (Minerals Council, 2023)

In their study of the SLP system, the Centre for Applied Legal Studies has found that there was an overreliance on desktop study, without field research or consultation with communities. Again, it was found that mining companies failed to disseminate SLPs to beneficiary communities as required by the Mining Charter, 2018. Progress reports submitted to regional offices are not easily accessible to the public unless communities resort to Promotion of Access to Information Act, 2, of 2000. The International Council on Mining and Metals (ICMM) also acknowledged that, "…there is no consistent, industry-wide approach to measuring and reporting on social and economic contribution. This creates challenges for identifying areas for performance improvement across the industry and hinders efforts to communicate the contribution responsible mining can make to society."

Members of the ICMM (which includes majority of large mining companies in South Africa) will only begin to report using the Social and Economic Reporting Framework from 2023 for 2024 disclosures. (ICMM, 2022)

The Human Rights Commission analysed SLP compliance for the years, 2013/14 and 2015/16, covering the Eastern Cape, Gauteng, Limpopo, Free State and KwaZulu Natal provinces. The compliance levels were dismal, with Gauteng showing no compliance at all for 2014/15 and 2015/2016 respectively. In all the provinces analysed for the same period, only 30% of mining companies complied with the SLP obligations. The Department of Mineral Resources (DMR) assessed the Mining Charter in 2015 to gauge if there was any progress made since the introduction of the Mining Charter. It is reported that 962 operations were due for assessment. Of the 962 mining rights eligible for assessment, only 442 submitted their reports. After their assessment, the Department of Mineral Resources and Energy DMRE concluded that "…there has been limited impact in terms of intended beneficiaries realising optimal economic benefits." (The Department of Mineral Resources, 2015) The Department also recognised the fact that mining companies only complied with the Mining Charter to protect their social license to operate. The results showed that only 36% of mining right holders had met their set target on mine community development. As a result, the mining industry has broadly been faced with increasing tensions with both the workers and host communities.

Since the Mining Charter 2018, requires that traditional authorities be consulted with, as one of the stakeholders in the SLP process, they often hamper broader consultation, especially with the community at large. In some cases, mining companies entered into agreements with traditional authorities without the community's consent and such arrangements would only benefit traditional authorities. Such practices have led to devastating outcomes including the deaths of members of communities opposed to mining. (Liewellyn L, 2019) There is no clear regulatory framework regarding

the role of traditional leaders in the SLP process and that exposes mining communities to exploitation by traditional leaders, mining companies and the government.

In March 2016, an activist, who was chairperson of a community-based organisation was murdered because they were opposed to mining in Xolobeni, Eastern Cape province. Members of the Xolobeni community were raising concerns that the titanium mine that the Australian company, Mineral Commodities Ltd, proposed to develop on South Africa's Wild Coast would displace the community and destroy their environment, traditions and livelihoods. Other mining areas in the Country, including Limpopo, KwaZulu-Natal and the North West Province have had experiences similar to Xolobeni. (Groundwork, Centre for Environmental Rights, Human Rights Watch, Earthjustice, 2019) Mine closure has some devastating effects on communities, especially if it's not properly planned for and managed. In South Africa, mine closure is associated with job losses, pollution, the zama zamas (illegal miners), and acid mine drainage). According to Prof Humby, "poorly regulated mine closure" is a significant problem with some detrimental effects on South Africa's poorest citizens. (Parliamentary Monitoring Group, 2017) In his Presidential address, Mthenjane mentioned, "From a policy perspective, current statutes and regulations in the MPRDA, NEMA and the Water Act are limited to physical rehabilitation and none of these statutes deal in any way with the social consequences of mine closure." (Mthenjane M I, 2019)

Governance

The South African mining industry was established under colonialism and the apartheid system where it had no restraint and had undue influence on government decision-making. This created an environment where mining companies maximized profits at the expense of people and the environment. Research studies show that the situation still persists under the democratic government, where mining companies establish close ties with government at national, provincial and local levels, to violate the Country's laws. (Liewellyn L, 2019) The Companies Act, 71, of 2008 (Companies Act) and the Mining Charter in South Africa are legislative instruments used for the management of the relationships between the stakeholders and the company. Eversheds Sutherland states that "from a mining company's perspective, the Companies Act, as amended read with the Mining Charter illustrate how the voluntary application of King IV corporate principles trigger statutory obligations and consequences." (Eversheds Sutherland) They further argue that the harmonization of the King VI corporate governance principles with the Companies Act and the Mining Charter legislative imperatives could offer a unique contribution towards establishing, for the boards of mining companies, a practical generic framework that will reduce potential liabilities for non-compliance with legislative requirements and ensure that decisions are implemented efficiently and effectively.

Mining companies are increasingly required to invest in broader service activities and that calls for the board to balance its responsibility to the shareholders, the company and the community within which it operates. The regulation process establishes mechanisms to hold the company accountable to its stakeholders, including the society in which it operates. The three most important legal instruments in respect of corporate governance in South Africa are: the Constitution, Companies Act and the Mining Charter. The Constitution ensures that governance and exercise of corporate power is consistent with the Bill of Rights. The Mining Charter ensures broad-based and meaningful transformation of the mining and minerals industry, while the Companies Act empowers the board's continuous independent oversight of material matters. (ibid)

What remains a barrier within the mining industry is the imbalance in the demographics of competitive board members within mining companies. The Mining Charter requires a board composition reflective of the racial and gender demographics of South Africa. However, the BEE Commission notes that the inadequate disclosure of demographics of the boards in the annual reports of most entities poses a challenge on the analyses of transformation at management level and that makes transparency a prerequisite in order for King IV principles to be effective. Eversheds Sutherland

is of the view that the voluntary nature of the King IV principles is such that companies can avoid applying the principles and explain non-compliance without consequences.

The SAMCODES Standards Committee (SSC) has responded to the shift in global recognition of the importance of competent assessment of and reporting on socio-environmental liability through the publication of the South African guideline for the reporting of environmental, social and governance parameters within the solid minerals, oil and gas industries (the SAMESG guideline). The SAMESG was produced to define the relevant ESG aspects which should be reported on in public reports issued for the extractive industries and provides guidance on the reporting of the following aspects:

- Organisational structure, systems, policies, procedures and risk control management plans;
- Compliance related ESG aspects;
- Key environmental parameters;
- External social and political parameters
- Internal social parameters;
- Conformance and compliance audits;
- ESG liability; and
- Risk analyses and materiality processes

The key reporting aspects contained in SAMESG are included in the updated SAMREC (the South African Code for the Reporting of Exploration Results, Mineral Resources and Mineral Reserves) report. In 2019 the SAMESG guideline received the International Standards of Accounting and Reporting Honours Award. The SAMESG Vice Chair commented that “The development of the SAMESG guideline was seen as an imperative considering that resources companies listed on the Johannesburg Stock Exchange, at that time, were not subjected to a formalised standard of reporting on ESG matters and determining their impact on mineral project reserves, resources and valuations.” (South African Minerals Reporting Codes Standard Committee, 2022) With the SAMESG guideline in place, South African mining companies, of all sizes, should be encouraged to consider ESG throughout the lifespan of their operations.

4.2.3 What would be the best practices for a responsible mining?

In South Africa, the mining and environmental laws are tailored to encourage responsible mining, provided they are adhered to. The government needs to take its oversight role serious and impose sanctions where there is non-compliance with the Country’s laws, while providing incentives for compliance, where possible. The call for responsible mining is a world-wide phenomenon which involves all stakeholders such as, government, investors, lenders, downstream customers, industry associations, voluntary initiatives, civil society and organised labour. The South African mining industry has the capacity to meet sustainable development requirements. Almost ten of South Africa’s large mining companies submitted their reports on ESG performance to Responsible Mining Foundation (RMF) for assessment and publishing in the Responsible Mining Index (RMI). The 2022 RMI included 40 companies which have mine sites across 57 countries. (Responsible Mining Foundation, 2022) Although in general, South African mining companies scored low on most of the indicators, more companies should be encouraged to benchmark themselves against international best practice standards. RMF stressed that despite interest in responsible mining standards, the evidence on the ground was still limited.

As Cembi and Romet mentioned, “by incorporating sustainable mining practices that prioritise environmental and social stewardship with proper governance rules, the industry will ensure that the current and future needs of its communities and society at large are met." They further explained that sustainable mining refers to the reduction of negative environmental, social and governance impacts of mining operations, while improving value creation at the local level. (Embellie Advisory, 2023) Steele-Schober, T, stated that profit seeking at the expense of society and the environment has resulted in a disconnect between companies and the real economy, including natural and human capital assets on which companies depend for their profitability. The purpose of directing funds

towards investments which are seen as sustainable is to generate measurable environmental and social impacts in addition to a financial return. (Steele-Schober T, 2021)

Increasing demand for battery and renewable energy metals associated with the ecological transition such as lithium, graphite, cobalt, copper and nickel means that the mining industry should increase its commodity outputs while incorporating key sustainability principles in its operations. The rise of ESG as a key driver for investment and operational success has added a new responsibility to corporate leadership, but also provides an opportunity to increase the sustainability of operations and securing the relevant social license to operate. Strategic investment should be made in areas that contribute to the collecting of accurate ESG data based on sound metrics, establishing the ESG impact of business operations, and by communicating ESG processes and results to a range of stakeholders varying from local communities to investors. Mbere and Steenkamp suggest, a key ESG opportunity exists for companies to roll out holistic and pro-active health and wellness programmes to community members with focus on their mental, physical and financial health. There is mounting pressure, by investors and regulators, for companies to disclose ESG performance and set targets. The King IV Guidance Paper on Responsibilities of Governing Bodies in Responding to Climate Change and JSE Sustainability and Climate Disclosure Guidance, as well as global disclosure standards will help to strengthen reporting on ESG goals. Mbere and Steenkamp advise that companies should invest in new technology and the relevant software to process the collected ESG data so that they have the relevant information to report to their governance structures, shareholders and potential investors. (Mbere N, Steenkamp S, 2022)

Responsible mining practices should avoid economic strain for mining communities after mine closure. The President of SAIMM stated that, “by creatively developing economic succession planning principles into the actual design of the mine, the sustainable economic viability of the project’s affected communities is ensured by using mining as the catalyst for other forms of economic activity.” (Mthenjane M I, 2019)

5. Business network between the European Union and the Republic of South Africa

5.1. Assessment of the upstream and downstream business ecosystem

5.1.1 Context, formal and informal players

Much of the contemporary trade, finance, technology and cultural links between the Republic of South Africa (RSA) and the EU were laid down in the period prior the establishment of South Africa as a democratic state in 1994. Parts of the RSA were colonised by the Netherlands (1652-1795 and 1803-1806) and Great Britain (1795-1803 and 1806-1910 and as a dominion to 1961). Archaeological evidence shows mining took place in South Africa before the emergence of anatomically modern humans, however, modern mining was launched by the discovery of diamonds and gold in 1867 and 1886 respectively, extensively capitalised by the City of London which ramified into deep mining, finance, and industrial links with Great Britain.

This chapter sets out the context of South Africa's minerals industry before moving onto examine existing networks and organisations with the potential to participate in the AfricaMaVal project. The main government bodies and research agencies involved in the mining and mineral industry are presented in Table 10 below, adapted from Dai Global, 2022.

Table 10: Key government and institutional players in the South African mining and energy industries.

Institution	Role
DMRE	Is the primary regulator of the mining industry under the MPRDA.
Entities that Report to the DMRE	
Regulatory and other entities	
Mine Health and Safety Council (MHSC)	The MHSC advises the Minister of Mineral Resources on occupational health and safety legislation based on research focused on improving and promoting health and safety in South African mines.
South African Diamond and Precious Metals Regulator (SADPMR)	The Diamond Exchange and Export Centre (DEEC) was established by the South African Diamond and Precious Metals Regulator (SADPMR), in terms of section 59(b) of Act No. 30, 2005 and started operating on the 14th of January 2008. It was established to administer the Diamonds Act, 1986 (as amended) and the Precious Metals Act, 2005 (Act 37 of 2005). The Precious Metals Act, 2005 (Act 37 of 2005) commenced on 1 July 2007 and Regulations made under the Act took effect on 9 July 2007. These Regulations were amended on 4 April 2008.
National Energy Regulator of South Africa (NERSA)	NERSA's mandate is to regulate the electricity, piped gas and petroleum pipelines industries in terms of the Electricity Regulation Act, 2006 (Act No. 4 of 2006), Gas Act, 2001 (Act No. 48 of 2001) and Petroleum Pipelines Act, 2003 (Act No. 60 of 2003).

South African Nuclear Regulator (NNR)	This is a public entity which is established and governed in terms of Section 3 of the National Nuclear Regulator Act, (Act No. 47 of 1999) to provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices.
Petroleum Agency of South Africa (PASA)	This is the official agency responsible for the promotion and regulation of South Africa's petroleum resources.
State Owned Corporations (SOCs) and Funds	
Central Energy Fund (CEF Group)	This is a Schedule 2[27] state owned diversified energy company that is involved in the search for appropriate energy solutions to meet the energy needs of South Africa, the Southern African Development Community and the sub-Saharan African region, including oil, gas, electrical power, solar energy, low-smoke fuels, biomass, wind and renewable energy sources.
PetroSA	This is a subsidiary of the CEF Group; it is the national oil company of South Africa and is registered as a commercial entity under South African law. The company holds a portfolio of assets that spans the petroleum value chain.
Strategic Fuel Fund (SFF)	This is another subsidiary of the CEF; it manages the country's strategic crude oil stockpile as well as the commercialisation of its substantial crude oil storage facilities in the Western Cape.
South African Gas Development Company (iGAS)	iGAS is another subsidiary of the CEF and was established for the development of hydrocarbon gas and gas infrastructure in Southern Africa.
African Exploration Mining and Finance Corporation (AEMFC)	This is the State-Owned Mining Company established to secure South Africa's energy supply primarily through the mining and supply of coal for the generation of electricity, as well as securing other resources that will provide energy for the future, including key minerals for beneficiation in the energy and steel value chain.
State Diamond Trader (SDT)	The SDT is a state-owned entity established in terms of Section 14 of the Diamonds Act 56, 1986, as amended ("the Act"). It operates in the diamond industry with the aim to grow local diamond beneficiation. The mandate of the SDT is to buy and sell rough diamonds and to promote equitable access to and beneficiation of the country's diamond resources
PELCHEM	This is a wholly owned subsidiary of NECSA SOC Ltd and is the sole producer and supplier of fluorochemicals in the Southern Hemisphere.
Research and Development Entities	

27 Schedule 2 public entities are business enterprises that are required to generate revenue to fund their operations.

MINTEK	Mintek is South Africa's national mineral research organisation and it is one of the world's leading technology organisations specialising in mineral processing, extractive metallurgy and related areas. Working closely with industry and other R&D institutions, Mintek provides service testwork, process development and optimisation, consulting and innovative products to clients worldwide.
Council for Geoscience (CGS)	The CGS is mandated to provide for the promotion of research and the extension of knowledge in the field of geoscience as well as the provision of specialised geoscientific services.
Mining Qualifications Authority (MQA)	The MQA is a Sector Educational and Training Authority (SETA) and is responsible for the administration of skills development programmes for the mining and minerals sector.
South African Nuclear Energy Corporation (NECSA)	NECSA was established as a public company by the Republic of South Africa Nuclear Energy Act in 1999 and is wholly owned by the State. To develop, utilise and manage nuclear technology for national and regional socio-economic development through: Applied R&D; Commercial application of nuclear and associated technology; Contributing to the development of skills in science and technology.
NTP Radioisotopes (NTP)	NTP Radioisotopes is a leading global producer and supplier of nuclear medicine and radiation-based products and services and is a subsidiary of NECSA.
South African National Energy Development Institute (SANEDI)	It was established in 2011 under the National Energy Act, 2008 (Act No. 34 of 2008). The Act provides for SANEDI to direct, monitor and conduct energy research and development, promote energy research and technology innovation as well as undertake measures to promote energy efficiency throughout the economy.
The Council for Scientific and Industrial Research (CSIR)	CSIR is a national research and development organisation that undertakes directed, multidisciplinary research and technological innovation in areas of national key interest, namely: agriculture and food; chemicals; health; manufacturing; mining; defense and security; smart mobility and places and enterprises and institutions.
Other Relevant Government Departments and related entities	
Department of Environment, Forestry and Fisheries (DEFF)	Regulates all activities pertaining to the environment as stipulated by NEMA.
Department of Water and Sanitation (DWS)	Regulates water and waste management.
Department of Transport (DoT)	Regulates South Africa's transportation infrastructure.
Transnet	Is a SOC that manages South Africa's ports, rail and pipeline infrastructure

Department of Agriculture, Land reform and Rural development (DALRRD)	Regulates land rights in South Africa.
Department of Employment and Labour	Is responsible for matters related to employment.
Department of Science and Innovation (DSI)	This department is responsible for research and innovation.
Department of Trade, Industry and Competition (DTIC)	Is responsible for the development and regulation of commercial and industrial policy.

5.1.2 Relationships at local or regional levels

The Republic of South Africa has diplomatic relations with EU member states alongside recognizing the Delegation from the EU which functions as a diplomatic mission representing the EU to South Africa together with the 27 Member States with the main objective to implement a Trade, Development and Cooperation Agreement.

European Union business chambers

National business chambers that represent companies in the minerals industry or declare a focus on minerals related cooperation in their scope of activities are the following:

The European Union Chamber of Commerce and Industry of Southern Africa:
https://www.euchamber.co.za

Amongst its 'key themes' it lists 'green and circular economy' and within that it says the following: "We will identify partnership opportunities between South African and EU companies in the following sectors: Green Economy: Demand-side energy efficiency and market for Energy Service Companies (ESCOs), wind and solar power, biomass power plants, power fuels, Urban mobility, battery storage".

This business council acts as an umbrella body for national business councils of EU member states to communicate views regarding legislation or business affairs to South African authorities.

Table 11 EU member business councils in South Africa

National business council	Website	Minerals
Austrian Business Council	https://austrianbc.co.za/	Yes
The Belgian Chamber of Commerce for Southern Africa (BCCSA)	https://belgianchambersa.co.za	No

Czech Trade	https://www.czechtradeoffices.com/en/za	No
Nordic-South African Business Association	https://www.nsba.co.za/	No
Business Finland	https://finlandabroad.fi/web/zaf/team-finland-in-country	Yes
The French South African Chamber of Commerce Industry (FSACCI)	https://www.fsacci.com	No
The German Chamber of Commerce and Industry for Southern Africa (AHK Southern Africa)	https://suedafrika.ahk.de/	Yes
Business Sweden	https://www.business-sweden.com	Yes
Swedish private companies	http://www.swedenafricachamber.se/	Yes

Austrian Business Council

The Austrian Business Council has private members as well as members of the following industries: manufacturing, engineering, energy, and mining. It declares that "The main areas of cooperation are projects in the fields of biotechnology, ICT, renewable energy, health sciences, food and nutrition, mining, security and sustainable agriculture."

Business Finland

Business Finland office in South Africa offers advisory services and support for finding local networks and consultants. It also answers requests for Angola, Botswana, Namibia, Zambia, and Zimbabwe.

"In our work, we focus on the sectors where the supply of Finnish companies and the demand in South Africa meet best. These include energy, smart mining, circular economy, digitalisation and 4IR technologies, agriculture, and food, as well as education and skills development."

Southern African – German Chamber of Commerce

The Southern African – German Chamber of Commerce and Industry has established a Competence Centre for Mining & Mineral Resources (CCMR), commissioned by the German Federal Ministry for Economic Affairs and Energy. The CCMR is aligned with the Resource Strategy of the Federal Republic of Germany. The Centre´s focus is on Southern Africa, more specifically South Africa, Zambia, Zimbabwe, and the Democratic Republic Congo where mining is one of the most important industries. These sources will contribute to the security and diversity of the German resource supply and will be markets for German technology, products and services.

https://suedafrika.ahk.de/en/competence-centres/mining-mineral-resources

Objectives of CCMR are to:

- Create Market Transparency
- Communicate programme objectives
- Provide Services
- Promote German Technologies

Ms. Selleen Sewpershad; Project Manager Competence Centre Mining & Mineral Resources
+27(0)11 486 2775

5.1.3 Overview of the local or regional clusters

Using the term cluster in a broad sense to refer to organisations that could cooperate to some degree on shared interests there are at least five potential clusters that could be focal points for networking within the scope of the AfricaMaVal project. Some of these networks or proto-clusters overlap with potential partner institutions listed in section 5.2.2 below.

An emerging critical minerals/battery metals mining sector. Several junior miners are actively pursuing projects in South Africa targeting critical minerals independently from the well-established PGM, chrome, manganese, vanadium mining sectors. These junior miners cannot be treated as a cluster yet, nor is formal cooperation between them known to the authors, however, they are raising South Africa's profile as a supplier of critical minerals. Relevant projects are the following:

- Marula Mining producing high-grade run-of-mine lithium ore at its Blesberg lithium and tantalum mine in the Northern Cape;
- Rainbow Rare Earths developing a mixed rare earth recovery plant to treat phosphate tailings from the Phalaborwa mining complex;
- Thakadu Group, positioning itself as a multi-asset producer of battery raw materials, has built nickel sulphate refinery in Marikana adjacent to Sibanye-Stillwater's base metals refinery to beneficiate the nickel and cobalt output by-products from the PGM stream; and
- Bushveld Energy in a joint venture with the IDC has built a vanadium electrolyte plant in East London with an 8 million litre annual capacity, the largest plant in the world outside of China.
- Sibanye-Stillwater with major gold and uranium and PGM mines in South Africa is building a global portfolio of green minerals, however, none in South Africa to date.

National science councils. Publicly funded research on national development priorities for the minerals industry is carried out at Mintek and the Council for Scientific and Industrial Research. Both science councils also perform research on contract for the minerals industry.

Academic collaboration networks. Networks in place which align with the AfricaMaVal include the Centre of Excellence for Integrated Mineral and Energy Resource Analysis at the University of Johannesburg and University of the Witwatersrand. A Mineral to Metals program at the University of Cape Town; Mining Resilience Research Centre at the University of Pretoria and the Centre for Sustainability in Mining and Industry at Wits. Minerals related teaching and academic research information is listed in section 5.2.3.1 below.

Hydrogen Society Roadmap. A large-scale multi-stakeholder initiative to prepare for future hydrogen use commenced in 2007. The Hydrogen Society Roadmap was published in 2021 showing how South Africa could leverage its significant natural renewable resources, mineral endowment, and capabilities to stimulate local demand for renewable hydrogen and build a viable green-hydrogen export market. The roadmap defines priority actions to create markets, skills, manufacturing capacity, infrastructure, standards, international cooperation, transition strategies and build a stronger partnership between government, the private sector and civil society by putting in place an enabling policy environment (Dept. Science and Innovation, 2021).

Mining inputs and capital equipment cluster. South Africa's minerals industry needs for consumables, machinery and equipment, specialist engineering, scientific and financial services are met by suppliers

that collectively make up a large share of the most technically advanced engineering and technical services parts of the economy. Minerals industry inputs companies comprise of local and international original equipment manufacturers (OEMs) drawing on tier 2 and 3 suppliers. These firms constitute an established supplier base with expertise spanning across an extensive range of commodities and product groupings. Most firms head offices are based in Ekurhuleni and Johannesburg with fabrication, warehousing and distribution centres located across South Africa. From this base export trading extends into Southern Africa, Central and West African mining regions, however, import competition from Chinese and Indian equipment suppliers has increased over time.

Of the clusters referred to above, mining inputs comes closest to the architype with a geographical centre and formal relations between participating firms. Two export councils established as public private partnerships between the South African Department of Trade, Industry and Competition (dtic) and firms in the capital equipment and electro-technical sectors operate to educate and advocate on behalf of member firms on issues pertaining to mining, construction, beneficiation, and utilities sectors within the export context.

