

Special Report 4

FUTURES: CRITICAL MINERALS

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Systemic Innovations for Critical Minerals in SADC Draft Strategic Framework

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African perspectives
Global insights

Executive summary

As the global demand for these minerals increases due to their integral role in clean energy technologies, electronic devices and various industries, it becomes crucial for SADC to develop a comprehensive and strategic approach to manage and harness the potential of these valuable resources.

This report is part of a series of four reports on the 'Futures of Critical Minerals in SADC: Building Anticipatory Governance'. The reports are:

- **Special Report 1**
Exploring Critical Minerals in SADC: Country Barriers and Enablers
- **Special Report 2**
Navigating the SADC Critical Minerals Transition: Towards Preferred Futures
- **Special Report 3**
Re-imagining the Critical Minerals Ecosystem in SADC: Building Anticipatory Governance
- **Special Report 4**
Systemic Innovations Toward the SADC Draft Critical Minerals Strategic Framework

This special report on the systemic innovations required for critical minerals in Southern Africa provides a comprehensive analysis of the critical minerals sector in the SADC region and outlines a strategic framework for shaping its future. With the increasing demand for critical minerals due to their role in clean energy technologies and various industries, it is crucial that SADC creates systemic change and identifies systemic innovations for challenges and opportunities in the sector.

The report examines the current conditions, key stakeholders and drivers of change in the critical minerals sector. It focuses on key questions such as how the region can effectively manage its valuable resources, ensure sustainable resource management and drive transformative change through anticipatory governance and systemic innovations.

By analysing potential leverage points for systemic change, the report offers insights and recommendations for policymakers, industry stakeholders and the international community. The strategic priorities outlined in the report provide actionable recommendations for investing in geological surveying capacities, building mineral stewardship competencies, developing regional value chains, embedding anticipatory governance and strengthening regulatory frameworks and transparency.

As the SADC region grapples with the complexities of the critical minerals sector, this report serves as a guide towards a sustainable and prosperous future. By fostering collaboration, innovation and anticipatory governance, the region can position itself as a key player in the global green technology revolution and ensure a resource-balanced approach to economic development, environmental sustainability and social well-being.

Abbreviations & acronyms

AfDB	African Development Bank
AMDC	African Minerals Development Centre
AMV	African Mining Vision
AU	African Union
DBSA	Development Bank of Southern Africa
EITI	Extractive Industries Transparency Initiative
EU	European Union
MIASA	Mining Industry Association of Southern Africa
OECD	Organisation for Economic Co-operation and Development
RBE	resource-balanced economy
SADC	Southern African Development Community
SAIIA	South African Institute of International Affairs
UN	United Nations
US	United States
4IR	Fourth Industrial Revolution

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About SAIIA

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Cover image

A worker in an electrowinning plant in Tenke Fungurume Mine, one of the largest copper and cobalt mines in the world, in southeastern DRCC on June 17, 2023. The DRC produces over 70% of the global supply of cobalt. The metal is a critical component of batteries and seen as key to the renewable energy transition (Emmet Livingstone/AFP via Getty Images)

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Introduction

The extraction and utilisation of critical minerals in Southern Africa are of paramount importance for the region's economic development, technological advancement and sustainability. As global demand for these minerals increases due to their integral role in clean energy technologies, electronic devices and various other industries, it becomes crucial for SADC to develop a comprehensive and strategic approach to manage and harness the potential of these valuable resources.

The purpose of this special report is to provide a comprehensive analysis of the critical minerals sector in the SADC region and to outline a strategic framework for shaping its future. It aims to address the urgent need for systemic innovations and anticipatory governance in the sector, in line with the SADC Draft Critical Minerals Strategic Framework. By examining current conditions, key stakeholders and drivers of change, this report seeks to provide insights into the alternative futures of critical minerals in the region.

The report focuses on key questions, such as:

- How can the SADC region effectively navigate the challenges and opportunities in the critical minerals sector?
- What strategies can be implemented to ensure sustainable resource management, economic wellbeing and social development?
- How can anticipatory governance and systemic innovations drive transformative change in the sector?

By analysing the 12 strategic places to intervene in complex systems, this report will offer insights into where and how policy interventions can have the most significant impact on reshaping the critical minerals landscape in Southern Africa.

The urgency of addressing these issues is evident from the increasing automation of the mining industry, the potential disruption to labour markets and the need for a just transition to cleaner technologies. Furthermore, inadequate power, transport and water infrastructure in many mineral-rich African countries poses significant barriers to efficient mineral extraction, processing and export. These challenges highlight the need for strong interventions and collaborative efforts to build the necessary infrastructure and human capital for sustainable mineral value chains.