Councils facilitate collaboration between members, between sectors and all along the value chain which is not prohibited by competition law. These are:

- SA Capital Equipment Export Council (SACEEC); https://saceec.com

Mineral processing equipment and valves and actuators are also clustered under SACEEC.

- SA Electro-technical Export Council (SAEEC); www.saeec.org.za

In addition to these entities, South Africa as a country is signatory to a host of regional trade cooperation and customs agreements. These are presented in the table below.

Table 12: Regional and African Trade agreements that South Africa is signatory to

Agreement type and title	Type of Agreement	Countries Involved	Main Objective/Terms	Products Involved
Customs Union				
Southern African Customs Union (SACU)	Customs Union	Botswana, Eswatini, Lesotho, Namibia and South Africa	Duty free movement of goods; a common external tariff applied on goods entering any of the countries from outside the SACU	All products
Free Trade Agreements (FTAs)				
Southern African Development Community (SADC): Protocol on Trade in Goods	Free Trade Agreement: Protocol on Trade in Goods	Among 13 of the 16 SADC Member States. Angola is in the process to accede to the free trade agreement; the DRC and Comoros have	A FTA, with 85% duty-free trade achieved in 2008. The 15% of trade, constituting the "sensitive list", was largely liberalised from 2009 to 2012.	Most products

		not yet acceded.		
Southern African Development Community (SADC): Protocol on Trade in Services	Services trade liberalization: Protocol on trade in services	Among 15 of the 16 SADC Member States. (Comoros being the exception.)	Liberalize trade in services. Seven of the 15 signatory countries have ratified; awaiting a further 3 countries to ratify the Protocol, for it to enter into force.	Six services sectors initially (communication, construction, energy, finance, transport, tourism); other sectors might follow in a second round of negotiations.
Trade, Development and Cooperation Agreement (TDCA) (Link: schedule 10 to the Customs and Excise Act, Part 1A: https://www.sars.gov.za/Legal/Primary-Legislation/Pages/Schedules-to-the-Customs-and-Excise-Act.aspx	Free Trade Agreement	South Africa and the European Union (EU)	The EU offered to liberalise 95% of its duties on South African originating products by 2010. In turn, by 2012, South Africa offered to liberalise 86% of its duties on EU originating products.	The TDCA was reviewed, with the aim of broadening the scope of product coverage. This took place under the auspices of the Economic Partnership Agreement (EPA) negotiations between SADC and the EU. Resulting from these negotiations, the TDCA trade chapter was replaced by the SADC-EU Economic Partnership Agreement.
EFTA-SACU Free Trade Agreement (FTA)	Free Trade Agreement	SACU and the European Free Trade Association (EFTA) – Iceland, Liechtenstein, Norway and Switzerland	Tariff reductions on selected goods	Industrial goods (including fish and other marine products) and processed agricultural products. Basic agricultural products are covered by bilateral agreements with individual EFTA States
Economic Partnership Agreement between the SADC EPA States, and the European Union and its Member States (Link: schedule 10 to the Customs and Excise Act, Part 1B: https://www.sars.gov.za/Legal/Primary-Legislation/Pages/Schedules-to-the-Customs-and-Excise-Act.aspx	Economic Partnership Agreement	South Africa, Botswana, Eswatini, Namibia, Lesotho and Mozambique (referred to as the SADC EPA Group), and the European Union (EU)	SA's core interest has been to harmonise trading regimes between SACU and the EU; to secure further market access in agriculture (beyond the SA-EU Trade Development and Cooperation Agreement (TDCA) provisions) and regain some policy space lost under the TDCA.	The agreement covers most products. It replaces the Trade Chapter of the TDCA.
Preferential Trade Agreements (PTAs)				
SACU-Southern Common Market (Mercosur) PTA (Link: schedule 10 to the Customs and Excise	Preferential Trade Agreement	SACU and Argentina, Brazil, Paraguay and Uruguay.	Tariff reductions on selected goods. It entered into force on 21 October 2016	About 1 000 product lines on each side of the border

Act, Part 7: https://www.sars.gov.za/Legal/Primary-Legislation/Pages/Schedules-to-the-Customs-and-Excise-Act.aspx		(Although Venezuela has since joined MERCOSUR, it is not party to the PTA with SACU.)		
Zimbabwe/South Africa bilateral trade agreement	Bilateral Preferential Trade Agreement	South Africa and Zimbabwe	Preferential rates of duty, rebates and quotas on certain goods traded between the two countries	Note: the agreement has been in existence since 1964 and was reviewed in 1996. It was terminated in November 2018, following the implementation of the wider-scope SADC free trade area which includes both South Africa and Zimbabwe.
Non-reciprocal Trade Arrangements				
Generalised System of Preferences (GSP)	Unilateral preferences granted under the enabling clause of the WTO; these preferences are not contractually binding upon the benefactors	Offered to South Africa as developing country by: the EU Norway Switzerland Russia Turkey The US Canada Japan	Products from developing countries qualify for preferential market access into these markets	Selected industrial and agricultural products
Africa Growth and Opportunity Act (AGOA) https://agoa.info/images/documents/5695/bills-114hr1295enr.pdf	Unilateral assistance measure; similar to the GSP programmes but wider in scope	Granted by the US to 39 sub-Saharan African countries	Preferential access to the US market through lower tariffs or no tariffs on selected products	Duty free access to the US market under the combined AGOA/GSP programme stands at approximately 7 000 product tariff lines.
Current Trade Negotiations				
SACU-India PTA	Preferential Trade Agreement	SACU and India	Tariff reductions on selected goods	SACU and India are in the process of exchanging tariff requests
SADC-EAC-COMESA Tripartite FTA	Free Trade Agreement	26 countries with a combined GDP of US$860 billion and a combined population of approximatel y 590 million people	The Tripartite Framework derives its basis from the Lagos Plan of Action and the Abuja Treaty establishing the African Economic Community (AEC), which requires rationalisation of the continent's regional economic communities.	The FTA will, as a first phase, cover only trade in goods; services and other trade-related areas will be covered in a second phase. The framework agreement and several annexes have been concluded; ratification in member countries are underway. South Africa has ratified. Ratifications have not

			The Tripartite initiative comprises three pillars that will be pursued concurrently, in order to ensure an equitable spread of the benefits of regional integration: market integration, infrastructure development and industrial development	yet reached the required number for it to enter into force. Negotiating the tariff liberalization schedules are underway. The negotiating modalities require that duties on 60 to 85% of tariff lines be liberalized upon entry into force; the remaining tariff lines will be subject to negotiation for liberalization, with implementation over a 5 to 8 year period. Work in Phase II has commenced
The African Continental Free Trade Area (AfCFTA)	Free Trade Agreement	The AfCFTA integrates a market of 55 countries with a combined GDP of over US$ 3.3 trillion and a population of more than 1 billion people. The AfCFTA builds on the Tripartite Free Trade Area (TFTA) with the Common Market for East and Southern Africa (COMESA), East African Community (EAC) and the Southern Africa Development Community (SADC). The AfCFTA therefore presents new market access opportunities in West Africa and North Africa which will be beneficial for the export of South African	The key objectives of the AfCFTA is to among others, create a single market for Goods, Services, and enhance economic integration in the African Continent in accordance with the Pan African Vision of "An integrated, prosperous and peaceful Africa" enshrined in Agenda 2063; promote structural transformation of the State Parties; boost intra-Africa trade by progressively eliminating tariffs and non-tariff barriers to trade in goods; progressively liberalize trade in services; cooperate on customs matters and the implementation of trade facilitation measures; and design a mechanism for the settlement of disputes concerning their rights and obligations. The AU Assembly launched the AfCFTA negotiations during the 25th Ordinary Summit of Head of States and Governments on 15 June 2015 in Johannesburg, South Africa; adopted the legal instruments establishing the AfCFTA on 21 March	– Agreement establishing the AfCFTA – Protocol on Trade in Goods and Annexes – Protocol on Trade in Services – Protocol on the Rules and Procedures for the Settlement of Disputes. Phase II of the negotiations will cover Competition, Intellectual Property and Investment. The AfCFTA is being pursued under the development integration approach which places emphasis on market integration, infrastructure and industrial development, to address Africa's productive capacity and supply side constr

		value added products services.	2018 in Kigali, Rwanda and launched the operational phase of the Agreement during the Extra-Ordinary Summit held July 2019 in Niamey, Niger. South Africa signed the Agreement and deposited the instrument of ratification on 1 July 2018 and 10 February 2019, respectively. Effectively, the Agreement entered into force as at 30 May 2019.	

5.2. Building new B2B relations

5.2.1 Promoting local content and enabling mining cluster actors

To drive transformation in the mining industry to overcome the legacy of racial exclusion in ownership, positions of authority and to open business opportunities for black owned businesses, a tri-partite process of government, business, and organized labour in 2002 prepared the Broad-Based Black Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry, commonly known as the Mining Charter. Targets were set for changes to be effected in six areas: Ownership; Mine Community Development; Employment Equity; Human Resource Development; Inclusive Procurement, Supplier and Enterprise Development; and Housing and Living Conditions. In 2010 changes were made to align it more closely with national legislation on Broad-Based Black -Economic Empowerment. In 2018 after three years of consultations that had not reached consensus, government went ahead with a new version of the Mining Charter (G.G. , 27 Sept 2018).

For local content Mining Charter III, a 70% minimum of the total mining goods budget needed to be spent on South African manufactured goods, and spent with Historically Disadvantaged Persons, women and youth owned and controlled companies, as well as BEE compliant companies, which could be phased in over 5 years to reach the target. For services an 80% minimum of total services spend needed to be sourced from South African companies, excluding non-discretionary expenditure. A two-year transitional period was allowed, with the first year set at 70%. To calculate local value addition an unusual definition of sales price of the capital good, component or consumable in Rand (excluding profit mark-up, intangible value such as brand value and indirect overheads) was applied. A 70% minimum of the total R&D budget needed to be spent on South African public or private entities.

The Minerals Council turned to the courts over the wide latitude of ministerial digression and onerous ownership transfer provisions. The high court declared the Mining Charter a policy, not a form of subordinate law and set aside prescriptive clauses on ownership and procurement, holding that the MPRDA comprehensively deals with empowerment requirements attached to mining rights that are binding on holders of mining rights (RSA Judicary, 21 September 2021). The other provisions on Mine Community Development; Employment Equity; Human Resource Development; and Housing and Living Conditions still stand.

Mining company procurement practices appear to have reverted to or improved upon the targets set in the 2010 Mining Charter II. Compliance is tracked by the DMRE on a mine-by-mine basis. The last

date for which consolidated information is available reported that 75.4% of expenditure on capital goods (R16.9 billion) was incurred on BEE entities against the Mining Charter 2010 target of 40%. For services 75.1% of expenditure was incurred on BEE entities (R45.5 billion), compared with the Mining Charter 2010 target of 70%. For consumables 79.0% of consumable goods were procured from BEE entities (R45.3 billion) against a target of 50% (Minerals Council, 2019).

5.2.2 Potential partner institutions for an Africa-focused critical minerals network

On account of its rich mining history, South Africa has developed an extensive network of institutes and organisations that support the research and development of various facets of mining and exploration knowledge. A list of these institutions is presented in the tables that follow.

Table 13: South African institutions related to the mining industry

Institution	Information
COUNCIL FOR GEOSCIENCE https://www.geoscience.org.za/	The Council for Geoscience (CGS), one of the National Science Councils of South Africa, is the custodian of the nation's geoscience data. It is mandated to provide for the promotion of research and knowledge in the field of geoscience as well as the provision of specialised geoscientific services to a variety of clients, including the state. The clientele base is national, throughout the SADC region, and further afield, including North Africa, Asia, and South America.
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH www.csir.co.za	The Council for Scientific and Industrial Research (CSIR) is South Africa's national science council for applied research and development (R&D). While it exists primarily to improve the technological base of the South African economy, it also works regionally and overseas leveraging multi-disciplinary expertise through public, private, and international partnerships in support of science, engineering, and technology (SET). It is in a strategic alliance with the University of Pretoria known as the Southern Education and Research Alliance (SERA) collaborates locally and internationally with universities, NGO's, companies, and multinational bodies. The CSIR also has partnerships with other local science councils, such as Mintek and the Council for Geoscience.
MANDELA MINING PRECINCT https://mandelaminingprecinct.org.za/	The Mandela Mining Precinct is a public-private collaboration between the Department of Science and Innovation (DSI) and the Minerals Council of South Africa that is managed by the CSIR. It is an

	initiative aimed at revitalising mining research, development, and innovation in South Africa with a view to promoting longevity and the sustainability of the industry.
MINING EQUIPMENT MANUFACTURERS OF SOUTH AFRICA https://memsa.org.za/	Mining Equipment Manufacturers of South Africa (MEMSA) is a formal industry cluster established in 2016 with the support of the Department of Trade, Industry and Competition (dtic) to build a competitive advantage for South African mining equipment manufacturers by providing access to key markets and championing existing and future local technology and innovation.
MINING QUALIFICATIONS AUTHORITY https://mqa.org.za/	The Mining Qualifications Authority (MQA) is a statutory body with a board consisting of the state, employers, labour and community organisations within the sector. MQA is responsible for quality assuring and administering several skills development initiatives
MINTEK https://www.mintek.co.za	Mintek is a state-owned, science council specialising in mineral processing, extractive metallurgy, and related areas. Their primary mandate is to serve South Africa's national interest through research, development, and technology transfer, to promote mineral technology and to foster the establishment and expansion of industries in the field of minerals and products derived therefrom.
INDUSTRIAL DEVELOPMENT CORPORATION https://www.idc.co.za	The Industrial Development Corporation of SA Ltd (IDC) is a state-owned development finance institution primarily mandated to provide funding for the development of industry through infrastructure development and investment aimed at stimulating economic growth in South Africa and regional integration with the rest of Africa. Funding is generated through income from loan and equity investments and exits from mature investments and borrowings from commercial banks, development finance institutions (DFIs), and other lenders.
MINERALS COUNCIL https://www.mineralscouncil.org.za/	The Minerals Council South Africa (Minerals Council), formerly the Chamber of Mines of South Africa is a mining industry employers' organisation that serves its members and promotes their interests by providing strategic support and advisory input

COPPER DEVELOPMENT ASSOCIATION AFRICA https://www.copper.co.za/	The Copper Development Association Africa (CDAA) is committed to promoting and expanding the interests of the copper and copper alloy industry throughout Africa. The Association has close links with the European Copper Institute (ECI) and the International Copper Association, Ltd (ICA).
FERRO ALLOY PRODUCERS ASSOCIATION https://fapa.co.za/	The Ferro Alloy Producers Association (FAPA) is an industrial association of ferroalloy smelting operations involved in the beneficiation of South Africa's ores and minerals into ferroalloys for local consumption and export markets
SOUTH AFRICAN STAINLESS STEEL DEVELOPMENT ASSOCIATION https://sassda.co.za/	The Southern Africa Stainless Steel Development Association (Sassda) provides a platform for Sassda members to collectively promote the sustainable growth and development of the industry.
STEEL AND ENGINEERING INDUSTRY FEDERATIONS OF SA https://www.seifsa.co.za/	The Steel and Engineering Industries Federation of Southern Africa (SEIFSA) is a national employer Federation representing the Metals and Engineering industry.
INSTITUTE OF MINE SURVEYORS OF SA https://www.ims.org.za/	The Institute of Mine Surveyors of SA is a non-statutory, South African Qualifications Authority (SAQA) recognised professional body. The primary objectives of the Institute are to advance the science and practice of mine surveying and allied disciplines, to promote and protect the character and interests of the profession of mine surveying
SOUTHERN AFRICAN INSTITUTE OF MINING AND METALLURGY https://www.saimm.co.za/	The Southern African Institute of Mining and Metallurgy (SAIMM) started as a learned society in 1894. This professional body enjoys both local and international links aimed at disseminating knowledge and assisting its members source information regarding technological developments in the mining, metallurgical and related sectors.

Table 14 South African Universities with minerals specialization

University	Chemical Engineering	Mining Engineering	CIMERA[28] member	Minerals Research units
University of Cape Town	✓		✓	✓
University of Fort Hare			✓	
University of the Free State				✓
University of Johannesburg	✓	✓	✓	✓
University of Kwazulu Natal	✓		✓	
University of Limpopo	✓		✓	✓
University of Mpumalanga				
Nelson Mandela University				
North West University	✓			
University of Pretoria	✓	✓	✓	✓
Rhodes University	✓		✓	
Sefako Makgatho Health Sciences University				
University of South Africa	✓			
University of Stellenbosch	✓		✓	✓

[28] CENTRE OF EXCELLENCE FOR INTEGRATED MINERAL AND ENERGY RESOURCE ANALYSIS (https://cimera.co.za)
The Centre of Excellence (CoE) for Integrated Mineral and Energy Resource Analysis (CIMERA) is hosted by the Department of Geology at the University of Johannesburg (UJ) and co-hosted by the School of Geosciences at the University of the Witwatersrand (Wits). Launched in 2014 by the National Research Foundation (NRF) section of the South African Department of Science and Technology (DSI). The CoE is funded by the (previous) Department of Science and Innovation (DSI) and the National Research Foundation (NRF), with contributions from the University of Johannesburg and the University of the Witwatersrand. CIMERA has diverse, local, and international collaborations. CIMERA is a central hub for research and training in mineral and energy resource analysis (for both scientific and economic sectors) in South Africa and Africa more broadly but also to make key mineral and energy resource information to policymakers and the community in general.

Walter Sisulu University				
University of Venda			✓	
University of the Western Cape	✓		✓	
University of the Witwatersrand	✓	✓	✓	✓
University of Zululand				

5.2.3 Strengthening African mining clusters

South Africa's minerals industry is deeply engaged with the implications of decarbonizing production and at company and organised industry level committed to a just energy transition. An engagement around critical minerals that aligns with these issues and enhancing the resilience, sustainability and good governance would doubtless be welcomed. In conclusion a note of caution should be conveyed- nevertheless. Mining companies' obligations for employment equity and human resource development under the Mining Charter are likely to limit their ability to commit resources to any critical minerals initiative that did not contribute directly to meeting those obligations.

Funded by
the European Union

6. Energy and digital transition: develop a strategy for the EU and Africa Partnership

6.1 Assessment of local EU funded activities

The EU has a long history of support to the South African development process. The EU mentions that South Africa is one of their ten strategic partners globally. Through the Budget Support Programme the EU funds Good Governance and Development Programmes, Sector Reform Programmes, and State Building Programmes. Other areas which the EU assists South Africa on include Peace and Security, Human Rights, Migration, Social Cohesion, Energy, and Innovation. The EU invests in many strategic areas of South Africa's development trajectory and their role is based on partnership. A typical example is in their supported initiatives which include policy dialogues on issues such as natural resources management, food waste, circular economy and natural capital accounting. The EU and South Africa work together to boost strategic public and private investment through investment programmes and operations that blend grants and loans. The EU is part of the International Partners Group formed to support South Africa's Just Energy Transition.

During 2022, South Africa developed the Just Energy Transition Investment Plan for the first 5 years since its agreements with international parties at COP26. This chapter provides a brief overview of that document[29] and the commitments outlined therein.

6.1.1 Context and partnerships

Risks associated to energy and climate change are significant for South Africa. These include dangers related to physical, social, and transitional aspects as well as inadequate investment in the electrical infrastructure and shortages of electricity. Specific interventions are needed to manage and mitigate the effects of transition, especially for impacted workers, communities, small businesses, and exporters' exposure to carbon trade barriers, given the high carbon intensity of industry and economic dependence on fossil fuel value chains. In the meanwhile, seizing new business opportunities presented by green technology can spur economic diversification, industrial growth, and innovation. This will pave the way for a sustainable and resilient future with respectable employment, reduced rates of poverty, and social inclusion.

The idea of a just transition is crucial when analysing the effects of moving to a low-carbon economy and a society that is resilient to climate change by the middle of the century. The Presidential Climate Commission (PCC) completed the Just Transition Framework after extensive consultations with industry, government, organised labour, and civil society. The framework was approved by Cabinet in August 2022 and will serve as the overarching framework for South Africa's climate transition.

The government of South Africa has committed to decarbonization; this is outlined in the country's Just Energy Transition Investment Plan (JET IP) for the five-year period 2023–2027. This plan is in line with the country's updated Nationally Determined Contribution (NDC), which was filed with the UNFCCC prior to its Conference of the Parties 26 (COP 26) in Glasgow in November 2021, and its Long-term Low-Emissions Development Strategy (LEDS), which was submitted to the UNFCCC in 2020

South Africa has established this JET IP to outline its priority investment requirements for the next five years in the electricity, NEVs, and GH2 sectors in order to meet the goals of energy security, just

[29] The JET IP is available from: https://www.thepresidency.gov.za/content/south-africa%27s-just-energy-transition-investment-plan-jet-ip-2023-2027

transition, and economic growth. Within these sectors, just transition initiatives—especially those resulting from the Mpumalanga Province's electrical sector transition—are highlighted. Two cross-cutting priorities for skills development and municipal capacity have been recognised as essential elements of the JET IP.

The JET IP is based on the National Development Plan (NDP) 2036 of South Africa, which aims to address the systemic issues of unemployment, inequality, and poverty in the nation. It fits into the broader push for sustainable development, changing energy and climate response policies, and bolstering public-private sector cooperation. The JET IP will be updated on a regular basis to reflect changes in national and international efforts on the climate crisis, the fair energy transition requirements, and the sustainable development difficulties facing South Africa.

A just energy transition is the foundation for South Africa's commitment to reducing greenhouse gas (GHG) emissions to 2030 and beyond, as outlined in its modified 2021 NDC. The JET IP seeks to reflect the hopes and ambitions of the government and its social partners in facilitating a just energy transition. It acknowledges that: (i) the energy transition has significantly disruptive social and economic consequences for a country heavily reliant on fossil fuels; and (ii) the just energy transition gives rise to valuable new economic opportunities for South Africa. As such, it presents the initial building blocks for managing South Africa's just energy transition and broader climate response. Both need assistance from the global community.

Additionally, it identifies the Just Transition factors—particularly the necessity of helping impacted workers and communities get through the transition—as a primary area of focus and investment, one that should prioritise reskilling, skill development, SME development, and social assistance. In order to move the electrical industry into a low-emission trajectory, the JET IP specifies the first priority investments. Along with this industry, it also seeks to expand potential for green industrialization in the fields of green hydrogen (GH2) and new energy vehicles (NEVs). The JET IP incorporates the "just transition" approach from the outset in accordance with the nation's Just Transition Policy and determines the early investments that will have the best chance of assisting in the fulfilment of the present NDC target and longer-term decarbonization. By doing this, it lays out the financial resources required over the following five years to create a phased low-emission development trajectory in compliance with the Paris Agreement, taking into account the national circumstances and policies of the nation, and balancing the benefits of the new economic opportunities with the mitigation of the negative social and economic effects of decarbonization.

The Paris Agreement and related decisions, which recognise that "...enhanced support for developing country Parties will allow for higher ambition in their actions," and which place the developed world's obligation to assist developing countries with their needs for mitigation and adaptation to climate change, place the JET IP in the context of international climate agreements, commitments, and institutional arrangements. In terms of the NDC, South Africa has set a lofty target for 2030, but achieving it will depend on receiving funding and other forms of assistance that would put the nation in the best possible position. This is difficult and calls for significant activity over the next five years. If sufficiently funded and carried out, these steps will enable the "most ambitious possible" outcome in 2030.

The historic Just Energy Transition Partnership (JETP), which was forged at the 26th Conference of the Parties (COP26) of the UNFCCC (United Nations Framework Convention on Climate Change) between the governments of South Africa and the governments of France, Germany, the United Kingdom (UK), the United States (US), and the European Union (EU) (forming the International Partners Group [IPG]), is put into effect by South Africa's Just Energy Transition Investment Plan (JET IP) for the first five years

(2023–2027). The JETP came up as a result of discussions between the parties about the particular economic and social difficulties involved in fairly transitioning South Africa's economy away from its reliance on fossil fuels.

The JETP assists South Africa in achieving the most ambitious emissions reduction range outlined in the country's updated Nationally Determined Contribution (NDC) of 420-350 MtCO2-eq by 2030. The significance and commitment of the partners to enabling a 'just transition', thereby addressing the direct and indirect impact of the energy transition on lives, workers, and communities, is a distinctive element of the JETP. The JETP's vision and objectives are articulated in a Political Declaration1, which aims to "establish an ambitious long-term partnership to support South Africa's pathway to low emissions and climate resilient development, to accelerate the just transition and decarbonization of the electricity system, and to develop new economic opportunities such as green hydrogen and renewable energy."

According to the Political Declaration, the IPG will raise an initial US$8.5 billion between 2023 and 2027, subject to agreement on an investment framework. This catalytic funding is meant to leverage significantly more resources from both private and governmental sources. To put the JETP into action, President Ramaphosa established a Presidential Climate Finance Task Team (PCFTT) in February 2022, tasked with engaging the IPG and analysing the offer, with the goal of advising Cabinet (via an Inter-Ministerial Committee [IMC]) on its composition, affordability, and alignment with South Africa's ambitions and priorities in relation to climate change risks. Figure 12 provids an overview of the JET IP governance framework

Under the leadership of the PCFTT and IPG, an independent JETP Secretariat, supported by the Climate Investment Funds (CIF), provides technical and convening capacities for establishing the investment framework. The South African government and its IPG partners appreciate the milestone reached in establishing this JET IP during 2022, which is critical for moving the collaboration forward and obtaining resources from other funding sources. The initial portfolio outlined in this JET IP focuses on the priorities required to catalyse a sustained just energy transition over the next five years in order to accomplish the country's economic, social, and economic results over the following decades. It also evaluates how to best use the first IPG offer of US$8.5 billion.

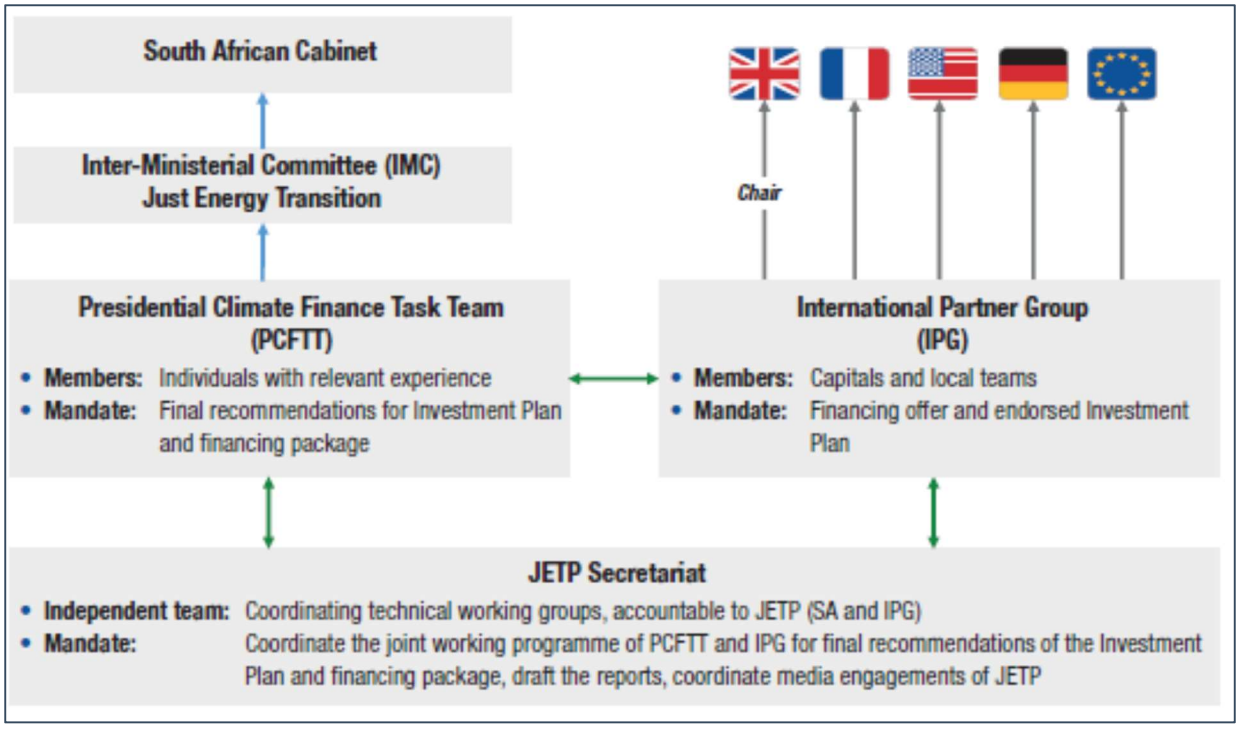


Figure 13: JET IP governance framework

The partners will continue collaborating through 2023 and beyond, with the JET IP serving as one significant step in a longer-term process. This work entails creating a thorough implementation plan that will address governance, accountability, results monitoring, and evaluation mechanisms among other things to guarantee the achievement of intended and significant outcomes. The plan will be updated as needed in response to new information on financing structures, timing of financial flows, and other implementation modalities.

The National Development Plan (NDP) 2030 of South Africa, which focuses on addressing the underlying issues of poverty, inequality, and unemployment in the nation, serves as the foundation for the JET IP. Thus, the energy transition in South Africa presents a chance for the nation to promote innovation, industrial growth, and economic diversity. It is heavily dependent on the amount and kind of financial support it can obtain from the international community to supplement domestic resources. It will take place over several decades in a well-planned manner, within the framework of the nation's energy, climate, and other pertinent policies, using both public and private sector resources. Thus, the JET IP serves as a call to action for both domestic and foreign funders and investors to collaborate with South Africa on the just energy transition journey.

The Government of South Africa and the Governments of France, Germany, United Kingdom (UK), United States (US), and the European Union (EU) (collectively, the International Partners Group [IPG]) signed the Political Declaration at COP26 which gave rise to the Just Energy Transition Partnership (JETP). It undertook to "*Establish an ambitious long-term partnership to support South Africa's pathway to low emissions and climate resilient development, to accelerate the just transition and the decarbonisation of the electricity system, and to develop new economic opportunities such as green hydrogen and electric vehicles amongst other interventions to support South Africa's shift towards a low carbon future*."

This Political Declaration envisaged the IPG to mobilise an initial US$8.5 billion over three- to five years to support the achievement of South Africa's low-carbon future in line with the most ambitious NDC

scenario possible, subject to the concurrence on an investment framework. The Political Declaration also resolved to establish a partnership comprised of South Africa and international partners that will enable:

- "*The accelerated decarbonisation of South Africa's electricity system to achieve the most ambitious target possible within South Africa's Nationally Determined Contribution (NDC) range to the extent of available resources;*
- *South Africa's efforts to lead a just transition that protects vulnerable workers and communities, especially coal miners, women and youth, affected by the move away from coal;*
- *South Africa's nationally determined efforts to successfully and sustainably manage Eskom's debt, define the role of the private sector, and create an enabling environment through policy reform in the electricity sector, such as unbundling and improved revenue collection;*
- *Local value chains (including Micro, Small and Medium Enterprises) to benefit from new areas of economic opportunity; and*
- *Opportunities for technological innovation and private investment to drive the creation of green and quality jobs as part of a prosperous low emission economy*."

President Ramaphosa announced the creation of the Presidential Climate Finance Task Team (PCFTT) in February 2022 in response to the Political Declaration's signing. The team's duties include advising and developing South Africa's JET IP, working with the IPG, and providing recommendations on the financing package to an Inter-Ministerial Committee (IMC) chaired by the Minister in the Presidency. A JETP Secretariat supports both the PCFTT and the IPG.

The US$8.5 billion IPG pledge will be distributed to the priority sectors of electricity, new energy vehicles (NEVs), and green hydrogen (GH2) in South Africa over a five-year period, in accordance with the JET IP's identified scale of need for investment in these areas. Thus, the collaboration between South Africa and the IPG is a first step towards the nation's more comprehensive goals for a just energy transition. In order to support South Africa's greater five-year JET IP needs and the nation's just energy transition over a longer time horizon, it aims to mobilise and harness additional resources from the domestic and international community.

The South African Cabinet and the IPG both endorsed the JET IP, with its priority allocations for the five-year period, in October 2022.

6.1.2 Assessment of the existing platforms and networks

South Africa and the IPG will continue to work closely together, and moving forward, regular progress reports on the JET IP will be given. A number of supportive policies and procedures, such as the Just Transition Framework, which was approved by Cabinet in August 2022, and extensive energy sector reforms that are facilitating investment in renewable energy, were implemented during the course of 2022, when the JET IP was being developed.

A process that includes technical working groups and stakeholder conversations with youth, labour, business, civil society, local government, and faith-based organisations resulted in the development of the JET IP. This process was led by the country and is owned by the country. It made use of the wealth of knowledge that South African officials, academics, businesspeople, and civic society had to provide. With the purpose of improving the effectiveness and impact of the JET IP, particularly in the upcoming implementation phases, the South African government has committed to upholding an

open line of communication with the stakeholders, aided by the Presidential Climate Commission (PCC).

The long-term collaboration between the South African government and the IPG is guided by the priorities specified in the JET IP and their resource requirements, which also help to mobilise additional resources. While all parties recognise that additional public and private resources would be required, the IPG offer of ZAR128 billion (US$8.5 billion)2 is a significant contribution to the aggregate ZAR1.5 trillion offered in this JET IP. Specifically, JETP acknowledges the vital role that charitable capital and the private sector must play in filling the funding gap mentioned in this investment plan, including creating strategies to aid in the just transition in South Africa's impacted areas.

All available forms of finance are required to enable a sustained drive towards South Africa's desired long-term economic, social, and environmental outcomes. The amount of money needed and the pledges made by the South African government to decarbonize are outlined in the country's Just Energy Transition Investment Plan (JET IP) for the five-year period 2023–2027. The JET IP aligns with South Africa's revised Nationally Determined Contribution (NDC), which was filed with the UNFCCC before its 26th Conference of the Parties (COP 26) in Glasgow in November 2021, as well as the country's 2020 Long-Term Low-Emissions Development Strategy (LEDS), which was also submitted to the UNFCCC.

By 2030, the nation is committed to lowering its emissions to between 420 and 350 megatons carbon dioxide equivalent (MtCO2-eq). This target is in line with South Africa's fair contribution to the long-term temperature goal specified in Article 2.1(a) of the Paris Agreement, whereby a target of 350 Mt in 2030 is consistent with a 1.5-degree temperature goal and a target of 420 Mt in 2030 is consistent with a fair contribution to a 2-degree temperature goal. The South African government stated when it submitted its updated NDC that the amount of funding available to assist its shift to lower-carbon technologies will determine its capacity to fulfil the bottom range of this commitment.

6.2 What are the key challenges to cope with the twin transition needs?

South Africa is making good progress towards the twin transition though in some areas more work is still required. There is commitment from the government in terms of policies and budget allocations. On the energy transition front there is tremendous progress with regards to green energy projects. Th JET IP outlines the challenges and has conducted a risk assessment to the main issues confronting the transition.

6.2.1 The twin transition needs

Thus, in order to do this, the international community must likewise have the same degree of ambition in supporting South Africa. The result in 2030 and beyond will largely depend on what South Africa can accomplish in these five years, which will depend on how well the required resources are committed to and mobilised.

According to the official JET IP statement, the programme is designed to:

- "Highlight the actions and investments required for South Africa's economic and social diversification away from a predominantly coal-based economy, including the creation of new industries, employment, skills, and livelihoods in geographies and sectors most affected by the transition, in particular, to ensure that the resources are available to support the workers, communities, and businesses whose livelihoods are negatively affected by the transition;

- Locate the targeted IPG investments within the context of broader country planning for a just transition towards a sustainable, inclusive, and climate-resilient economy, including an emissions reduction trajectory that strives to achieve the lower range of South Africa's updated 2021 NDC;
- Identify the early and catalytic investments required in the sectors identified in the Political Declaration over the next three to five years;
- Identify the indicative costs of these priority interventions and the time scales within which they are required;
- Specify key interventions and the scale of financing required to support workers, communities, and sectors affected by the transition;
- Set out the prioritisation and financing principles that will guide the investments;
- Identify the potential for private sector investment opportunities and partnerships with the public sector; and
- Confirm the enabling policy and regulatory framework that is in place to support the
- implementation of South Africa's just energy transition".

To compile the JET IP, a variety of sources including published studies, data analytics, policy documents, bodies of information, and financial data were gathered and examined. Experts in the relevant professions, including government officials, reviewed and analysed the draughts, and revisions were made based on their feedback. Additionally, a multi-phase consultation procedure was used, which Annexure A summarises.

6.2.2 Proposal of a strategy outline

There is an established relationship between the EU and the South African government as evidenced by the number of initiatives funded by the EU and its member states. That pave way for further cooperation on other areas of strategic importance to the EU. South Africa is a developing country and requires support from developed countries. The EU should target development areas where South Africa requires expertise and financial support to earn more cooperation from the country's leadership and the citizens. The Department of Minerals Resources and Energy is in process of developing a critical minerals strategy and could learn from the EU since they already have a strategy.

There is skills shortage to drive the twin transition and the EU could support the process with skills development. South Africa has an abundance of critical minerals which could be used for the twin transition. Knowledge of how to take advantage of such minerals requires an understanding of the international demand and use of critical minerals. The EU has already done a thorough situation analysis regarding the demand and different uses of critical minerals. Such knowledge could be beneficial to the Department of Mineral Resources and Energy as they are developing the strategy.

6.2.3 Mining Sector Strategy South Africa and potential alignment with the EU partnership

Definition of 'responsible mining' (according to Mining Charter):

- Responsible' mining is defined as increasing economic participation, ownership, access to resources and opportunities, and wage equality for women, youth and persons with disabilities.

- Stronger legislation and monitoring to prevent accidents and related fatalities.

- Limit the incidence of illegal mining, which is partially fueled by growing unemployment and economic constraints in many other sectors. Small-scale mining should also be encouraged,

to prevent illegal mining. Supporting artisanal miners will encourage legitimate mining, particularly if backed by a framework on how to support artisan miners – this framework will have to be developed.

Mining Charter (adopted 2002, revised 2010 and 2018) – mining sector development vision
SA sees opportunities in the energy and transport transformation process, both for its mining sector as well as for the wider development perspectives stemming from promoting value-added activities.

Following key goals:
Economic transformation & job creation, incl
- Growth of jobs
- Industrialization and local growth
- Transformed, diversified and sustainable minerals sector contributing to economic growth
-

This includes battery minerals such as lithium, cobalt, platinum, vanadium and copper. There will be numerous opportunities for both local and international investors in the platinum industry and battery minerals commodities. These opportunities need to be managed in a way that will ensure the sustainability of the mining industry. It is also key to move from a raw export economy to a processing economy.

The promotion of local beneficiation is manifested in legislation and by way of various regulations, such as for instance the Mineral and Petroleum Resources Development Act which states that 'If the Minister, acting on advice of the Board and after consultation with the Minister of Trade and Industry, finds that a particular mineral can be beneficiated economically in South Africa, the Minister may promote such beneficiation…'.

Furthermore, access for beneficiating products to international markets can be improved. This can be done by using bilateral and multilateral agreements to facilitate preferential access, which would increase exports of manufactured products.

To address the lack of innovation in mining beneficiation, investment in research and development will be increased. There will also be a focus on upskilling and increasing capacity, to diversify products and improve the country's manufacturing capability.

The Mining sector seen as critical for wider economic growth, job creation and transformation objectives of the country.
Key for the promotion of the sector and mining activities outcomes is 'research', i.e.
- Geological research
- Research in beneficiation (skills)
- Research in manufacturing (i.e. extended downstream)

Council for Geoscience (GCS) will be transformed and streamlined so as to become a trustworthy partner of commercial businesses. Battery metals will be prioritized in the future.
Investment in exploration to be promoted through implementation of the Geoscience Technical Programme, especially for battery metals, which remain insufficiently explored. Also, RSA is actively looking for new sources of funding for exploration. World Bank and RICS are explicitly mentioned – so here might be a way in for the EU.

Reduce licensing turn-around times
Also stronger reliability of the policy and regulators environment is regarded as important to attract long-term financial investments into the mining and energy industries.

Social issues:

- Programme on reviving mining towns, based on partnerships between DMRE and mining companies, as well as on collaborative
- Efforts between mining companies and municipalities.

6.2.3 Risk assessment

The JET IP has developed a risk assessment that outlines the key risks and planned mitigation measures to the Just Transition in South Africa.

Table 15: Just Transition Risk Assessment and mitigation measures

Risk	Risk Level	Mitigation measure	Residual Risk
Capacity risk: Implementing institutions may have limited experience or skills to implement activities.	High	Projects will be selected with reference to the capacity, knowledge, and sector-specific experience of the implementing institutions and their understanding of regulations and approval requirements. Technical assistance will be provided as necessary to build capacity and support implementation.	Low
Financial risk: This includes debt and credit worthiness, currency risk, and insufficient funding. The national debt position may worsen, leading to an adverse impact on the country's credit rating and undermining its potential to raise funds in the market on favourable terms. As such, there may be insufficient funding to meet the financing needs of the JET IP.	High	JET IP initiatives will follow strict guidelines from National Treasury to ensure debt and credit worthiness considerations have been incorporated in their financing. Risk-appropriate instruments will be deployed in a targeted manner to address specific barriers. Design considerations will be built-in to mobilise additional funding from a range of sources including DFIs, MDBs, climate finance, philanthropies, and the private sector, among others.	Medium
Implementation risk: Private sector projects are delayed by financing, pricing, technology factors, or challenges at local construction sites.	High	Given the multi-sectoral, multi-stakeholder and inter-dependent nature of the JET IP projects and programmes, government will establish mechanisms to monitor such developments and escalate intervention measures where required.	Medium
Policy risk: There may be delays in design and implementation of key reforms needed to provide certainty to the market and key players for their long-term participation in the JET IP's implementation.	High	Clear, long-term policy signals from government and relevant entities will be provided to ensure a predictable regulatory environment that facilitates participation of the private sector and other stakeholders.	Low
Regulatory risk: The risk that regulatory provisions, consistent with efficient licensing, approvals, and cost-reflective tariffs, are not unequivocally adopted by the energy regulator and other regulators, thereby creating	High	The regulatory regime to support the energy sector policy reforms will be resolved to create long-term certainty for energy infrastructure investment.	Medium

Funded by
the European Union

Risk	Risk Level	Mitigation measure	Residual Risk
uncertainty for investments by SOCs, government financiers, and the private sector			
Social risk: Transition efforts will directly and indirectly affect the communities in the coal regions in the short and long terms. These effects must be proactively managed through systematic and real-time efforts.	High	A guideline on just transition financing, including eligibility, relevant entry points, and other key considerations will be provided by government to ensure the most effective and efficient use of available funds. Regular monitoring and coordination across government and implementing institutions, along with regular stakeholder consultations, will ensure that the right types of funds reach the right beneficiaries by addressing their specific needs, while reducing wastage.	Medium
Political risk: including uncertainty caused by national / provincial / local political processes and changes.	. High	The JET IP and its associated policies will be integrated into the long-term country transition pathway planning, so potential short-term political instability does not shift its priorities and adversely affect its implementation timelines.	Medium
Corruption risk: given the multiplicity of entities involved and including potential state capture and misappropriation of funds that can drive funding away from its intended use, resulting in theft, wastage of scarce domestic and international, public, and private capital.	High	Regular monitoring and oversight by a JET IP unit, transparency, tight localised governance structures, and clear safeguards around the use of the funds, along with the periodic reporting and evaluation of the JET IP's progress, will offer tight controls to ensure minimum wastage and prevent the misuse of funds.	Medium
Capital deployment risk: given that some of the funding offers may be dependent on third party intermediaries subject to their own deployment processes and/or project-by-project approval, there is a risk that the access to capital can be delayed or not accessible.	Medium	A JET IP unit will monitor the scale and pace of translation of capital commitments to capital deployed. It will ensure that the implementation plan and access to funding are aligned, focussing on programmatic rather than project-level funding deployments.	Low
Technology risk: Lack of access to new technology from international markets, procurement delays to implementation, challenges with integrating technology to local conditions, knowledge, skills, capacity gaps in managing the installation, operation	Medium	Government will ensure a supportive enabling environment, including predictable and smooth procurement guidelines and the strategic use of public and development finance, to enable technology transfer. Technical assistance and capacity building to expand technical and local capacity will be provided as necessary by the government and its partners. Additional infrastructure and	Low

Funded by
the European Union

Risk	Risk Level	Mitigation measure	Residual Risk
and maintenance of solutions in local markets, among others.		performance guarantees will be provided on a case-by-case basis to facilitate technology transfer.	
Global economic risk: The volatility of international markets, caused by unexpected events, such as a pandemic, war, or political unrest, may have adverse impacts on the availability of funds through public and private sources.	Medium	Regular monitoring of the JET IP will be carried out and a funding strategy adjusted in light of changing macroeconomic considerations.	Medium
Private sector risk: A lack of predictable regulatory environment, a low level of awareness about provisions and programmes, a prevalence of real and perceived risk may discourage private sector engagement and participation in the implementation of the JET IP.	Medium	Clear policy signals by the government, the targeted use of limited public and concessional resources to mitigate real and perceived risks, the use of fit -or-purpose instruments, demonstration projects, public awareness campaigns, and ongoing consultations will be key components of the implementation process.	Low
Safeguards risk: in case of environmentally sensitive regions or sites, vulnerable communities, excluded groups may be impacted by implementation of one or more activities.	Medium	The JET IP implementation will follow the national government and implementing institutions' safeguards measures. Appropriate environmental management and social development measures will be incorporated into the design of projects and programmes. Technical assistance can be provided to upgrade and enhance domestic capacity to implement good practice safeguard measures.	Low
Public health risks: The recent Covid-19 pandemic has illuminated how such an event could be highly disruptive to implementation and undermine the availability of domestic and international financing, as funds are diverted to urgent needs.	Low	Based on lessons learned over the recent pandemic, the JET IP and its associated planning mechanisms will incorporate global health hazards safeguards, while designing scenario interventions. This will include securing long-term, predictable finance, on the best possible terms are locked in order to avoid disruption should availability be constrained in an uncertain market scenario.	Low

In the light of persistent recent power outages, South Africa is aggressively pursuing a path to alternative energy sources. An overview of current green energy projects in South Africa is provided in the APPENDIX_6.1_GREEN_DEAL.

Funded by
the European Union

7. Opportunities for responsible investments

7.1. Proposal of projects to be presented as fact sheets in WP7

7.1.1 Identification of individual exploration, mining and refining projects

In consultation with BGR, we have selected the following projects for assessment as potential investment targets in South Africa.

Project	CRM
Phalaborwa	REE
Zandkopsdrift	REE (Mn sulfate)
Platreef [smelter]	PGE
Sherwood EMM [smelter]	Mn sulfate
Mokopane (Bushveld Minerals)	V
Steelpoortdrift (Vanadium Resources)	V
Zebediale (ZEB Nickel Corp.)	Ni-PGE
Waterberg (Platinum Group Metals)	PGE
Manganese Metal Co. [smelter]	Mn

Fact sheets for each of these projects are being developed by BGR. In addition, two recycling operations were also identified by WRF, and are included in this list:

Project	CRM
Desco Electronic Recyclers	WEEE and associated plastic waste as well as ferrous/ non-ferrous metals recovery.
Kusini Resources Proprietary Limited	Mine waste recycling and value recovery. PGM recovery from catalysts

SPOTLIGHT: MMC

Manganese Metals Company (MMC)

MMC's refinery is situated in Mbombela (Nelspruit), South Africa.