By analysing the potential leverage points for systemic change in the critical minerals sector, this report aims to provide policymakers, stakeholders and the international community with insights and recommendations to drive meaningful transformations. The ultimate

goal is to ensure that the extraction and utilisation of critical minerals in Southern Africa contribute to both economic prosperity and the well-being of its citizens, while promoting environmental sustainability and social inclusivity. Through strategic innovation, the SADC region can position itself as a global leader in responsible mineral resource management and contribute to the achievement of the UN's Sustainable Development Goals.

Through a comprehensive analysis of key drivers of change, trends and strategic priorities, this report seeks to guide policymakers, industry stakeholders and the international community in navigating the future of critical minerals in Southern Africa. By exploring alternative futures and strategic actions, it provides a draft roadmap for the SADC region to transform its critical minerals sector into a sustainable, resilient and inclusive driver of economic development. As the SADC Draft Critical Minerals Strategic Framework evolves, systemic innovations will play a crucial role in shaping the trajectory of critical minerals mining and utilisation, ultimately influencing the region's economic, environmental and social landscape.

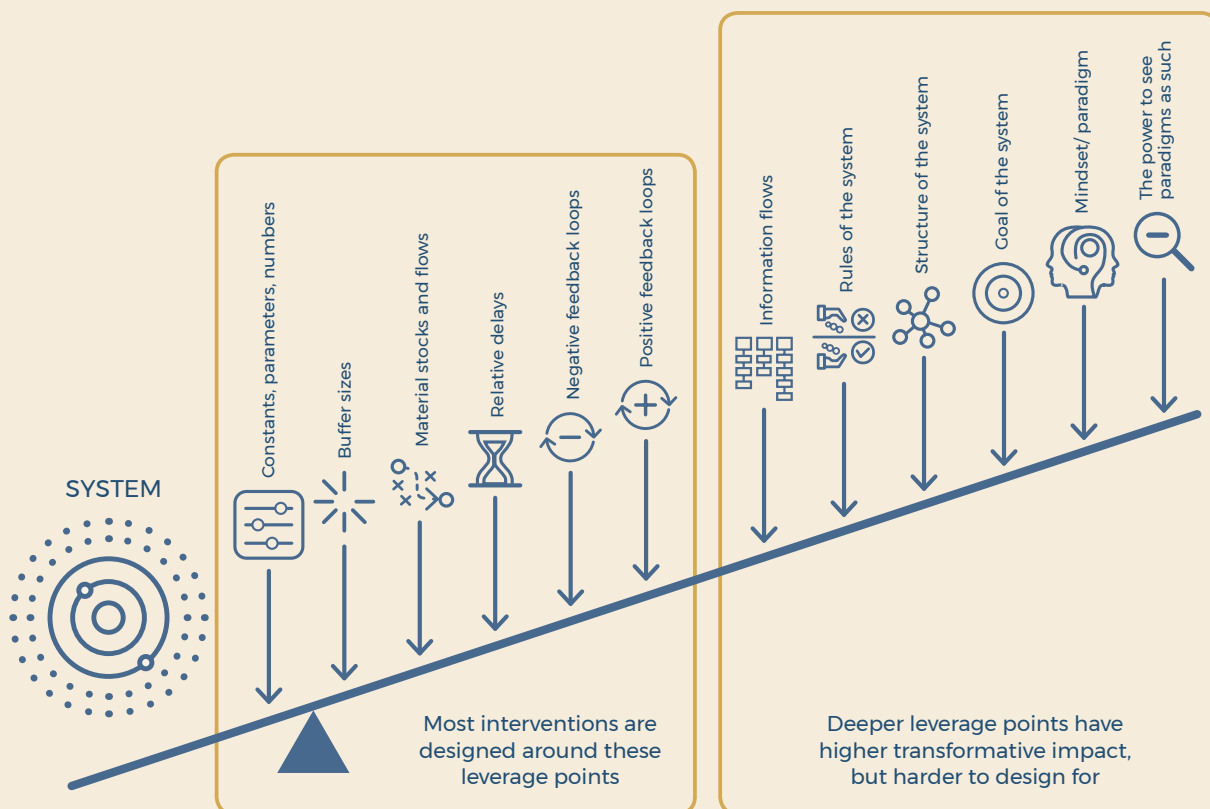
The conclusions drawn from this analysis will provide a roadmap for SADC member states, policymakers, industry stakeholders and the wider community to embrace alternative futures and achieve desired outcomes in the critical minerals sector. The strategic priorities outlined here offer draft actionable recommendations for investing in geological surveying capacities, building mineral stewardship competencies, developing regional value chains, embedding anticipatory governance and strengthening regulatory frameworks and transparency.