In operation since 1974, It is the world's only producer of high-grade electrolytic manganese metal (EMM) outside China and the world's largest refinery of 99.9% (selenium-free) EMM.

Production: 28000 tpa

Exported: 95%

Employees: 400+

Supplies various quality grades of EMM to a niche market of over 120 established customers in 20 countries.

A new project is underway to produce High Purity Manganese Sulphate Monohydrate (HP MSM) for the battery market.

WHAT TO CONSIDER IF YOU INVEST IN SOUTH AFRICA

Strong Points

South Africa has large market potential, well developed infrastructure and a competitive domestic economy. The country's democracy is also well-established and the rule of law is observed. As a

productive pole, it is the most industrialised, technologically advanced and diversified economy on the African continent.

South Africa's main assets are: The business climate is good and state financial management is competent. The country enjoys a good-sized and active stock exchange. South Africa has shifted from its traditional industries to production and financial services, which are the main contributors to GDP. The tourism and retail sectors have a great potential. The mining sector is a major part of the economy. It is the world's largest producer of chrome, manganese, platinum, vanadium and vermiculite. It is the second largest producer of ilmenite, palladium, rutile and zirconium. It is the world's third largest coal exporter. South Africa is also a huge exporter of diamonds and iron ore (U.S. Geological Survey). The country also enjoys a strategic geographical location, that makes it an ideal hub to access the sub-Saharan markets.

Weak Points

The economic stability of the country has been weakened by the strict lockdown, which has exacerbated social tensions such as widespread poverty and inequality. Investment (13% of GDP) is also at a standstill due to a lack of business confidence and the postponement of public capital expenditure linked to the diversion of funds for emergency needs. Other problems may discourage foreign investors: increased labour strikes in recent years, which rating agencies have warned could further lower South-Africa's credit rating, violence and corruption continue to hinder the economy, while income inequality remains high. Access to electricity is insufficient because of a lack of investment. Lack of high-skilled labour force, high unemployment (33.6% in 2021), rigidity of the labour market immigration laws make the employment of foreign workers more complicated. Import-export process may be difficult. Economy depends on the ore prices and FDI inflows. Market entry is very competitive, as the market is very mature **(Lloyds Bank 2023).**

Conclusion

South Africa is a country that is vastly rich in mineral resources. The limited scope of this report precludes an in-depth treatment of all aspects of the country; rich geology, and the ecosystem of supports systems, institutes of learning, legislation and industry that has developed over more than a century in support of this mineral wealth.

This report provides the reader with an overview of the current scenario and key aspects of CRM prospectivity, institutions and potential in South Africa. The report is an integral part of the larger AfricaMaVal programme and, in that context, provides this country overview specifically aimed at Eu investors and decision-makers. The report demonstrates South Africa's suitability as a destination of choice for stable future CRM supply to the EU.

South Africa remains a significant target for mineral investment in the African continent, despite the rise in the importance of other mining jurisdictions. Its mineral industry is well developed, with a full suite of complimentary institutions and a relative stable economic and regulatory environment.

South Africa's mining and mineral industry is vast and complex. Despite the decline of mining's relative importance in terms of absolute contribution to GDP, it has shaped the landscape of the country, its infrastructure development and labour relations in ways that remain evident to the present day. The new global demand for CRM's has seen South Africa ready to engage with buyers and investors from all over the world and, given the persistent decline of the traditional mineral commodities since the 2008 global financial crisis, this interest is met with eager anticipation from a variety of stakeholders within well-organised sectors in the country.

As a supplier of Critical Raw Minerals, South Africa presents a rich and diverse range of options for mineral investment and exhibits potential for downstream industry development.

The country admittedly has many challenges to investment and sustained growth, including the current electricity crisis and impending elections, in 2024, which may signal a further change in the current dominance of the ruling party.

Funded by
the European Union

References

African Development Bank, (2017). South Africa, in African Economic Outlook 2017: Entrepreneurship and Industrialisation. OECD. https://www.oecd-ilibrary.org/development/african-economic-outlook-2017_aeo-2017-en

African Development Bank, (2018). Republic of South Africa Country Strategy Paper 2018-2022, Southern Africa Development and Business Delivery Office (RDGS). AfDB. https://www.afdb.org/en/documents/document/south-africa-country-strategy-paper-2018-2022-103236

African Development Bank, (2022). South Africa Mid-Term Review of the Country Strategy Paper 2018- 2022 and Country Portfolio Performance Review 2021. AfDB. https://www.afdb.org/en/documents/south-africa-mid-term-review-country-strategy-paper-2018-2022-and-country-portfolio-performance-review-2021

African Development Bank, (2023). African Economic Outlook 2023. AfDB. https://www.afdb.org/en/knowledge/publications/african-economic-outlook

Afrobarometer. 2021. Afrobarometer Round 8 Survey in South Africa: Summary of Results. Available at: https://www.afrobarometer.org/publication/summary-results-afrobarometer-round-8-survey-south-africa-2021-0/ (Accessed May 2023)

Anhaeusser, C. R. (1969). A comparison of pebble and fold deformations in the Nelspruit granite contact aureole, Barberton Mountain Land. South African Journal of Geology, 72(2), 49-60.

Anhaeusser, C. R. (1975). Precambrian tectonic environments. Annual Review of Earth and Planetary Sciences, 3, 31.

Anhaeusser, C. R. (1981). Geotectonic evolution of the Archaean successions in the Barberton Mountain land, South Africa. In Developments in Precambrian Geology, 4, 137-160. Elsevier.

Anhaeusser, C. R., & Wilson, M. G. C. (Eds.). (1998). The Mineral Resources of South Africa. Council for Geoscience.

Armstrong, R. A., Compston, W., De Wit, M. J., & Williams, I. S. (1990). The stratigraphy of the 3.5-3.2 Ga Barberton Greenstone Belt revisited: a single zircon ion microprobe study. Earth and Planetary Science Letters, 101(1), 90-106.

Arvis et al., 2018. Connecting to Compete 2018. Trade Logistics in the Global Economy. The Logistics Performance Index and Its Indicators. The International Bank for Reconstruction and Development/The World Bank, 82 p.

Arvis et al., 2018. Connecting to Compete 2018. Trade Logistics in the Global Economy. The Logistics Performance Index and Its Indicators. The International Bank for Reconstruction and Development/The World Bank, 82 p.

Begbie, L. (2022). South Africa's Debt Sustainability: A Multi-factor Approach. University of Cape Town unpublished manuscript. https://open.uct.ac.za/handle/11427/37062

Bench Marks Foundation, Policy Gap 12, Waiting to Inhale, 2017

Bench Marks Foundation, Policy Gap 12, Waiting to Inhale, 2017

Blengini, G.A., Latunussa, C.E.L., Eynard, U., Torres de Matos, C., Wittmer, D., Georgitzikis, K., Pavel, C., Carrara, S., Mancini, L., Unguru, M., Blagoeva, D., Mathieux, F., Pennington, D., 2020. Study on the EU's list of Critical Raw Materials (2020). Final report. European Commission, ISBN 978-92-76-21049-8, doi: 10.2873/11619, 158 p.

Blengini, G.A., Latunussa, C.E.L., Eynard, U., Torres de Matos, C., Wittmer, D., Georgitzikis, K., Pavel, C., Carrara, S., Mancini, L., Unguru, M., Blagoeva, D., Mathieux, F., Pennington, D., 2020. Study on the EU's list of Critical Raw Materials (2020). Final report. European Commission, ISBN 978-92-76-21049-8, doi: 10.2873/11619, 158 p.

BMC Public Health, Health and Wellbeing needs and priorities in mining host communities in South Africa: a mixed-method approach for identifying key SDG3 targets, 2022.

BMC Public Health, Health and Wellbeing needs and priorities in mining host communities in South Africa: a mixed-method approach for identifying key SDG3 targets, 2022.

Bordy, E. M., & Eriksson, P. (2015). LITHOSTRATIGRAPHY OF THE ELLIOT FORMATION (KAROO SUPERGROUP), SOUTH AFRICA. South African Journal of Geology: Being the Transactions of the Geological Society of South Africa = Suid-Afrikaanse Tydskrif Vir Geologie: Syndie Die Verhandelinge van Die Geologiese Vereniging van Suid-Afrika, 118(3), 311–316.

Botha, Z. 2023. A glass half full for SA for SA exploration and Mining. SAIMM Journal online. Monday, 11 September 2023. https://www.saimm.co.za/journal-presidents-corner/1042-a-glass-half-full-for-sa-for-sa-exploration-and-mining

Bowmans Attorneys, Guide-Environmental law in South Africa, 2020

Bowmans Attorneys, Guide-Environmental law in South Africa, 2020

Bowmans. (2018). A brief guide to doing business in South Africa, 2018. Johannesburg: Bowmans.

Brandl, G., Cloete, M., Anhaeusser, C. R., Johnson, M. R., & Thomas, R. J. (2006). Archaean greenstone belts. In The Geology of South Africa. 9-56. Geological Society of South Africa/Council for Geoscience Johannesburg/Pretoria.

Byerly, G. R. (1999). Komatiites of the Mendon Formation: Late-stage ultramafic. Geologic Evolution of the Barberton Greenstone Belt, South Africa, 329, 189.

CAMERON, E. N. (1978). The lower zone of the eastern Bushveld Complex in the Olifants River trough. Journal of Petrology, 19(3), 437-462.

Carranza E. J. M., 2017. Natural resources research publications on geochemical anomaly and mineral potential mapping, and introduction to the special issue of papers in these fields. Natural Resources Research 26(4), 379-410.

Carranza E. J. M., 2017. Natural resources research publications on geochemical anomaly and mineral potential mapping, and introduction to the special issue of papers in these fields. Natural Resources Research 26(4), 379-410.

Cawthorn, R. G. (2015). The Bushveld Complex, South Africa. In Layered intrusions. 517-587) Springer, Dordrecht.

Cawthorn, R. G., Lee, C. A., Schouwstra, R. P., & Mellowship, P. (2002). Relationship between PGE and PGM in the Bushveld Complex. The Canadian Mineralogist, 40(2), 311-328.

Centre for Applied Legal Studies, The Social and labour Plan Series, Phase 1: System Design Trends Analyses, 2016

Centre for Applied Legal Studies, The Social and Labour Plan Series, Phase 2: Implementation Operation Analyses Report, 2017

Centre for Applied Legal Studies, The Social and Labour Plan Series, Phase 3: Alternative Models for Mineral-Based Social Benefit, 2018

Centre for Applied Legal Studies, The Social and labour Plan Series, Phase 1: System Design Trends Analyses, 2016

Centre for Applied Legal Studies, The Social and Labour Plan Series, Phase 2: Implementation Operation Analyses Report, 2017

Centre for Applied Legal Studies, The Social and Labour Plan Series, Phase 3: Alternative Models for Mineral-Based Social Benefit, 2018

Centre for Environmental Rights and Lawyers for Human Rights, Mining and Your Community: Know Your Environmental Rights, 2014

Centre for Environmental Rights and Lawyers for Human Rights, Mining and Your Community: Know Your Environmental Rights, 2014

Centre for Environmental Rights, Environmental Compliance Monitoring and Enforcement at Mines: The Department of Mineral Resources and Energy's Performance During the Financial Years 2017 to 31 March 2019, 2020

Centre for Environmental Rights, Environmental Compliance Monitoring and Enforcement at Mines: The Department of Mineral Resources and Energy's Performance During the Financial Years 2017 to 31 March 2019, 2020

Centre for Environmental Rights, et al. 2016. The threats to human rights from mining and coal-fired power production in South Africa. Universal Periodic Review of South Africa 2017.

Coetzee, L. L. (2001). Genetic Stratigraphy of the Paleoproterozoic Pretoria Group in the Western Transvaal, Master of Science, University of Johannesburg. https://search.proquest.com/openview/1619ae6f5bc07914739a84e72b17fc59/1?pq-origsite=gscholar&cbl=2026366&diss=y

Coface, (2023). South Africa Economic Analysis. Coface for Trade. https://www.coface.com/Economic-Studies-and-Country-Risks/South-Africa

Coffin, M. F., & Eldholm, O. (1994). Large igneous provinces: crustal structure, dimensions, and external consequences. Reviews of Geophysics, 32(1), 1-36.

Dai Global, LLC. 2022. Study on a potential EU - South Africa partnership on Raw Materials Value Chains. Trade and Private Sector Development (TPSD) FacilityDann, J. C. (2000). The 3.5 Ga Komati Formation, Barberton greenstone belt, South Africa, part I: new maps and magmatic architecture. South African Journal of Geology, 103(1), 47-68.

Development Alternatives Incorporated (DAI Global), LLC. Trade and Private Sector Development (TPSD) Facility. *Study on a potential EU - South Africa partnership on Raw Materials Value Chains*. August 2022.

De Swardt, T. (2022). Determining the risk of a sovereign debt default in South Africa and the consequences thereof; an international overview. University of Stellenbosch. https://www.ekon.sun.ac.za/blog/2022-3-23-stellenbosch-students-win-priz/tiaan-de-swardt---budget-speech-.pdf

De Wit, M. J., Furnes, H., & Robins, B. (2011). Geology and tectonostratigraphy of the Onverwacht Suite, Barberton greenstone belt, South Africa. Precambrian Research, 186(1-4), 1-27.

Deloitte, (2022, December 2). Africa Economic Outlook. Deloitte Insights. https://www2.deloitte.com/us/en/insights/economy/emea/africa-economic-outlook-03-2022.html

Deloitte, (2023, April). South Africa Economic Outlook. Deloitte. https://www2.deloitte.com/xe/en/insights/economy/emea/africa-economic-outlook-04-2023.html

Department of Forestry, Fisheries and Environment, Environmental Impact Assessment Amendment Regulations, 2014

Department of Forestry, Fisheries and Environment, Environmental Impact Assessment Amendment Regulations, 2014

Department of Forestry, Fisheries and Environment, Financial Provisioning Regulations, 2015

Department of Forestry, Fisheries and Environment, Financial Provisioning Regulations, 2015

Department of Forestry, Fisheries and Environment, National Environmental Management Act, 107, of 1998

Department of Forestry, Fisheries and Environment, National Environmental Management: Air Quality Act, 39, of 2004

Department of Forestry, Fisheries and Environment, National Environmental Management: Protected Areas Act, 57, of 2003

Department of Forestry, Fisheries and Environment, National Environmental Management: Waste Act, 59, of 2008

Department of Forestry, Fisheries and Environment, National Environmental Management Act, 107, of 1998

Department of Forestry, Fisheries and Environment, National Environmental Management: Air Quality Act, 39, of 2004

Department of Forestry, Fisheries and Environment, National Environmental Management: Protected Areas Act, 57, of 2003

Department of Forestry, Fisheries and Environment, National Environmental Management: Waste Act, 59, of 2008

Department of Mineral Resources and Energy (DMRE), (2022). The Exploration Strategy for the Mining Industry of South Africa. DMR. https://www.energy.gov.za/files/policies/Exploration-Strategy-for-the-Mining-Industry-of-SA.pdf

Department of Mineral Resources and Energy, Amendment Regulations, 2020

Department of Mineral Resources and Energy, Amendment Regulations, 2020

Department of Mineral Resources and Energy, Assessment of the Broad-Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry (Mining Charter), May 2015

Department of Mineral Resources and Energy, Assessment of the Broad-Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry (Mining Charter), May 2015

Department of Mineral Resources and Energy, Broad-Based Socio-Economic Empowerment Charter for the Mining and Minerals Industry, 2018

Department of Mineral Resources and Energy, Broad-Based Socio-Economic Empowerment Charter for the Mining and Minerals Industry, 2018

Department of Mineral Resources and Energy, Mine Community Resettlement Guidelines, 2022

Department of Mineral Resources and Energy, Mine Community Resettlement Guidelines, 2022

Department of Mineral Resources and Energy, Mine Health and Safety Act, 29, of 1996

Department of Mineral Resources and Energy, Mine Health and Safety Act, 29, of 1996

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Act: Artisanal and Small-Scale Mining Policy, 2022

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Act, 28, of 2002

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Regulations, 2004

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Royalty Act, 28, of 2008

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Act: Artisanal and Small-Scale Mining Policy, 2022

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Act, 28, of 2002

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Development Regulations, 2004

Department of Mineral Resources and Energy, Minerals and Petroleum Resources Royalty Act, 28, of 2008

Department of Rural Development and Land Reform, Interim Protection of Informal Land Rights Act, 31, of 1996

Department of Rural Development and Land Reform, Interim Protection of Informal Land Rights Act, 31, of 1996

Department of Trade Industry and Competition (DTIC), (2010). A South African Trade Policy and Strategy Framework. DTIC. https://www.tralac.org/files/2012/12/Trade-Policy-and-Strategy-Framework-2010.pdf

Department of Trade Industry and Competition (DTIC), (2021). A Trade Policy for Industrial Development and Employment Growth. DTIC. http://www.thedtic.gov.za/wp-content/uploads/SA_Trade_Policy.pdf

Department of Trade Industry and Competition (DTIC), (2022). Report on South Africa's Trade Portfolio, Presentation to the Select Committee on Trade and Industry. Economic Development, Tourism, Employment and Labour DTIC. http://www.thedtic.gov.za/media-room/parliamentary-presentations/presentations/

Department of Trade Industry and Competition (DTIC), (2023). Trade Agreements. DTIC. http://www.thedtic.gov.za/sectors-and-services-2/1-4-2-trade-and-export/market-access/trade-agreements/

Dept. Science and Innovation. (2021). Hydrogen Society Roadmap for South Africa 2021. Pretoria: Department of Science and Innovation.

DMRE. (2021). Annual Report 2020/21. Pretoria: Department of Mineral Resources and Energy.

DMRE. (2022). D1-2022 Operating Mines, Quarries and Mineral Processing Plants in SA. Pretoria: Department of Mineral Resources and Energy.

Du Plessis, L, Mining and land rights in South Africa: How has the Maledu judgement empowered rural communities?, 2022.

Du Plessis, L, Mining and land rights in South Africa: How has the Maledu judgement empowered rural communities?, 2022.

Dziggel, A., Stevens, G., Poujol, M., Anhaeusser, C. R., & Armstrong, R. A. (2002). Metamorphism of the granite–greenstone terrane south of the Barberton greenstone belt, South Africa: an insight into the tectono-thermal evolution of the 'lower' portions of the Onverwacht Group. Precambrian Research, 114(3-4), 221-247.

Eales, H. V., & Cawthorn, R. G. (1996). The bushveld complex. In Developments in petrology, 15, 181-229. Elsevier.

Economist Intelligence Unit. 2023. Democracy Index 2022: Frontline democracy and the battle for Ukraine. London, EIU.

Edwards, L, (2021). South Africa's International Trade. PRISM Working Paper 2021-1. School of Economics and PRISM. University of Cape Town. https://commerce.uct.ac.za/sites/default/files/content_migration/commerce_uct_ac_za/869/files/PRISM%2520Working%2520Paper%25202021-1%2520-%2520Lawrence.pdf

Edwards, L. and Lawrence, R. (2012). South African Trade Policy and the Future Global Trading Environment. SAIIA Occasional Paper No 128. SAIIA. https://saiia.org.za/research/south-african-trade-policy-and-the-future-global-trading-environment/

Eglington, B. M., & Armstrong, R. A. (2004). The Kaapvaal Craton and adjacent orogens, southern Africa: a geochronological database and overview of the geological development of the craton. South African Journal of Geology: Being the Transactions of the Geological Society of South Africa = Suid-Afrikaanse Tydskrif Vir Geologie: Syndie Die Verhandelinge van Die Geologiese Vereniging van Suid-Afrika, 107(1-2), 13–32.

Embellie Advisory, Towards a Sustainable Mining Environment in South Africa, 2023

Embellie Advisory, Towards a Sustainable Mining Environment in South Africa, 2023

ENCA, Mining halted at Mapungubwe heritage site, for now, 10 September 2017

Eriksson, K. A. (1980). Transitional sedimentation styles in the Moodies and Fig Tree Groups, Barberton mountain land, South Africa: Evidence favouring an Archean continental margin. Precambrian Research, 12(1-4), 141-160.

Eriksson, P. G., Mazumder, R., Catuneanu, O., Bumby, A. J., & Ountsché Ilondo, B. (2006). Precambrian continental freeboard and geological evolution: A time perspective. Earth-Science Reviews, 79(3), 165–204.

Eversheds Sutherland, Harmonising Corporate Governance Framework for South African Mining Companies: King IV, Companies Act and the Mining Charter, 2019

Eversheds Sutherland, Harmonising Corporate Governance Framework for South African Mining Companies: King IV, Companies Act and the Mining Charter, 2019

Fasken Attorneys, Amendments to the Minerals and Petroleum Resources Development Regulations, 2020

Fasken Attorneys, Amendments to the Minerals and Petroleum Resources Development Regulations, 2020

Fortunato, A. (2022). Getting Back on the Curve: South Africa's Manufacturing Challenge. CID Working Paper No 139. Harvard University. https://growthlab.hks.harvard.edu/publications/getting-back-curve-south-africa-manufacturing-challenge

Fraser Institute , Annual Survey of Mining Companies, 2021

Fraser Institute , Annual Survey of Mining Companies, 2021

Fuchs, S., Williams-Jones, A. E., & Przybylowicz, W. J. (2016). The origin of the gold and uranium ores of the Black Reef Formation, Transvaal Supergroup, South Africa. In Ore Geology Reviews, 72, 149–164. https://doi.org/10.1016/j.oregeorev.2015.07.010

G.G. . (27 Sept 2018). Based Socio- Economic Empowerment Charter for the Mining and Minerals Industry, 2018. Pretoria: GOVERNMENT GAZETTE .

Gibson, R. L., Robb, L. J., & Kisters, A. F. M. (1996). Regional setting and geological evolution of the Okiep Copper District, Namaqualand, South Africa. South African Journal of Geology. https://journals.co.za/doi/abs/10.10520/EJC-92e742794

Global Change Institute, Looking at innovative ways to utilise mining land post closure, 2023.

Global Change Institute, Looking at innovative ways to utilise mining land post closure, 2023.

Good, N., & De Wit, M. J. (1997). The Thabazimbi-Murchison lineament of the Kaapvaal craton, South Africa: 2700 Ma of episodic deformation. Journal of the Geological Society, 154(1), 93-97.

Government of the Republic of South Africa. 2018. Broad-Based Socio-Economic Empowerment Charter for the Mining and Metals Industry, 2018. Government Gazette (No. 41934) on 27th September 2018

Government of the Republic of South Africa. Mineral and Petroleum Resources Development Act, No.28 of 2002

Government of the Republic of South Africa. Mineral and Petroleum Resources Development Act, No.28 of 2002: Publication of the Codes of Good Practice for the Minerals Industry. Government Gazette (No.32167) on 29 April 2009

Government of the Republic of South Africa. The Constitution of the Republic of South Africa, Act No.108 of 1996.

Grab, S., & Knight, J. (2015). Landscapes and Landforms of South Africa—An Overview. In S. Grab & J. Knight (Eds.), Landscapes and Landforms of South Africa, 1–9. Springer International Publishing.

Grosch, E. G., Kosler, J., McLoughlin, N., Drost, K., Slama, J., & Pedersen, R. B. (2011). Paleoarchean detrital zircon ages from the earliest tectonic basin in the Barberton Greenstone Belt, Kaapvaal craton, South Africa. Precambrian Research, 191(1-2), 85-99.

groundwork, Centre for Environmental Rights, Human Rights Watch, Earthjustice, We know our lives are in danger, 2019.

groundwork, Centre for Environmental Rights, Human Rights Watch, Earthjustice, We know our lives are in danger, 2019.

Groupe Credit Agricole, (2023). South Africa Economic and Political Overview. GCA. https://international.groupecreditagricole.com/en/international-support/south-africa/economic-overview

Gubanov, A. P., & Mooney, W. D. (2009, December). New global geological maps of crustal basement age. In AGU Fall Meeting Abstracts, 2009,T53B-1583).

Gutzmer, J. (1996). Genesis and alteration of the Kalahari and Postmasburg manganese deposits, Griqualand West, South Africa: Unpublished Ph. D. thesis, Johannesburg, Rands Afrikaans University.

Hamman, J. N., Rozendaal, A., & Jordaan, W. (1996). Gabbro-norite-hosted Ni-Cu-(Co)-sulphide mineralization in southern Namaqualand and its relationship to the cupriferous

Hausmann, R, Sturzenegger, F, Goldstein, P, Muci, F and Barrios, D. (2022). Macroeconomic risks after a decade of microeconomic turbulence: South Africa 2007–2020. SA-Tied Working Paper No. 206. UNU-WIDER. https://www.wider.unu.edu/publication/macroeconomic-risks-after-decade-microeconomic-turbulence#:~:text=South%20Africa%20(2007%E2%80%932020)&text=Real%20GDP%20growth%20decelerated%20more,rapidly%20rising%20public%20debt%20load.

Hayes, E, Spotlight: Mining Law in South Africa, The Mining Law Review, 11th Edition, 2022

Hayes, E, Spotlight: Mining Law in South Africa, The Mining Law Review, 11th Edition, 2022

Heinrichs, T. K., & Reimer, T. (1977). A sedimentary barite deposit from the Archean Fig Tree Group of the Barberton Mountain Land (South Africa). Economic Geology, 72(8), 1426-1441.

Hofmann, A. (2005). The geochemistry of sedimentary rocks from the Fig Tree Group, Barberton greenstone belt: Implications for tectonic, hydrothermal and surface processes during mid-Archaean times. Precambrian Research, 143(1-4), 23-49.

Honohan, P. and Orphanides, A. (2022). Monetary Policy in South Africa 2007–21. WIDER Working Paper 2022/29. UNU-WIDER. https://www.wider.unu.edu/publication/monetary-policy-south-africa-2007%E2%80%9321

https//:www.mineralscouncil.org.za/about/board-and office-bearers

https//:www.mineralscouncil.org.za/about/board-and office-bearers

Independent Electoral Commission. 2022. Democracy's dividend: results from the voter participation survey (VPS) 2021. IEC, Centurion

Independent Electoral Commission. 2023. Results Dashboard. Available at: https://results.elections.org.za/dashboards/npe/app/dashboard.html (Accessed May 2023)

Industrial Development Corporation (IDC), (2013, December). South African Economy: An overview of key trends since 1994. IDC Department of Research and Information. https://www.idc.co.za/wp-content/uploads/2018/11/IDC-RI-publication-Overview-of-key-trends-in-SA-economy-since-1994.pdf

Industrial Development Corporation (IDC), (2023, February). Economic Overview: Recent developments in the global and South African Economies. IDC Department of Research and Information. https://www.idc.co.za/economic-overview-recent-developments-in-the-global-and-south-african-economies/

ING Bank, (2023). South Africa: Key takeaways from the 2023 budget. ING Bank N.V. https://think.ing.com/articles/south-africa-key-takeaways-from-the-2023-budget/#:~:text=Real%20GDP%20growth%20is%20forecast,and%20a%20less%20supportive%20global

International Council for Mining and Metals, Social and Economic Reporting Framework and Guidance, 2022

International Council for Mining and Metals, Social and Economic Reporting Framework and Guidance, 2022

International Monetary Fund (IMF), (2020). South Africa: 2019 Article IV Consultation —Press Release; Staff Report; and Statement by the Executive Director for South Africa, IMF Country Report No. 20/33. IMF. https://www.imf.org/en/Publications/CR/Issues/2020/01/29/South-Africa-2019-Article-IV-Consultation-Press-Release-and-Staff-Report-and-Statement-by-49003

International Monetary Fund (IMF), (2022). South Africa: 2021 Article IV Consultation—Press Release; Staff Report; and Statement by the Executive Director for South Africa, IMF Country Report No. 22/37. IMF. https://www.imf.org/en/Publications/CR/Issues/2022/02/10/South-Africa-2021-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-513001

International Monetary Fund (IMF), (2022). South Africa: Selected Issues. IMF Country Report No. 22/38. IMF. https://www.imf.org/-/media/Files/Publications/CR/2022/English/1ZAFEA2022002.ashx

International Monetary Fund (IMF), (2023a). South Africa: Staff Concluding Statement of the 2023 Article IV Mission. IMF. https://www.imf.org/en/News/Articles/2023/03/21/mcs032223-south-africa-2023-article-iv-mission#:~:text=This%20progress%20is%20welcome%20and,and%20reduce%20poverty%20and%20inequality.&text=Growth.,term%20growth%20outlook%20has%20deteriorated.

International Monetary Fund (IMF), (2023b). South Africa: Article IV Consultation —Press Release; Staff Report; and Statement by the Executive Director for South Africa. IMF Country Report No. 23/194. IMF. https://www.elibrary.imf.org/view/journals/002/2023/194/002.2023.issue-194-en.xml

International Monetary Fund (IMF), (2023c). South Africa: Selected Issues. IMF Country Report No. 23/195. IMF. https://www.imf.org/-/media/Files/Publications/CR/2023/English/1ZAFEA2023002.ashx

International Monetary Fund. 2023. Staff Concluding Statement of the 2023 Article IV Mission. IMF: Washington, DC. Available at: https://www.imf.org/en/News/Articles/2023/03/21/mcs032223-south-africa-2023-article-iv-mission (Accessed May 2023)

Investec (2023), Macro-economic outlook: South Africa's electricity crisis dims the economic growth outlook. Investec Bank. https://www.investec.com/content/dam/south-africa/content-hub/annabel-bishop/sa-economics/documents/Macro-economic-outlook-24-March-2023.pdf

Investec (2023), Rand Note. The Investec View. Investec Bank. https://www.investec.com/en_za/focus/economy/rand-note.html

ITC TRADE MAP. (2023). trade statistics for international business development. Retrieved from Trade Map: https://www.trademap.org/Index.aspx

Johannesburg Stock Exchange, JSE's Sustainability and Climate Change Disclosure Guidance, June 2022

Johnson, M. R., Van Vuuren, C. J., Hegenberger, W. F., Key, R., & Show, U. (1996). Stratigraphy of the Karoo Supergroup in southern Africa: an overview. Journal of African Earth Sciences, 23(1), 3–15.

Kamo, SL, & Davis, DW (1994). Reassessment of Archean crustal development in the Barberton Mountain Land, South Africa, based on U-Pb dating. Tectonics, 13 (1),167-192.

Kaufmann D., Kraay A., Mastruzzi M., 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper 5430.

Kaufmann D., Kraay A., Mastruzzi M., 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. World Bank Policy Research Working Paper 5430.

Kearney, 2023. Foreign Direct Investment Confidence Index 2023, Kearney. https://www.kearney.com/service/global-business-policy-council/foreign-direct-investment-confidence-index

Khamfula, Y. (2004). Macroeconomic policies, shocks and economic growth in South Africa. School of Economic and Business Sciences University of the Witwatersrand. http://www.wits.ac.za https://www.imf.org/external/np/res/seminars/2005/macro/pdf/khamfu.pdf

Kinnaird, J. A. (2005). The Bushveld large igneous province. Review Paper, The University of the Witwatersrand, Johannesburg, South Africa, 39pp.

Kohler, E. A., & Anhaeusser, C. R. (2002). Geology and geodynamic setting of Archaean silicic meta volcaniclastic rocks of the Bien Venue Formation, Fig Tree Group, northeast Barberton greenstone belt, South Africa. Precambrian Research, 116(3-4), 199-235.

Koperberg Suite of the Okiep Copper District, South Africa. South African Journal of Geology: Being the Transactions of the Geological Society of South Africa = Suid-Afrikaanse Tydskrif Vir Geologie: Syndie Die Verhandelinge van Die Geologiese Vereniging van Suid-Afrika, 99(2), 153–168.

Kose, M. Ayhan, and Franziska Ohnsorge, eds. (2020). A Decade after the Global Recession: Lessons and Challenges for Emerging and Developing Economies. Washington, DC: World Bank.

https://thedocs.worldbank.org/en/doc/b9e2c532907731fc33861df9d018b2eb-0350012021/original/Decade-after-global-recession.pdf

Kruener, A., Byerly, G. R., & Lowe, D. R. (1991). Chronology of early Archaean granite-greenstone evolution in the Barberton Mountain Land, South Africa, based on precise dating by single zircon evaporation. Earth and Planetary Science Letters, 103(1-4), 41-54.

Kruger, F. J. (1990). The stratigraphy of the Bushveld Complex: a reappraisal and the relocation of the Main Zone boundaries. South African Journal of Geology, 93(2), 376-381.

Kruger, F. J. (2005). Filling the Bushveld Complex magma chamber: lateral expansion, roof and floor interaction, magmatic unconformities, and the formation of giant chromitite, PGE and Ti-V-magnetite deposits. Mineralium Deposita, 40(5), 451-472.

Ledwaba, P, and Mutemeri, N, Preliminary Study on artisanal and small-scale mining in South Africa, 2017

Lenhardt, N., Eriksson, P. G., Catuneanu, O., & Bumby, A. J. (2012). Nature of and controls on volcanism in the ca. 2.32–2.06Ga Pretoria Group, Transvaal Supergroup, Kaapvaal Craton, South Africa. Precambrian Research 214-215, 106–123.

Llewellyn, L, How South Africa's rural communities are getting a raw deal from mining companies, The Conversation, 14 July 2019

Llewellyn, L, How South Africa's rural communities are getting a raw deal from mining companies, The Conversation, 14 July 2019

Lloyds Bank, (2023). Investing in South Africa. https://www.lloydsbanktrade.com/en/market-potential/south-africa/investment-environment

Loewald, C and M, Stern, eds. (2022) Unlocking growth prospects in post-pandemic South Africa. SARB. https://www.resbank.co.za/content/dam/sarb/what-we-do/research/UNLOCKING%20GROWTH%20PROSPECTS%20FINAL%20050423.pdf

Lowe, D. R., & Byerly, G. R. (Eds.). (1999). Geologic evolution of the Barberton greenstone belt, South Africa, 329. Geological Society of America.

Makua M Pretty, Kola O. Odeku, Harmful mining activities, environmental impacts and effects the mining communities in South Africa: a critical perspective, Environmental Economics (open access), 2017

Makua M Pretty, Kola O. Odeku, Harmful mining activities, environmental impacts and effects the mining communities in South Africa: a critical perspective, Environmental Economics (open access), 2017

Mbere, N and Steenkamp, S, ESG in the South African mining industry: What's missing?, 2022.

Mbere, N and Steenkamp, S, ESG in the South African mining industry: What's missing?, 2022.

McClung, C. R., Gutzmer, J., Beukes, N. J., Mezger, K., Strauss, H., & Gertloff, E. (2007). Geochemistry of bedded barite of the Mesoproterozoic Aggeneys-Gamsberg Broken Hill-type district, South Africa. Mineralium Deposita, 42(5), 537–549.

McCourt, S., Armstrong, R. A., Grantham, G. H., & Thomas, R. J. (2006). Geology and evolution of the Natal belt, South Africa. Journal of African Earth Sciences 46(1), p.71–92.

McNaughton, N. J., Pollard, P. J., Groves, D. I., & Taylor, R. G. (1993). A long-lived hydrothermal system in Bushveld granites at the Zaaiplaats tin mine; lead isotope evidence. Economic Geology, 88(1), 27-43.

Mikomangwa, P. (2022 November, 1). South Africa: Analyzing South Africa's debt trap. The Exchange Online. https://theexchange.africa/countries/south-africa/south-africa-debt/

Minerals Council South Africa, At Work - Community, 2023

Minerals Council South Africa, At Work - Community, 2023

Minerals Council South Africa, Social Impacts and Benefits of Mining, 2022

Minerals Council South Africa, Social Impacts and Benefits of Mining, 2022

Minerals Council. (2019). Mining Industry Transformation Progress Report for 2019. Johannesburg: Minerals Council.

Minerals Council. (2023). Facts & Figures pocketbook 2022. Johannesburg: Minerals Council.

Minerals Council. (2023, June 13). Members. Retrieved from Minerals Council: https://www.mineralscouncil.org.za/about/members

Miyajma, K. (2019). Exchange rate volatility and Pass-Through to Inflation in South Africa. IMF Working Paper WP/19/277. IMF. https://www.imf.org/-/media/Files/Publications/WP/2019/wpiea2019277-print-pdf.ashx#:~:text=To%20shed%20some%20light%20on,limited%20extent%20in%20South%20Africa.

Mthenjane M I, Post-mining use of rehabilitated land – an opportunity for the South African mining industry for sustainable development, The Southern African Institute of Mining and Metallurgy, 2019

Mthenjane M I, Post-mining use of rehabilitated land – an opportunity for the South African mining industry for sustainable development, The Southern African Institute of Mining and Metallurgy, 2019

Nedbank, (2022). What does the July repo rate increase mean for you? Nedbank blog. http://www.personal.nedbank.co.za

NEDLAC, (2023, June). Economic and Employment Trends in South Africa. Issue 3. NEDLAC. https://nedlac.org.za/wp-content/uploads/2023/06/June-2023.pdf

NEDLAC, (2023, March). Economic and Employment Trends in South Africa. Issue 1. NEDLAC. https://nedlac.org.za/wp-content/uploads/2023/03/April-2023-Issue-1_Final.pdf

Newton, A. R., Shone, R. W., Booth, P. W. K., Johnson, M. R., Anhaeusser, C. R., & Thomas, R. J. (2006). The Cape fold belt. The Geology of South Africa, 521-530.

Nex, P. A. M., Cawthorn, R. G., & Kinnaird, J. A. (2002). Geochemical effects of magma addition: compositional reversals and decoupling of trends in the Main Zone of the western Bushveld Complex. Mineralogical Magazine, 66(6), 833-856.

Nyathi, N. (2014). Stratigraphy, sedimentary facies and diagenesis of the Ecca Group, Karoo Supergroup in the Eastern Cape, South Africa [University of Fort Hare]. https://core.ac.uk/download/pdf/145034612.pdf

OECD, (2015). South Africa Policy Brief. OECD Better Policies Series. OECD. https://www.oecd.org/policy-briefs/south-africa-territorial-development-for-more-inclusive-growth.pdf

OECD, (2020). OECD Economic Surveys South Africa. OECD. http://www.oecd.org/economy/south-africa-economic-snapshot/

OECD, (2021, October 14). Tax and fiscal policies after the COVID-19 crisis. OECD Policy Responses to Coronavirus (COVID-19). OECD. https://www.oecd.org/coronavirus/policy-responses/tax-and-fiscal-policies-after-the-covid-19-crisis-5a8f24c3/

OECD, (2022). OECD Economic Outlook. Volume 2022 Issue 2: Preliminary Version. OECD. https://doi.org/10.1787/f6da2159-en

Parman, S. W., & Grove, T. L. (2004). Petrology and geochemistry of Barberton komatiites and basaltic komatiites: evidence of Archean fore-arc magmatism. Developments in Precambrian Geology, 13, 539-565.

Pharoe, B. K., Evdokimov, A. N., Gembitskaya, I. M., & Bushuyev, Y. Y. (2020). Mineralogy, geochemistry and genesis of the post-Gondwana supergene manganese deposit of the Carletonville-Ventersdorp area, North West Province, South Africa. Ore Geology Reviews, 120, 103372.

Portfolio Committee on Trade and Industry, (2010, May 12). Report of the Portfolio Committee on Trade and Industry on South African Trade Policy and Strategy Framework. https://static.pmg.org.za/docs/2010/comreports/100517pctradereport.htm

Pretoria High Court: Case No. 20341/19, 2021

Pretoria High Court: Case No. 20341/19, 2021

Puchner, R. A. (2002). The geology and rock mass quality of the Cenozoic Kalahari Group, Nchwaning Mine Northern Cape. https://ukzn-dspace.ukzn.ac.za/handle/10413/4108

PWC, (2022, June 30). South Africa Economic Outlook. PWC. https://www.pwc.co.za/en/press-room/south-africa-economic-outlook-june-2022.html

PWC, (2023 January 30). South Africa Economic Outlook. PWC. https://www.pwc.co.za/en/press-room/south-africa-economic-outlook-january-2023.html

PWC, (2023, April 24). South Africa Economic Outlook. PWC. https://www.pwc.co.za/en/press-room/south-africa-economic-outlook-april-2023.html

PWC, (2023, March 30). South Africa Economic Outlook. PWC. https://www.pwc.co.za/en/press-room/south-africa-economic-outlook-march-2023.html

Reimer, T. O. (1967). Die Geologie der Stolzburg-Synklinale im Barberton Bergland (Transvaal, Südafrika). [MS thesis], 108.

Reimer, T. O. (1990). Arcbaean Baryte Deposits of Southern Africa. Geological Society of India, 35(2), 131-150.

Republic of South Africa (National Treasury), (2020). Supplementary Budget review 2020. https://www.treasury.gov.za/documents/national%20budget/2020s/review/fullsbr.pdf

Republic of South Africa (National Treasury), (2021a). Budget review 2021. https://www.treasury.gov.za/documents/national%20budget/2021/review/FullBR.pdf

Republic of South Africa (National Treasury), (2021b). Medium Term Budget Policy Statement 2021. https://www.treasury.gov.za/documents/mtbps/2021/mtbps/FullMTBPS.pdf

Republic of South Africa (National Treasury), (2022a). Budget review 2022. https://www.treasury.gov.za/documents/national%20budget/2022/review/FullBR.pdf

Republic of South Africa (National Treasury), (2022b). Medium Term Budget Policy Statement 2022. https://www.resbank.co.za/content/dam/sarb/publications/quarterly-bulletins/boxes/2022/december/The%202022%20Medium%20Term%20Budget%20Policy%20Statement.pdf

Republic of South Africa (National Treasury), (2023). Budget review 2023. https://www.treasury.gov.za/documents/national%20budget/2023/review/FullBR.pdf

Rozendaal, A., & Horn, R. (2013). Textural, mineralogical and chemical characteristics of copper reverb furnace smelter slag of the Okiep Copper District, South Africa. Minerals Engineering, 52, 184–190.

Rozendaal, A., Rudnick, T.-K., & Heyn, R. (2017). Mesoproterozoic base metal sulphide deposits in the Namaqua Sector of the Namaqua-Natal Metamorphic Province, South Africa: a review. South African Journal of Geology: Being the Transactions of the Geological Society of South Africa = Suid-Afrikaanse Tydskrif Vir Geologie: Syndie Die Verhandelinge van Die Geologiese Vereniging van Suid-Afrika, 120(1), 153–186.

RSA Judiciary. (21 September 2021). High Court of South Africa Gauteng Division Case 2034/19. Johannesburg: High Court Gauteng.

Sachs, M. (2021). South Africa faces a slowly worsening chronic fiscal crisis, The Conversation. https://theconversation.com/south-africa-faces-a-slowly-worsening-chronic-fiscal-crisis-172247#:~:text=First%2C%20the%20chronic%20position%20of,are%20crowding%20out%20social%20spending.

Sanlam, (2020). A Sovereign Debt Crisis? Sanlam Corporate Investments. https://www.sanlaminvestments.com/SISharedDocuments/Sovereign-Debt-Crisis.pdf

Schouwstra, R. P., Kinloch, E. D., & Lee, C. A. (2000). A short geological review of the Bushveld Complex. Platinum Metals Review, 44(1), 33-39.

Schweitzer, J. K., Hatton, C. J., & De Waal, S. A. (1995). Economic potential of the Rooiberg Group: volcanic rocks in the floor and roof of the Bushveld Complex. Mineralium Deposita, 30(2), 168-177.

Söhnge, A. P. G., & Halbich, I. W. (1983). The Cape Fold Belt-Perspective. Geodynamics of the Cape Fold Belt, 12, 1-6.

South African Environmental, Social and Governance Committee, The South African Guideline for Reporting of Environmental, Social and Governance Parameters within the Solid Minerals and Gas and Oil Industries, 2017

South African Human Rights Commission, National Hearing on the Underlying Socio-Economic Challenges of Mining-affected Communities in South Africa, 2018

South African Human Rights Commission, National Hearing on the Underlying Socio-Economic Challenges of Mining-affected Communities in South Africa, 2018

South African Human Rights Commission, SAHRC Report on Mining Affected Communities and DMR response, 2019

South African Human Rights Commission, SAHRC Report on Mining Affected Communities and DMR response, 2019

South African Minerals Reporting Codes Standards Committee, ESG-Is here to stay, 2022.

South African Minerals Reporting Codes Standards Committee, ESG-Is here to stay, 2022.

South African Presidential Economic Advisory Council, (2020). How should South Africa deal with rising national debt? Fiscal policy options for inclusive growth in a debt-constrained environment. The Presidency. https://www.thepresidency.gov.za/sites/default/files/05.%20How%20should%20South%20Africa%20deal%20with%20rising%20National%20Debt%202020.pdf

South African Reserve Bank (SARB), (2022). A new framework for implementing Monetary Policy in South Africa, Financial Markets Division SARB. https://www.resbank.co.za/en/home/what-we-do/financial-markets/monetary-policy-implementation-framework#:~:text=The%20SA%20Reserve%20Bank%20implements,surplus%20or%20tiered%20floor%20system.

South African Reserve Bank (SARB), (2023). Monetary Policy Implementation Framework. SARB. https://www.resbank.co.za/en/home/what-we-do/financial-markets/monetary-policy-implementation-framework

South African Revenue Service (SARS), (2010). Merchandise Trade Statistics December 2010. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2010/Merchandise-Trade-Statistics-for-December-2010.pdf

South African Revenue Service (SARS), (2012). Merchandise Trade Statistics December 2012. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2012/Merchandise-Trade-Statistics-for-December-2012.pdf

South African Revenue Service (SARS), (2014). Merchandise Trade Statistics December 2014. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2014/Dec/Merchandise-Trade-Statistics-December-2014.pdf

South African Revenue Service (SARS), (2016). Merchandise Trade Statistics December 2016. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2016/Dec/Merchandise-Trade-Statistics-Dec-2016.pdf

South African Revenue Service (SARS), (2018). Merchandise Trade Statistics December 2018. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2018/Dec/Merchandise-Trade-Statistics-December-2018.pdf

South African Revenue Service (SARS), (2020). Merchandise Trade Statistics December 2020. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2020/Dec/Trade-Statistics-December-2020.pdf

South African Revenue Service (SARS), (2022). Merchandise Trade Statistics December 2022. SARS. https://www.sars.gov.za/wp-content/uploads/Docs/TradeStats/2022/Dec3461/Trade-Statistics-December-2022-1.pdf

StatsSA P2041. (2023). Mining: Production and sales (Preliminary) January 2023. Statistics South Africa .

StatsSA P3041.2. (2023). Manufacturing: Production and Sales April 2023. Pretoria: Statistics SA.

Steele-Schober, T, The Importance of ESG for Mineral Reporting , Journal of the Southern African Institute of Mining and Metallurgy, vol.121 N.6, Johannesburg, June, 2021

Steele-Schober, T, The Importance of ESG for Mineral Reporting , Journal of the Southern African Institute of Mining and Metallurgy, vol.121 N.6, Johannesburg, June, 2021

Steele-Schober, T, The Importance of ESG for Mineral Reporting, Journal of the Southern African Institute of Mining and Metallurgy, vol.121 n.6 Johannesburg, June 2021 DMRE (Department of Mineral Resources and Energy), Artisanal and Small-Scale Mining Policy, 2022

Stern, M. and Ramkolowan. Y. (2021). Understanding South Africa's trade policy and performance. South African Reserve Bank Working Paper Series WP/20/17. SARB. https://www.resbank.co.za/en/home/publications/publication-detail-pages/working-papers/2021/UnderstandingSouthAfricastradepolicyandperformance

Thamm, A. G., Johnson, M. R., Anhaeusser, C. R., & Thomas, R. J. (2006). The cape supergroup. The Geology of South Africa, 443-460.

The geology of the Barberton area. Vol. 15. Union of South Africa, Department of Mines, 1956.

Toulkeridis, T., Peucker-Ehrenbring, B., & Kroner, A. (1993). Geochemistry and timing of magnesite formation in the Barberton greenstone belt. In International colloquium on Africa geology, 345-347.

Trade and Industrial Policy Strategies, (2022). The Real Economy Bulletin Third Quarter 2022. TIPS. https://www.tips.org.za/manufacturing-data/the-real-economy-bulletin/quarterly-bulletin/item/4457-the-real-economy-bulletin-third-quarter-2022

Trade and Industrial Policy Strategies, (2022). TIPS Tracker Fourth Quarter 2022. TIPS. https://www.tips.org.za/manufacturing-data/tips-import-tracker/item/4560-import-tracker-q4-2022

Trower, E. J., & Lowe, D. R. (2016). Sedimentology of the~ 3.3 Ga upper Mendon Formation, Barberton Greenstone Belt, South Africa. Precambrian Research, 281, 473-494.

Tsikos, H., Beukes, N. J., Moore, J. M., & Harris, C. (2003). Deposition, Diagenesis, and Secondary Enrichment of Metals in the Paleoproterozoic Hotazel Iron Formation, Kalahari Manganese Field, South Africa. Economic Geology and the Bulletin of the Society of Economic Geologists, 98(7), 1449–1462.

Twist, D., & French, B. M. (1983). Voluminous acid volcanism in the Bushveld Complex: A review of the Rooiberg Felsite. Bulletin Volcanologique, 46(3), 225-242.

UNCTAD, (2022). World Investment Report 2022. United Nations. https://unctad.org/system/files/official-document/wir2022_en.pdf

UNCTAD, (2023). World Investment Report 2023. United Nations. https://unctad.org/system/files/official-document/wir2023_en.pdf

UNCTAD, (2023).Trade and Development Report Update - Global Trends and Prospects. United Nations. https://unctad.org/system/files/official-document/gdsinf2023d1_en.pdf

United Nations Conference on Trade and Development. Investment Policy Hub: International Investment Agreements Navigator. Available at: https://investmentpolicy.unctad.org/international-investment-agreements/countries/195/south-africa (Accessed May 2023)

United Nations. 1966. International Covenant on Economic, Social and Cultural Right. General Assembly Resolution 2200A (XX1. UN, New York

United States Department of State, (2021). 2021 Investment Climate Statements: South Africa. USA. https://www.state.gov/reports/2021-investment-climate-statements/south-africa/

Utembe, W, Faustman, E M, Matatiele, P, and Gulumian, M, Hazards identified and the need for health risk assessment in the South African mining industry, Human and Experimental Toxicology, vol. 34 (12)

Utembe, W, Faustman, E M, Matatiele, P, and Gulumian, M, Hazards identified and the need for health risk assessment in the South African mining industry, Human and Experimental Toxicology, vol. 34 (12)

Vella, A. 2023. Highlighting mineralized geological environments through a new Data-driven predictive mapping approach. PhD thesis University Orléans, France

Vennemann, T. W., & Smith, H. S. (1999). Geochemistry of mafic and ultramafic rocks in the type section of the Kromberg Formation, Barberton greenstone belt, South Africa. Geologic Evolution of the Barberton Greenstone Belt, South Africa. Geological Society of America, Special Papers, 329, 133-150.

Viljoen, M. J. (1969). An introduction to the geology of the Barberton granite-greenstone terrain. Spec. Publ. Geol. Soc. S. Afr., 2, 9-28.

Von Gruenewaldt, G. (1973). The modified differentiation index and the modified crystallization index as parameters of differentiation in layered intrusions. South African Journal of Geology, 76(1), 53-61.

Walraven, F. (1987). Textural, geochemical and genetic aspects of the granophyric rocks of the Bushveld Complex.

Walraven, F., Armstrong, R. A., & Kruger, F. J. (1990). A chronostratigraphic framework for the north-central Kaapvaal craton, the Bushveld Complex and the Vredefort structure. Tectonophysics, 171(1-4), 23-48.

Werkmans Attorneys, A Guide to Mining in South Africa, 2017

Werkmans Attorneys, A Guide to Mining in South Africa, 2017

Williams, D. A. C., & Furnell, R. G. (1979). Reassessment of part of the Barberton type area, South Africa. Precambrian Research, 9(3-4), 325-347.

World Bank, (2021). Country Partnership Framework with The Republic of South Africa for the period FY22 – FY26. World Bank. https://documents1.worldbank.org/curated/en/139701627178427304/pdf/South-Africa-Country-Partnership-Framework-for-the-Period-FY22-FY26.pdf

World Bank, (2023, April) Macro Poverty Outlook for South Africa : April 2023 (English). Macro Poverty Outlook (MPO) Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/099550204132331586/IDU0f2bdab130c9c904ff40bd3f0d5cf3cf3b775

World Economic Forum. 2022. The Global Risks Report 2023 (17th Edition). Geneva, 2022

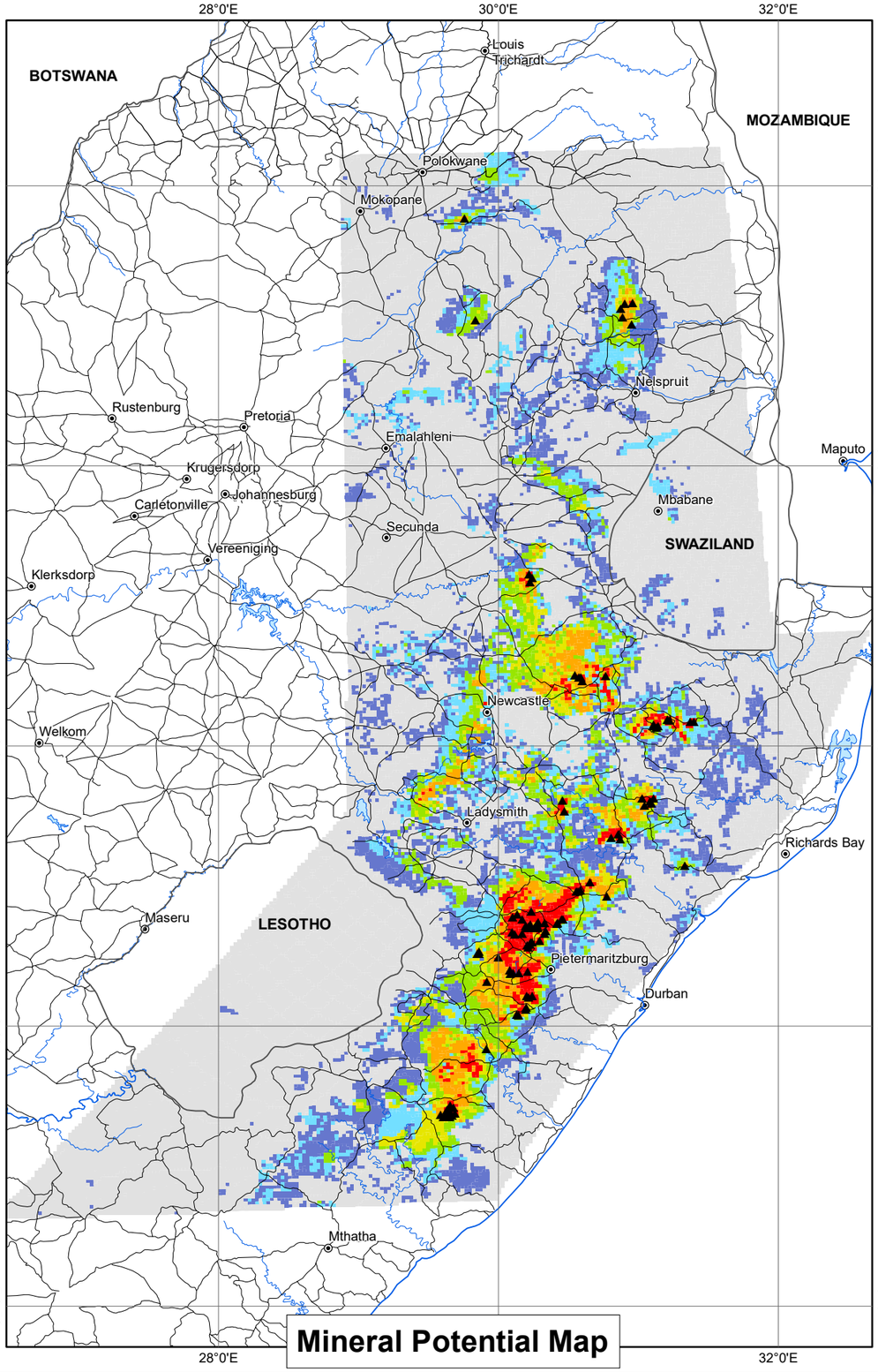
World Economic Forum. 2023. The Global Risks Report 2023 (18th Edition). Geneva, 2023

APPENDICES

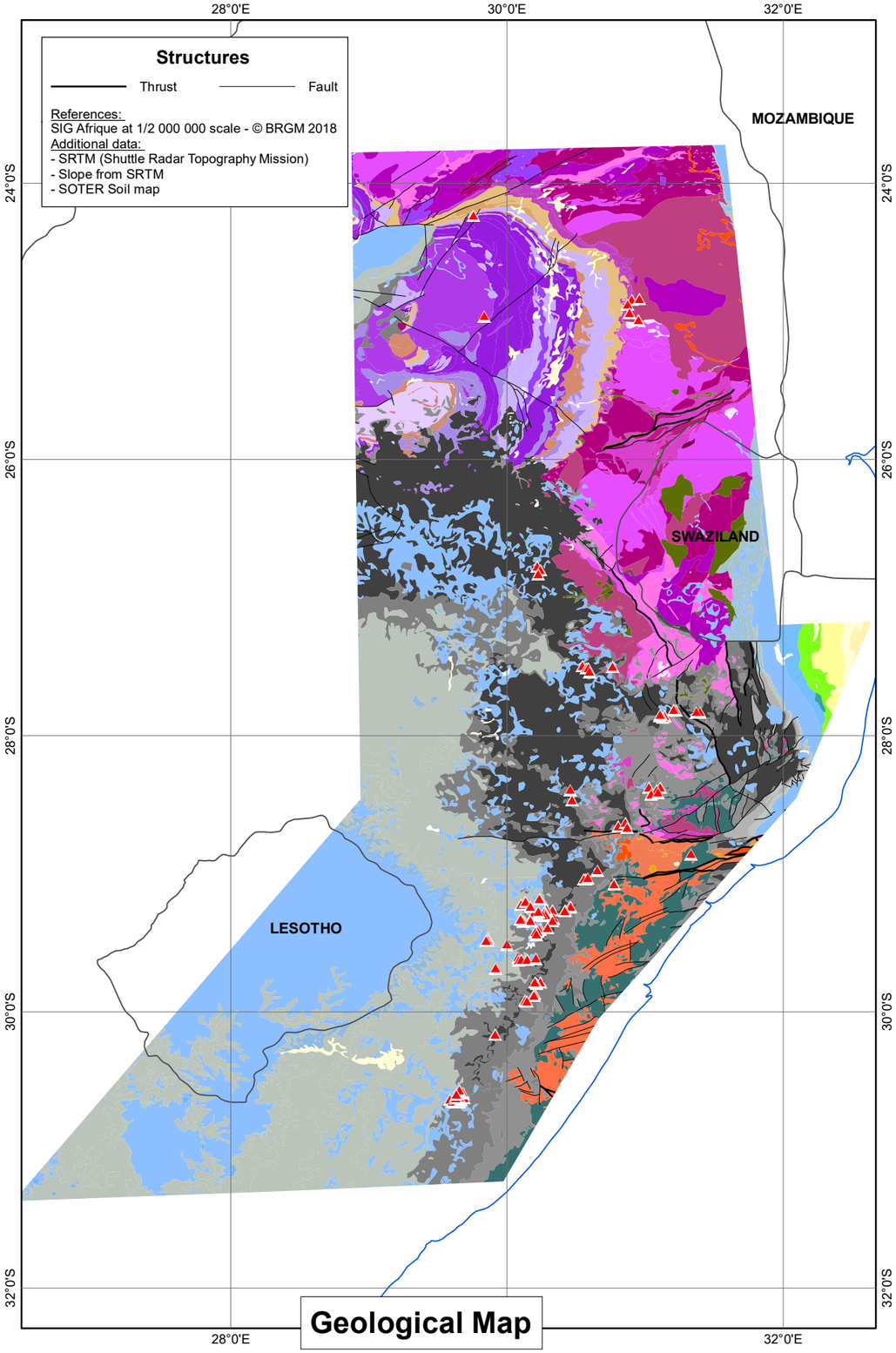
Funded by
the European Union

Country: REPUBLIC of SOUTH AFRICA

MINERAL POTENTIAL MAP - *ALUMINIUM-BAUXITE (Al)*



Mineral Potential Map



Geological Map

Structures

Thrust — Fault

References:
SIG Afrique at 1/2 000 000 scale - © BRGM 2018
Additional data:
- SRTM (Shuttle Radar Topography Mission)
- Slope from SRTM
- SOTER Soil map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

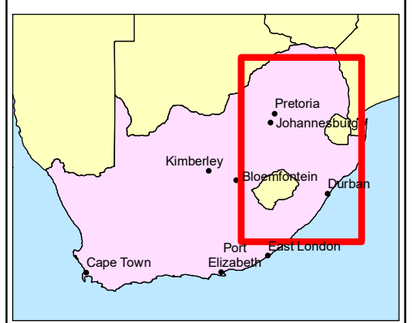
Known occurrences

Aluminium (Al)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 28559 94.80% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1411 4.68% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 156 0.52% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.56
Cell size: 2500 m



N

0 50 100 200 Km

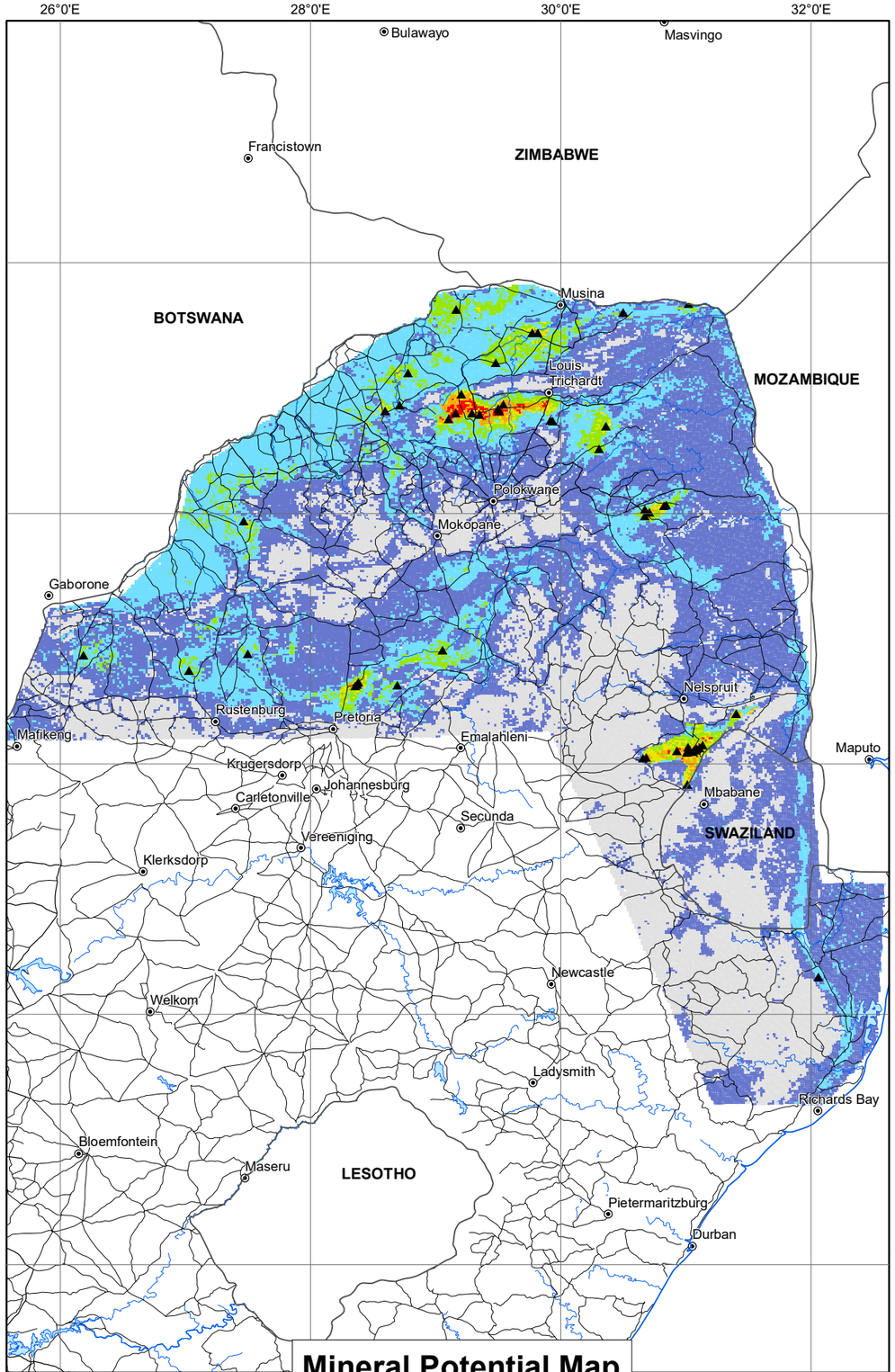
Datum : WGS84 (World Geodetic System 1984)

January 2024

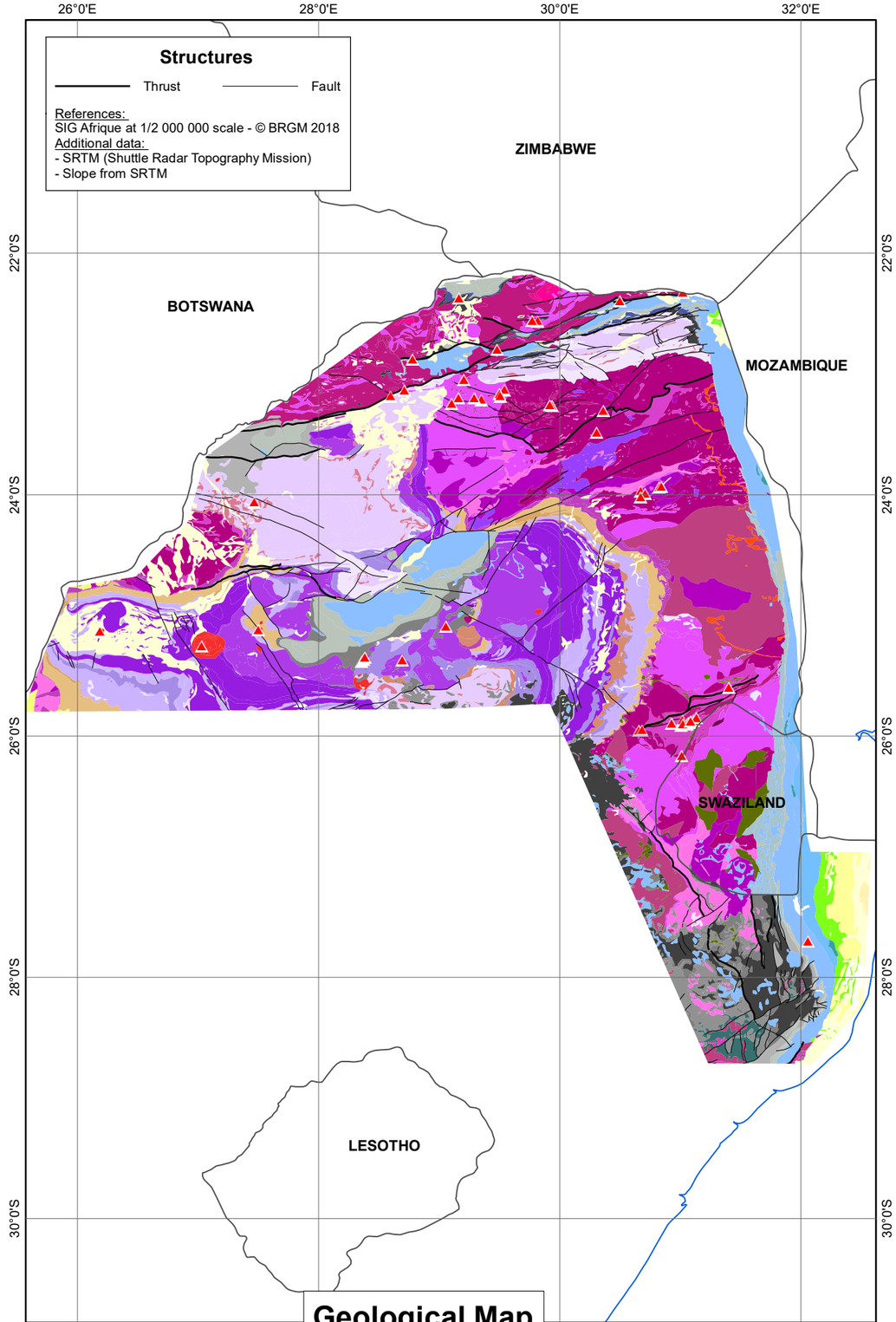
Country: REPUBLIC of SOUTH AFRICA (East)

MINERAL POTENTIAL MAP - *BARIUM (Ba)*

Africa MaVal



Mineral Potential Map



Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

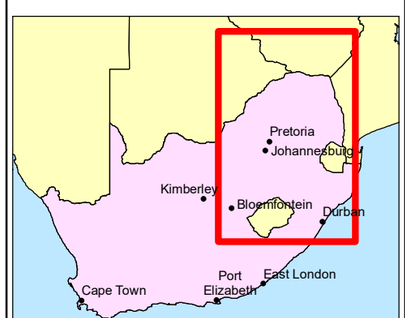
Known occurrences

▲ Barium (Ba)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 78222 98.70% Non-occurrence in database Non-occurrence predicted	False positive Cells: 977 1.23% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 53 0.07% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.45
Cell size: 1750 m



N

0 50 100 200 Km

Datum : WGS84 (World Geodetic System 1984)

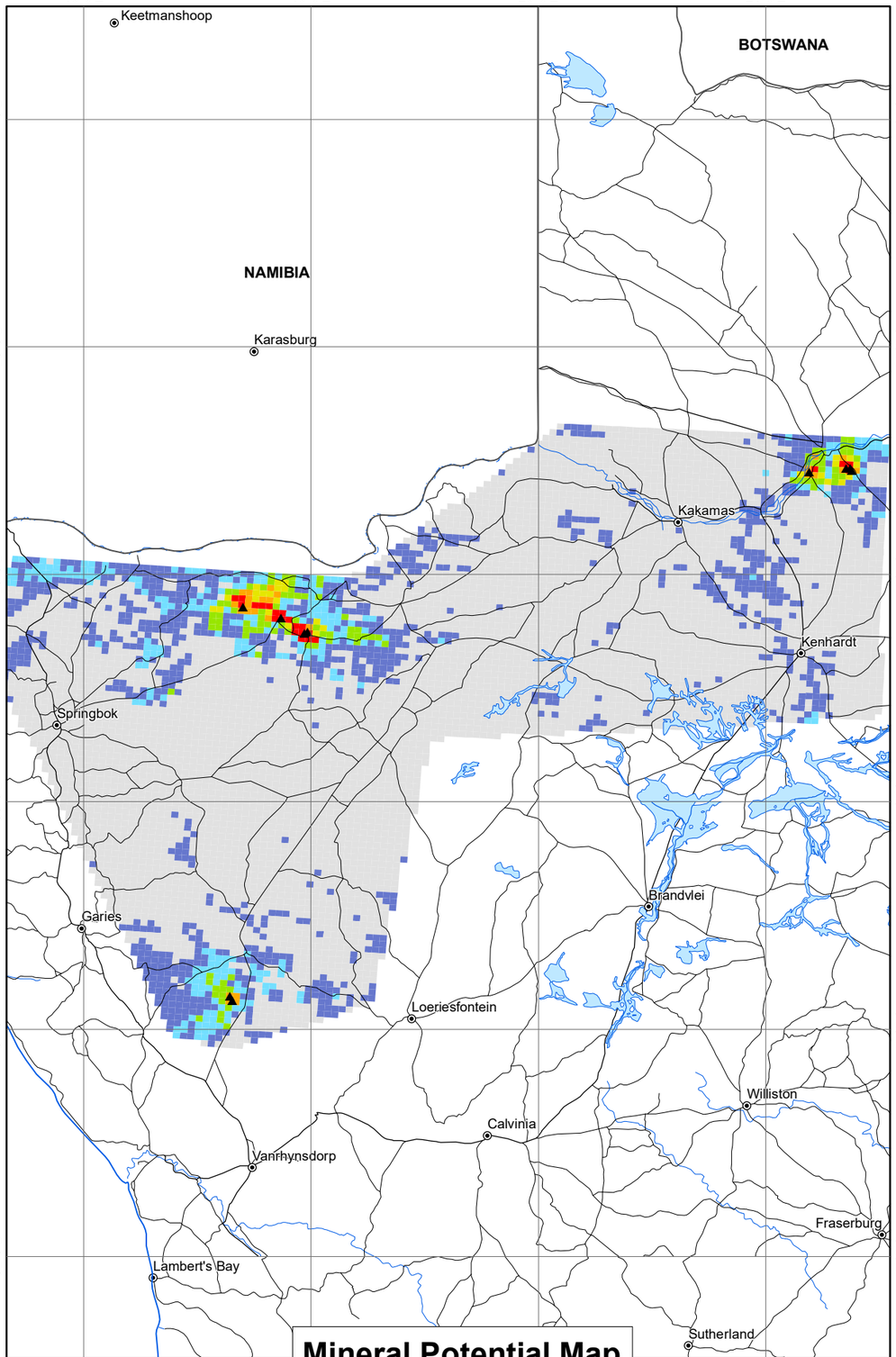
January 2024

Géosciences pour une Terre durable
brgm

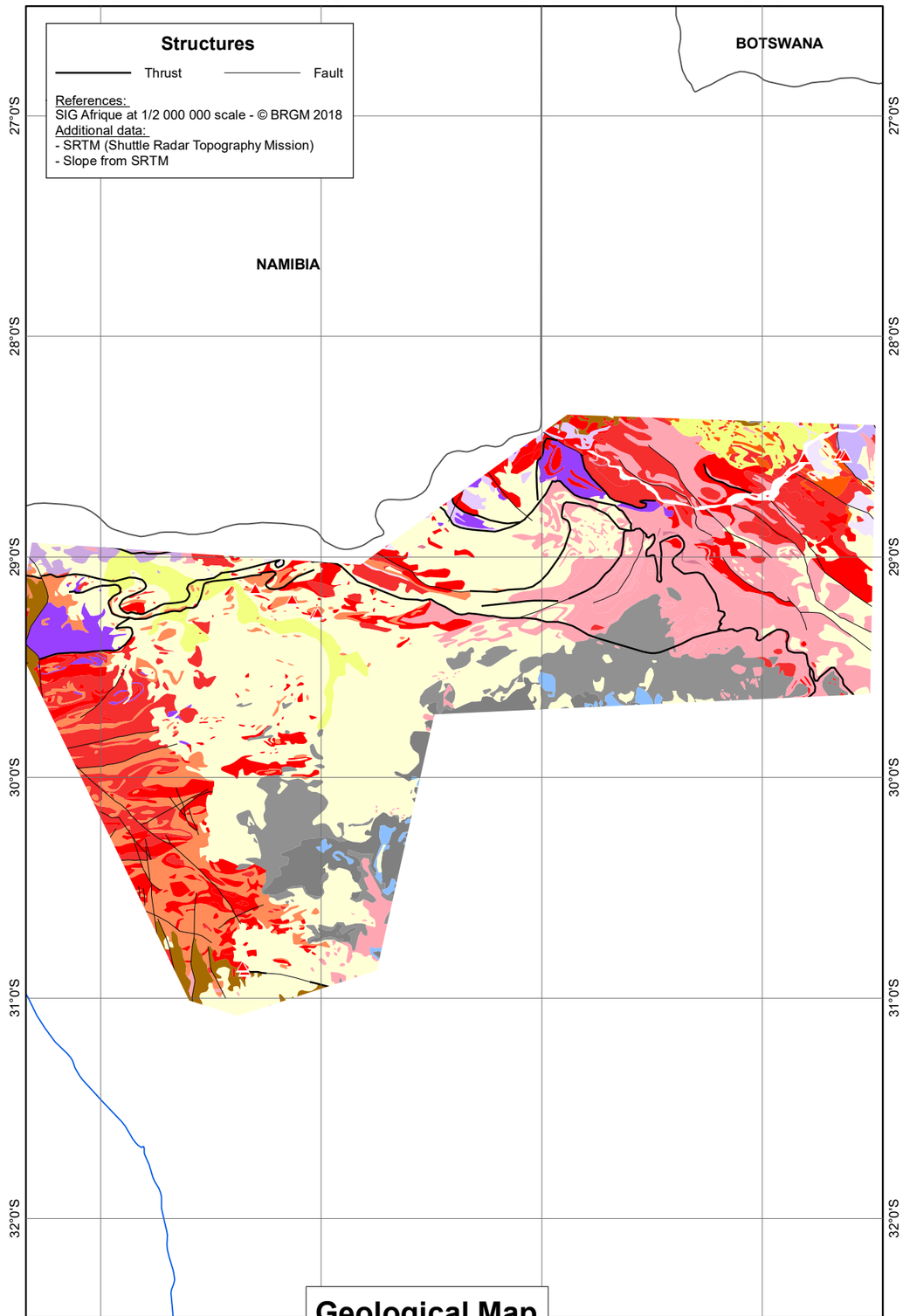
Country: REPUBLIC of SOUTH AFRICA (West)

MINERAL POTENTIAL MAP - *BARIUM (Ba)*

Africa MaVal



Mineral Potential Map



Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

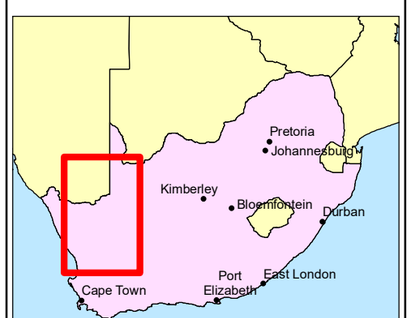
Known occurrences

▲ Barium (Ba)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 6783 99.42% Non-occurrence in database Non-occurrence predicted	False positive Cells: 16 0.23% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.01% Occurrence in database Non-occurrence predicted	True positive Cells: 23 0.34% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.68
Cell size: 3000 m



N

0 25 50 100 Km

Datum : WGS84 (World Geodetic System 1984)

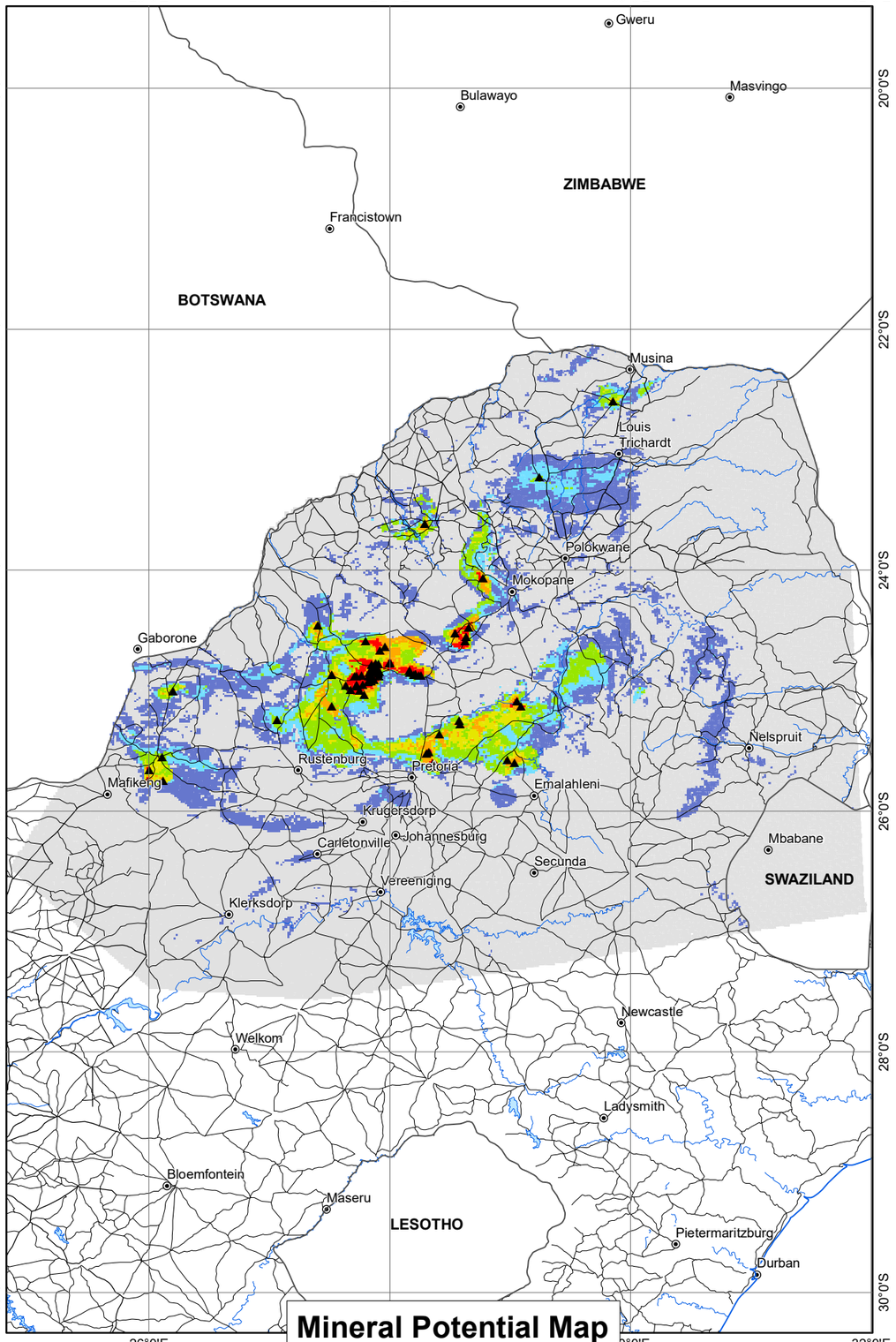
January 2024

Géosciences pour une Terre durable
brgm

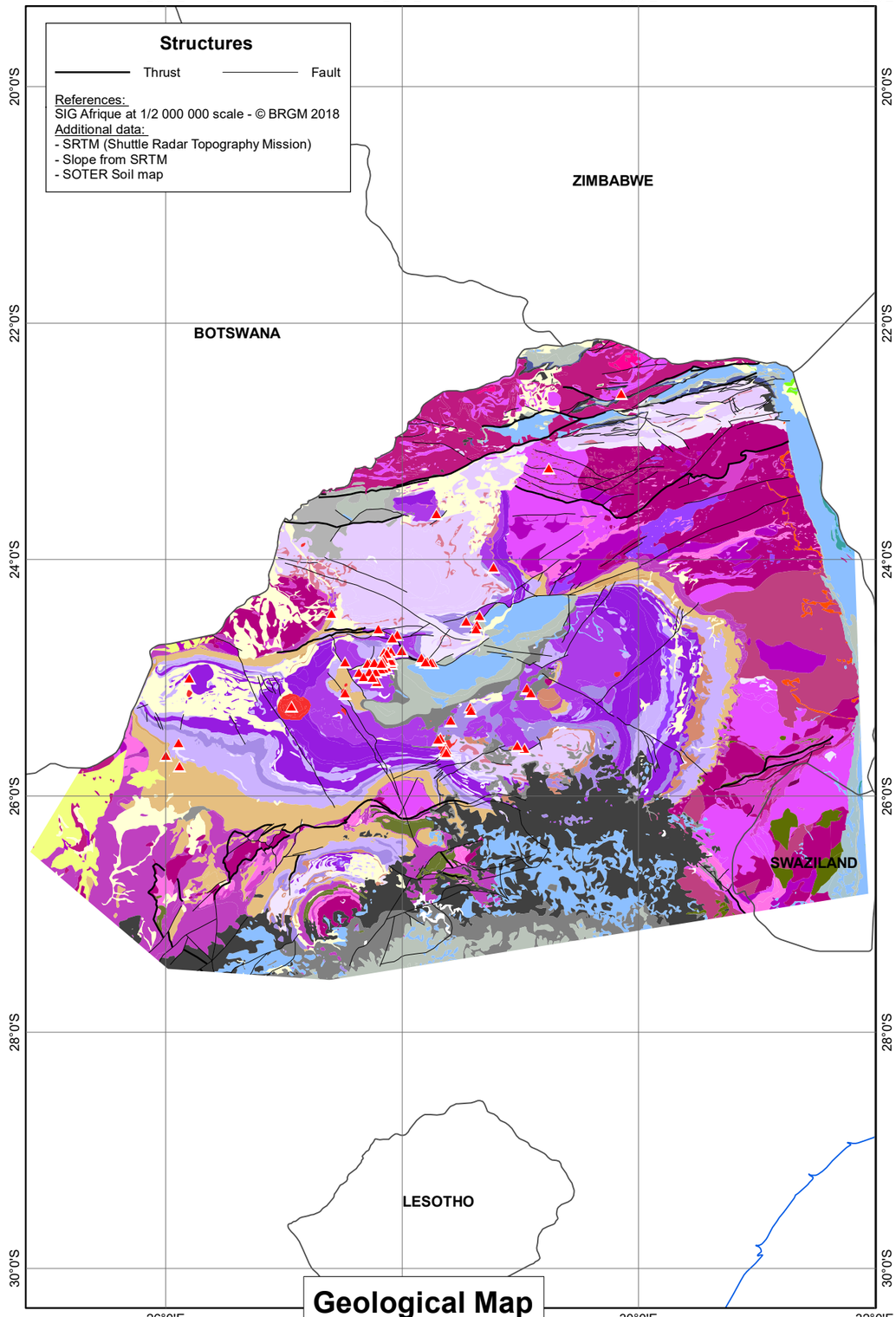
Country: REPUBLIC of SOUTH AFRICA (North East)

MINERAL POTENTIAL MAP - *FLUORINE (Fl)*

Africa MaVal



Mineral Potential Map



Structures

Thrust — Fault

References:
SIG Afrique at 1/2 000 000 scale - © BRGM 2018
Additional data:
- SRTM (Shuttle Radar Topography Mission)
- Slope from SRTM
- SOTER Soil map

Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

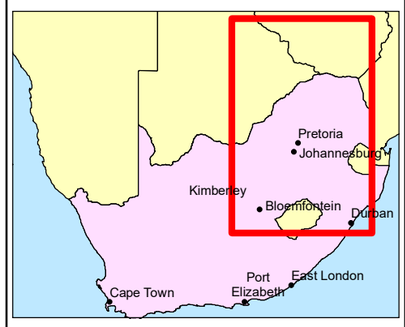
Known occurrences

▲ ▲ Fluorine (Fl)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 90646 97.32% Non-occurrence in database Non-occurrence predicted	False positive Cells: 2269 2.44% Non-occurrence in database Occurrence predicted
False negative Cells: 1 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 222 0.24% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.41
Cell size: 1800 m



N

0 50 100 200 Km

Datum : WGS84 (World Geodetic System 1984)

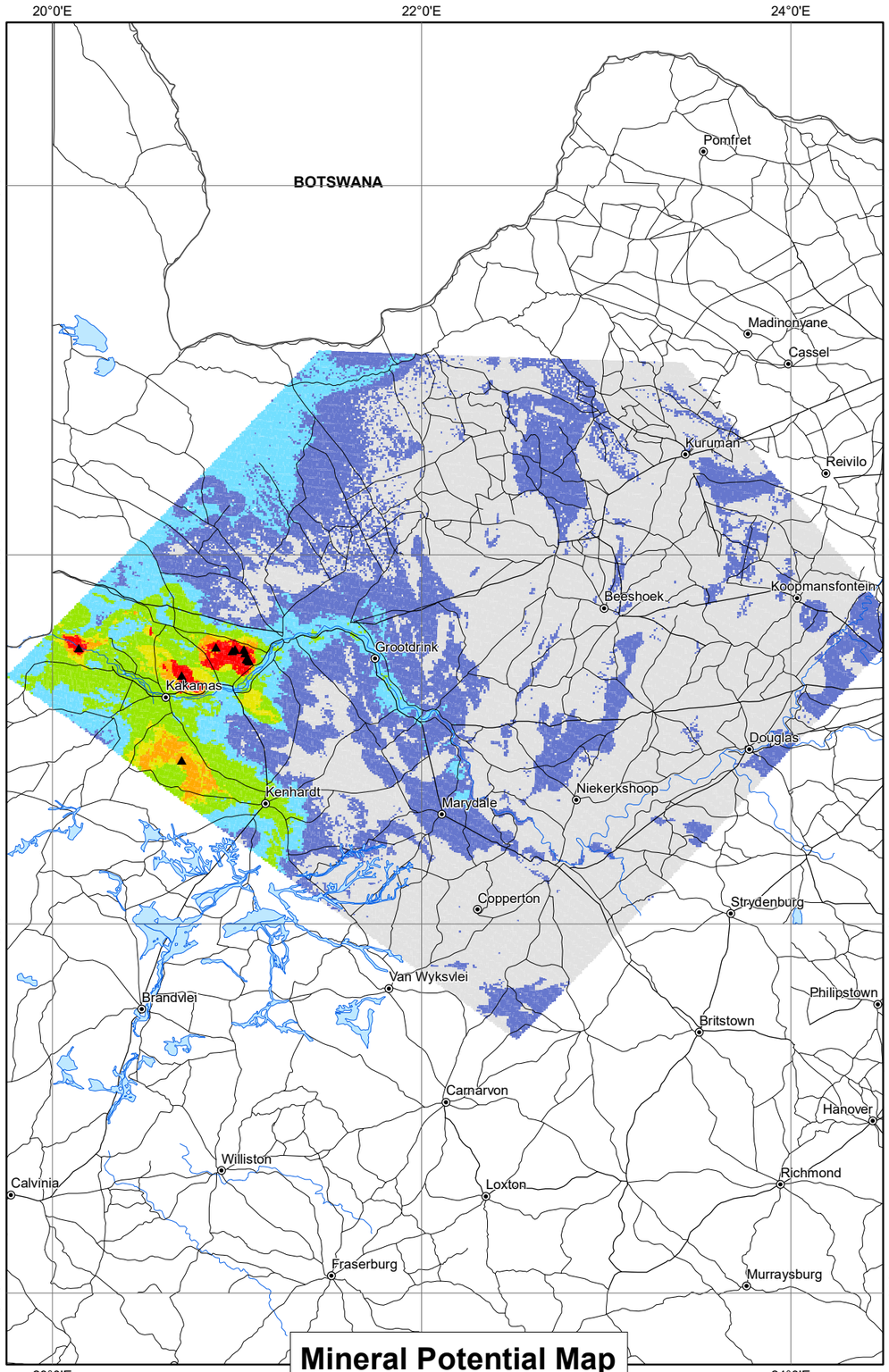
January 2024

Géosciences pour une Terre durable
brgm

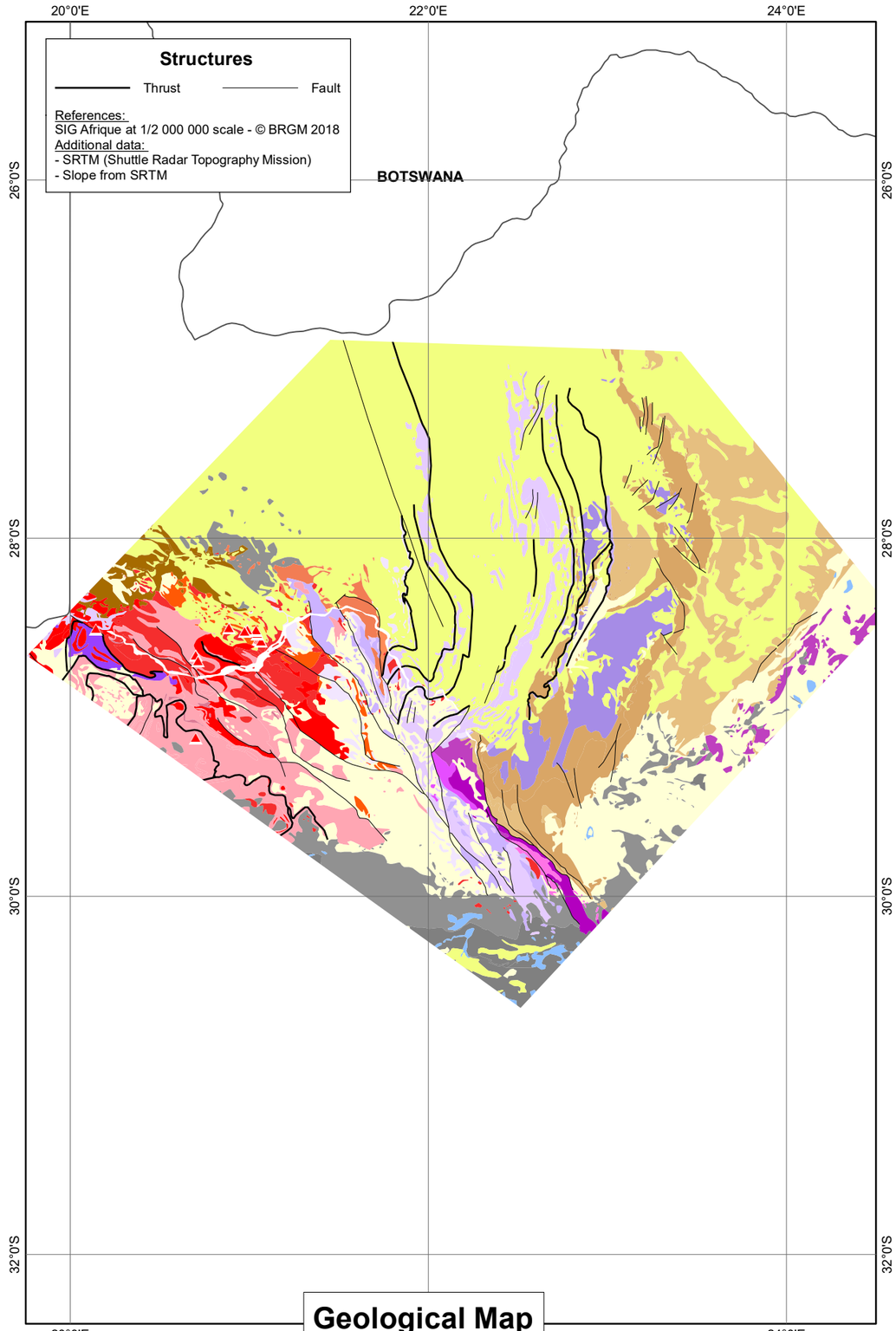
Country: REPUBLIC of SOUTH AFRICA (South West)

MINERAL POTENTIAL MAP - *FLUORINE (Fl)*

Africa MaVal



Mineral Potential Map



Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

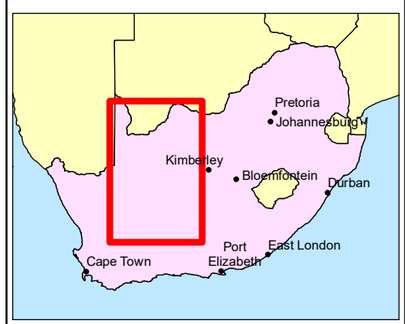
Known occurrences

▲ ▲ Fluorine (Fl)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 113621 98.67% Non-occurrence in database Non-occurrence predicted	False positive Cells: 1276 1.11% Non-occurrence in database Occurrence predicted
False negative Cells: 0 0.00% Occurrence in database Non-occurrence predicted	True positive Cells: 250 0.22% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.60
Cell size: 1000 m



N

0 37,5 75 150 Km

Datum : WGS84 (World Geodetic System 1984)

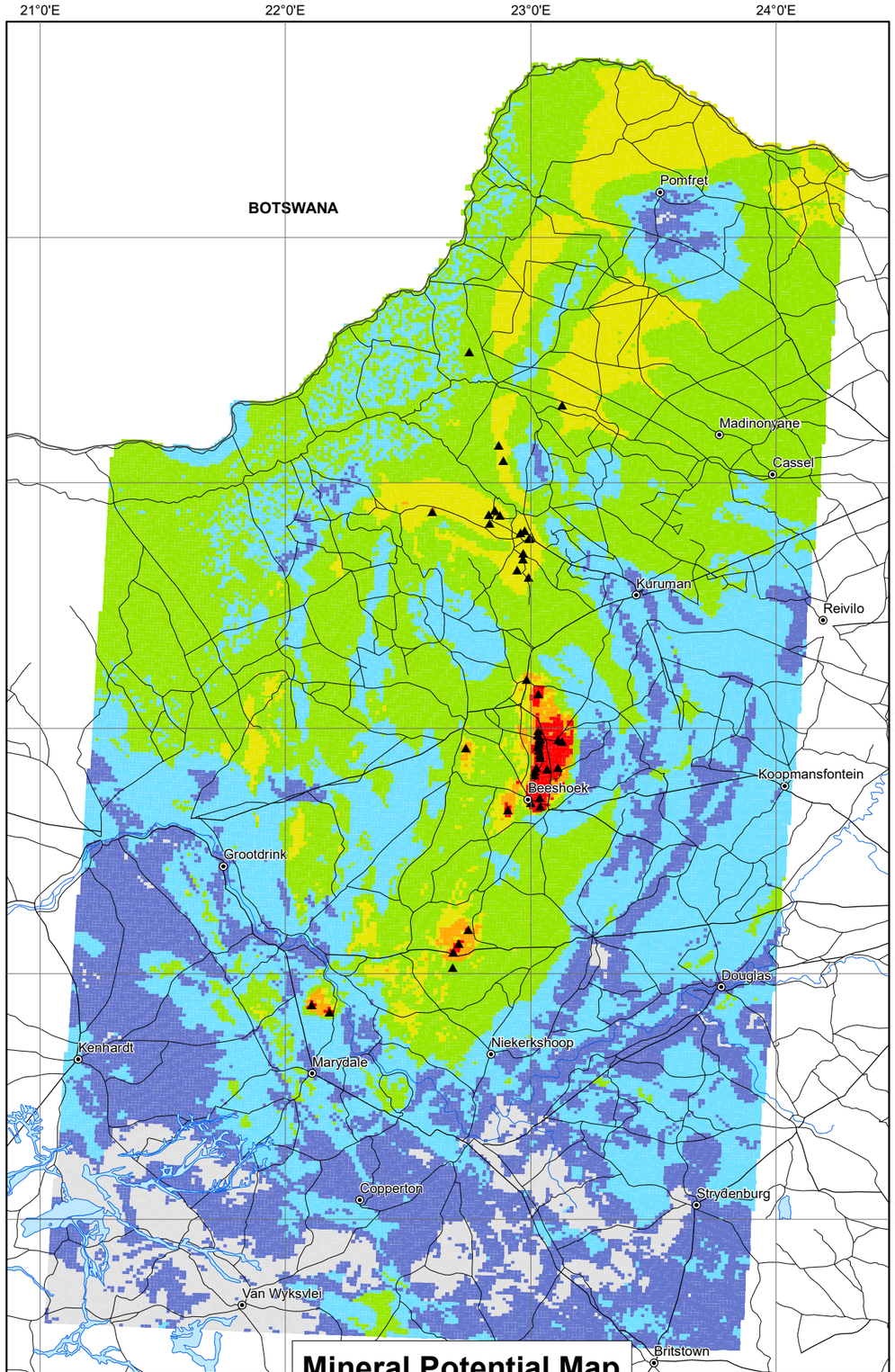
January 2024

Géosciences pour une Terre durable
brgm

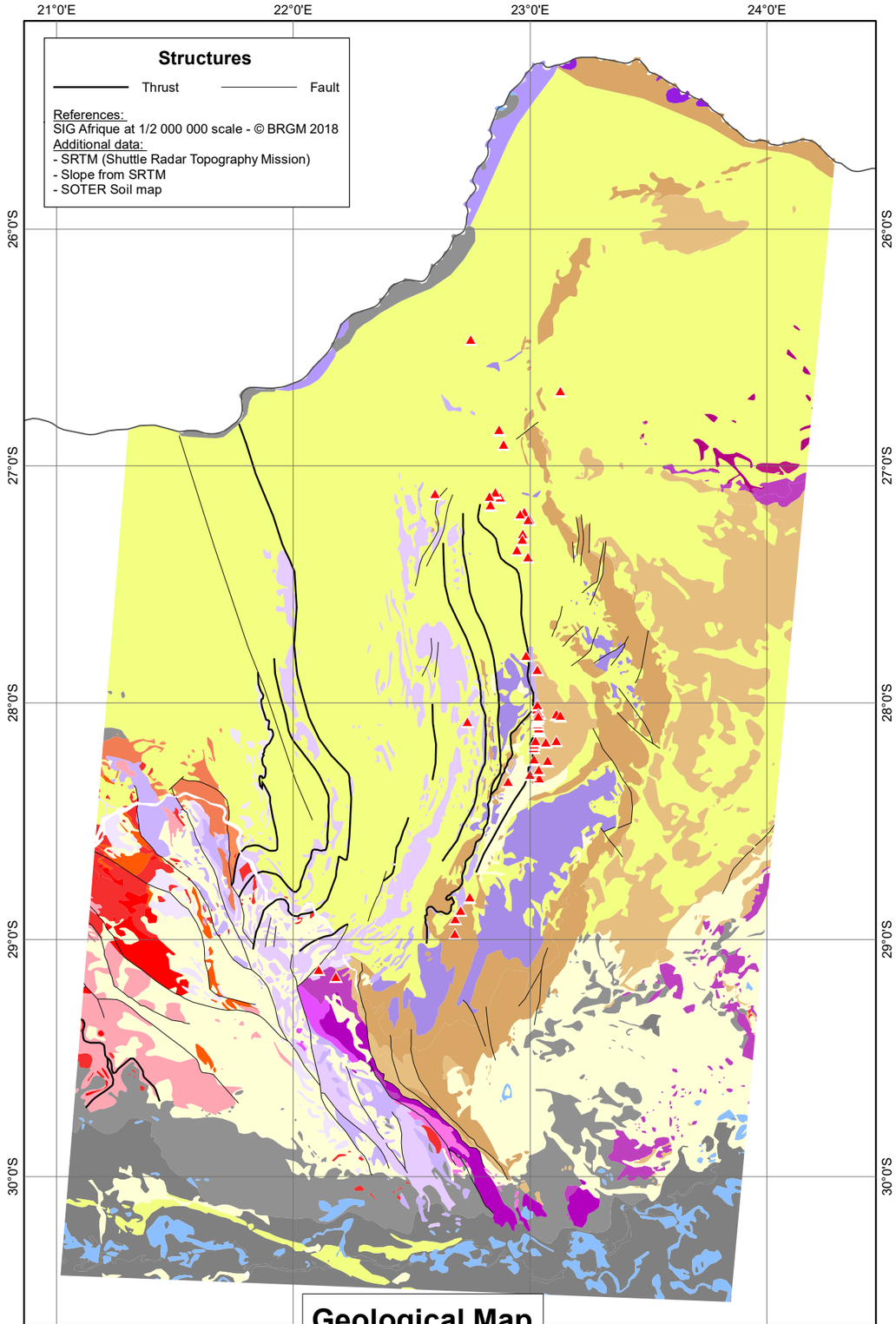
Country: REPUBLIC of SOUTH AFRICA (Center)

MINERAL POTENTIAL MAP - *MANGANESE (Mn)*

Africa MaVal



Mineral Potential Map



Geological Map

Legend

Score

- < 0.05
- 0.05 - 0.125
- 0.125 - 0.25
- 0.25 - 0.45
- 0.45 - 0.60
- 0.60 - 0.80
- 0.80 - 1

Known occurrences

▲ ▲ Manganese (Mn)
SIG Afrique - © BRGM 2018

Confusion matrix

True negative Cells: 68865 95.12% Non-occurrence in database Non-occurrence predicted	False positive Cells: 3280 4.53% Non-occurrence in database Occurrence predicted
False negative Cells: 15 0.02% Occurrence in database Non-occurrence predicted	True positive Cells: 238 0.33% Occurrence in database Occurrence predicted

Best threshold (G-Means): 0.49
Cell size: 1400 m

N

0 25 50 100 Km

Datum : WGS84 (World Geodetic System 1984)

January 2024

Géosciences pour une Terre durable
brgm

APPENDIX 2.1 MINING LIST: List of Major CRM operations in South Africa (DAI Global 2022)

CRM	Stakeholder	Details	Origin
Vanadium: Mining	Bushveld Minerals	Developing the Brits and Mokopane Vanadium Resources; and the processing operations at their Vametco and Vanchem facilities	South Africa
	VTM Mining	Developing the Vanadium resource at Tweefontein in Limpopo	South Africa
	Ironveld PLC	Developing a vanadium and titanium project at the Bushveld Complex	UK
	VR8 Resources	Developing the Steelpoortdrift Vanadium Project	Australia
	International Resources Limited South Africa	Operating Mapochs Mine	China
Vanadium Processing	Highveld Robusteel	Processors of vanadium and producers of steel	South Africa
	Vanchem	Vanadium-processing facility and beneficiation plant owned by Bushveld Minerals	South Africa
	Vanadium and Magnetite Exploration and Development Co SA Pty Ltd (Vametco)	Is a vanadium processing operation owned by Bushveld Minerals	South Africa
	Bushveld Energy	Subsidiary of Bushveld Minerals that manufactures vanadium energy storage systems	South Africa
	Glencore	Glencore owns a majority stake in the Rhovan-Bakwena Vanadium Venture which mainly produces ferrovanadium and vanadium pentoxide.	UK/ Switzerland
	Abengoa	Energy company that signed an agreement with Bushveld Minerals to establish a solar-plus-storage microgrid at the Vametco Alloys vanadium mining and processing plant	Spain
	Invinity	Storage battery manufacturing company	UK
	German Competence Centre for Mining and Mineral Resources	Arm of the German Chamber of Commerce	Germany
Flourspar: Mining	Sepflour	Owns Wallmannsthal, Welgelegen/Welgevonden and Kruidfontein and operates Nokeng fluorspar mine project,	South Africa
	SA Fluorite (Pty) Ltd	Partial owner and developer of Doornhoek Flourspar Project	South Africa

CRM	Stakeholder	Details	Origin
	Southern Palace (Pty) Ltd	Partial owner and developer of Doornhoek Flourspar Project. Part of the Luxembourg based Eurasian Resources Group	UK
	Minerales y Productos Derivados SA (Minersa)	Jointly owns Vergenoeg fluorite mine	Spain
	South Africa's MEDU Capital	Jointly owns Vergonoeg fluorite mine	South Africa
Flourspar: Processing	**Department of Science and Technology**	Launched the local beneficiation Fluorochemical Expansion Initiative	**South Africa**
	Department of Trade, Industry and Competition	Launched the local beneficiation luorochemical Expansion Initiative	South Africa
	Pelchem SOC Ltd.	Is the sole producer and supplier of fluorochemicals in the Southern Hemisphere	South Africa
	Rare Earth Refiners (RER)	A refinery which exclusively licenses dry fluorination technology developed and patented by Necsa	South Africa
REE: Mining	Frontier Rare Earths Ltd	Developer of Zandkopsdrift	Luxembourg
	KORES – Korean Resource Corporation	Listed on the Toronto stock exchange Acquired a 10 % interest in Zandkopsdrift in 2012	South Korea
	Glenover Pty Ltd	Glenover held the prospecting rights for the Glenover carbonatite complex in a JV with Galileo Resources PLC.	UK
	Galileo Resources PLC	JV partner on Glenover	UK
	Afrimat	Acquired Glenover in 2021	South Africa
	Steenkampskraal Monazite Mine (Pty) Limited	Hold a "new order" mining right for Steenkampkraal till 2030. Owner of Steenkampskraal Monazite Mine (Pty) Ltd.	South Africa
REE: Processing	Industrial Development Corporation	Is undertaking a 'Mine 2 Magnets' value chain prefeasibility study for the manufacturing of rare earth magnets in South Africa.	South Africa
	Mintek	Is undertaking a 'Mine 2 Magnets' value chain prefeasibility study for the manufacturing of rare earth magnets in South Africa.	South Africa
Cobalt: Miners	Anglo American Platinum	Largest PGM miner in South Africa that mines cobalt	South Africa
	Anglo American	Holding company for Anglo American Platinum	UK
	Impala Platinum	Major PGM miner in South Africa that mines cobalt	South Africa

CRM	Stakeholder	Details	Origin
	Sibanye-Stilwater	Major PGM miner in South Africa that mines cobalt	South Africa
	Northam Platinum	Major PGM miner in South Africa that mines cobalt	South Africa
	African Rainbow Minerals	The owner and operator of Nkomati mine that mines cobalt as a by-product.	South Africa
	Norilsk Nickel	A 50% percent shareholder in the Nkomati Nickel mine	Russia
Cobalt: Processing	Sasol	Uses cobalt as a catalyst for its gas-to-liquid process	South Africa
	Mintek	Is undertaking a 'Mine 2 Magnets' value chain pre-feasibility study for the manufacturing of rare earth magnets in South Africa	South Africa
PGM's: Mining	Anglo American Platinum Limited (AMPLATS)	The world's largest primary producer of platinum (±38% of global annual supply)	South Africa
	Impala Platinum Holdings Limited	A holding company that operates mines that produce PGMs, as well as nickel, copper and cobalt.	South Africa
	Sibanye-Stillwater	A major PGM producer in South Africa.	South Africa
	Sedibelo Platinum Mines Ltd (Platinum Limited)	A South African PGM producer with operational assets and reserves (5.8% of SA PGM resources)	South Africa
	African Rainbow Minerals (ARM)	ARM has interests in a wide range of mines, including PGMs, iron, coal, copper, and gold.	South Africa
	Platinum Group Metals Ltd	The operator of the Waterberg Project, an underground palladium and platinum deposit located in South Africa	Canada
	Eastern Platinum Ltd (Eastplats)	A PGM and chrome operating Company with a tailings retreatment operation and projects in development	Canada
	Northham	An integrated PGM producer	South Africa
	Wesiswe Platinum Ltd	A South African public company that intends to enter the PGM market once it completes construction of its PGM mine	South Africa
PGM's: Processing	Impala Refining Services (IRS)	Provides smelting and refining services through offtake agreements with Group companies (except Impala) and third parties.	South Africa
	Tenova Pyromet	Small smelter and furnace refurbishing company	South Africa
PGM's: End users in SA	BMW, Mercedes Benz, Volkswagen, Nissan, Mahindra, Isuzu, Toyota, Ford	Car manufacturers operating in South Africa	Various nations (Germany, Japan, India, USA)

CRM	Stakeholder	Details	Origin
	Department of Trade, Industry and Competition	Responsible for initiatives and policy to support local beneficiation in the South African automotive sector.	South Africa
	Department of Science and Innovation	Part of the South African hydrogen economy stakeholders consortium	South Africa
	South African National Energy Development Institute	Part of the South African hydrogen economy stakeholders consortium	South Africa
	Bambili Energy	Part of the South African hydrogen economy stakeholders consortium	South Africa
	ENGIE	Part of the South African hydrogen economy stakeholders consortium	France
	First Mode, Ballard, NPROXX, Plug Power, ABB, Nel	Various companies involves in AMPLAT's nuGEN project, including engineering consultants, hydrogen storage, fuel cell systems, and automation	Various countries
	AMT Composites, Thermitec, Specialised Moulding	Manufacturers of platinum-catalysed silicone	South Africa
	Omnia	A chemicals company that produces nitric acid	South Africa
	Sasol	An energy company that produces nitric acid and fertilisers	South Africa
	AEL Mining Services	A company that produces explosives	South Africa
	Kynoch, Profert, TRIOMF, Nutri-Flo, Nitrophosk, Jara	Companies that produce fertiliser	South Africa
	Durban Water Recycling (Pty) Ltd,	A local municipality that recycles water	South Africa
	Veolia	A producer of water recycling technologies	France
	Coca Cola Beverages	A beverage company that uses recycled water	USA
	Rustenburg Local Municipality Wastewater Treatment Plant	A water treatment facility	South Africa
	Whirlpool, Defy, Samsung, LG Electronics, HiSEnse, Univa	Consumer electronics companies that produce products in South Africa	Various countries
	South Africa Electrotechnical Export Council (SAEEC)	PPP between government and electrotechnical industry	South Africa

CRM	Stakeholder	Details	Origin
	Swift Heat and Control, Heating elements and Control CC, Thermon Africa, BMR Controls CC	Thermocouple manufacturers	South Africa
	NGK Spark Plugs	Sparkplug manufacturer	South Africa
E-Waste collection, recycling and processing	Africa E-waste	Collection and dismantling of WEEE in Gauteng, 10% from SADC	South Africa
	Bolunga Enterprise	Collection and dismantling of WEEE in the Eastern Cape	South Africa
	Cape E-waste Recyclers	Collection and dismantling of WEEE in the Western Cape	South Africa
	Computer Scrap Recycling	Collection and dismantling of WEEE in the Western Cape	South Africa
	Desco Electronic Recyclers	Collection and dismantling of WEEE in the Gauteng and KZN	South Africa
	Electronic Cemetery EWaste Management	Collection, dismantling and pre-processing in Gauteng, Western Cape and KZN, has contracts with large corporates SOEs and manufacturers	South Africa
	E-waste Africa	Collection and dismantling in KZN	South Africa
	INCA Metals (PTY) Ltd	Collection and preprocessing of lamps in Gauteng, KZN, Western and Eastern Cape	South Africa
	Reclite (PTY) Ltd	Collection and dismantling in the Eastern Cape; scrap metal trading company	South Africa
	SA Precious Metals	Collection and preprocessing of lamps in Gauteng, KZN, Eastern and Western Cape	South Africa
	Sibanye Recycling	Developed a proprietary environmentally friendly fully automated hydrometallurgical solution to process PCBs in South Africa (Only processing company)	South Africa
	SIMS Recycling Solutions LTD	Collection, dismantling and preprocessing in KZN	South Africa
	Sindawonye Granulators and Processors	Collection, dismantling and preprocessing in KZN	South Africa
	SmartMatta	Largest WEEE recycling firm in SA, Collection, dismantling and preprocessing in Gauteng and Eastern Cape Collection in Gauteng, Western Cape and KZN	South Africa
	Tshwane Electronic Waste	Collection and dismantling in Gauteng, Western Cape and KZN	South Africa
	Universal Recycling Company (PTY) LTD	Collection, dismantling and processing in Gauteng; Sources inputs from SA and SADC	South Africa

CRM	Stakeholder	Details	Origin
	Waste Plan LTD	Collection in Gauteng, Western Cape and KZN	South Africa

Table 1: List of CRM recycling operations in SA and state of maturity

Name of company	Location	Commodity recycled	Owner	Degree of maturity
Brits Vanadium Project	North West	Vanadium	Bushveld Minerals	Prospecting
Rietfontein 338JQ Project	North West	Chrome and PGMs	Sukuma Millenium	Prospecting
Roan / Doornpoort Project	North West	Vanadium	Sable Metals & Bushveld Minerals	Prospecting
Tjate Platinum Project	Limpopo	PGMs	Jubilee	Prospecting
Bauba Platinum Project	Limpopo	PGMs	Bauba Resources	Exploration
Hacra Project	North West	PGMs	Sylvania Platinum	Exploration
Kalahari Platinum project	North West	PGMs	Glacier Resources	Exploration
Lesego Platinum Project	Limpopo	PGMs	Lesego Platinum	Exploration
Mareesburg Project	Limpopo	PGMs	East Plats	Exploration
Tamboti Platinum (Pty) Ltd	Mpumalanga	PGMs	African Rainbow Minerals	Exploration
Volspruit Platinum	Limpopo	PGMs	Sylvania Resources	Exploration
Steelpoortdrift Vanadium Project	Limpopo	Vanadium	Vanadium resources	Scoping
Waterberg Platinum Project / Group Metals Waterberg Operations	Mpumalanga	PGMs	Platinum Group Metals	Feasibility

Name of company	Location	Commodity recycled	Owner	Degree of maturity
Grootboom Project	Mpumalanga	PGMs	Last owned by Platmin	On-hold
Highveld Steel & Vanadium	North West	Vanadium	Evraz	On-hold
Onderstepoort Project				On-hold
Rooipoort Platinum Project	Mpumalanga	PGMs and Nickel	Caledonia Mining	On-hold
Smokey Hills Platinum Mine	Limpopo	PGMs	Thunder Platinum	On-hold
Spitzkop Project	Mpumalanga	PGMs	EastPlats	On-hold
Tweespalk Project	North West	PGMs	Platinum Group Metals	On-hold
War Springs Project	Limpopo	PGMs	Platinum Group Metals	On-hold
VanMag Mine	Limpopo	Vanadium	Bushveld Minerals	On-hold
Bakubung Platinum Mining Project	North West	PGMs (platinum, palladium, rhodium), nickel and cobalt by-products	Wesizwe	Development
Platreef project	North West	PGMs	Ivanhoe Mines	Development
Nkwe-Garatau Project	Limpopo	Platinum, Palladium, Rhodium	Zijin	Development
Tivani Iron Ore Project	Limpopo	Vanadium, phosphates	Ferox Minerals	Development
Booysendal	Mpumalanga	iron, steel, aluminium, copper, stainless steel, lead, nickel, brass, tin and bronze	Northham	Operational
Crocodile River Mine	North West	PGMs	Eastplats	Operational
Doornbosch PGM Plant	North West	PGMs	Sylvania Platinum	Operational

Name of company	Location	Commodity recycled	Owner	Degree of maturity
Modikwa Mine	Limpopo	PGMs	African Rainbow Minerals	Operational
Mokopane Vanadium Project	Limpopo	Vanadium	Bushveld Minerals	Operational
Nkomati Mine	Mpumalanga	PGMs, nickel, chrome, cobalt, copper	African Rainbow Minerals	Operational
Pilanesberg Platinum Mine	North West	PGMs	Sedibelo Resources	Operational
Rooderand Project	North West	PGMs	Chrometco	Operational
Siyanda Bakgatla Platinum Mine (Union)	Limpopo	Pt, Rh, Ir, Palladium, Co, Ni	Siyanda Platinum	Operational
Tharisa Platinum Mine	North West	PGMs	Tharisa Minerals	Operational
Vametco Mine	North West	Vanadium	Bushveld Minerals	Operational
Phalaborwa rare earths project	Mpumalanga	Neodymium, praseodymium and dysprosium	Rainbow Rare Earths	Operational
Vanchem Processing Plant	North West	Vanadium	Bushveld Minerals	Operational
Maseve Platinum	North West	PGMs	Royal Bafokeng Platinum	Care and Maintenance
Messina Platinum mines	Limpopo	PGMs	DRA global	Care and Maintenance