As the region grapples with the complexities of the critical minerals sector, this report serves as a guide towards a sustainable and prosperous future. By fostering collaboration, innovation and anticipatory governance, the SADC region can position itself as a key player in the global green technology revolution and ensure a resource-balanced approach to economic development, environmental sustainability and social well-being.

Towards systemic innovations for SADC critical material ecosystems

Leverage points are the ‘places within a complex system ... where a small shift in one thing can produce big changes in everything.’¹ What will it take to transition from a business-as-usual mindset to alternative, co-created preferable SADC critical minerals futures? When developing complexity-informed policies, it is critical to know where to intervene as systems grow, adapt or change. According to systems change specialist Donella Meadows, there are 12 strategic places in which to intervene in complex social, political, economic and environmental systems.²

Figure 1 Places to intervene in a system



Source: Corina Angheloiu, "IPCC: A Site for innovation In Its Own Right?", October 18, 2018

1 Donella H Meadows, "Places to Intervene in a System (in Increasing Order of Effectiveness)", *Whole Earth*, no. 91 (1997): 78-84.
 2 Meadows, "Places to Intervene in a System".

The effectiveness of interventions can be evaluated on a spectrum ranging from weak to strong. Strong interventions can generate broad and lasting improvements, thereby enhancing the resilience and sustainability of the entire ecosystem. Weaker interventions, while beneficial, do not necessarily instigate systemic change that fundamentally reimagines and transforms the underlying structure, power dynamics and paradigms of the ecosystem as a whole. Weaker interventions typically focus on the individual capacities of actors and employ predictive measures to envision a system. The pursuit of systemic change becomes feasible when change agents begin to modify information flows, rules and the structure of systems, thereby transforming the conception and enactment of leadership and power. Once the information flows, rules, structure and goals of systems undergo a critical transformation, change actors can engage with more profound leverage points that yield a higher transformative impact. In the context of SADC critical minerals, systemic innovation entails a comprehensive exploration of all potential leverage points from a mindset rooted in systems innovation thinking. This approach aims to develop strong interventions collaboratively with significant transformative impact, thereby enabling resilient and sustainable systemic change.

Communicate behaviour-changing facts and build skills

The mining industry's increasing automation makes it difficult for workers in developing nations to adapt to the rapid pace of technological advancements. Automation is just one of several transformations introduced by the Fourth Industrial Revolution (4IR), that could disproportionately affect the labour force within the mining sector, particularly low-skilled mine workers and their communities.³ Given the economic importance of mining in many African economies, related trends such as digitisation and automation will not only affect the nature of the labour force but could also worsen socio-economic conditions in countries with low levels of growth and high levels of unemployment. It is thus increasingly urgent that African policymakers focus on creating decent jobs that are in keeping with the emerging technological changes in the mining industry. In order to foster job creation and establish robust mineral supply chains, African governments must prioritise the development of both human capital and physical infrastructure required for the local assembly of clean energy technologies. Without sufficient skills development for workers, the integration of new technologies associated with the 4IR could enlarge the skills gap and hinder the ability of developing nations to capitalise on opportunities related to critical minerals development.⁴ If mineral-rich African countries are to leverage their mineral wealth, they will need to invest in high-quality education and training to develop a globally competitive mining workforce. Closing the skills gap will also be crucial for communities to address many of the mining sector's inherent negative externalities, such as water stress and loss of biodiversity.

³ International Council on Mining and Metals, *External Drivers Shaping the Future of the Mining Industry and Implications for Skills and Community Resilience* (London: International Council on Mining and Metals, 2021).

⁴ Deloitte, *The Future of Mining in Africa: Navigating a Revolution* (Johannesburg: Deloitte, 2022).

Build infrastructure that lowers the costs of acting

Many mineral-rich African countries lack the power, transport and water infrastructure essential for extracting, processing and transporting mineral concentrates to production locations or export markets. Energy and transport deficiencies are serious non-tariff barriers that undermine resource-based industrialisation on the continent. While several African governments have expressed interest in the value-added transformation of minerals, additional mineral processing activities are likely to only add further stress to the electricity burden, while many Africans still have insufficient access to electricity.⁵ Given the unreliable and costly access to electricity, many mining operations in sub-Saharan Africa have decided to build their own energy infrastructure, as mining requires an uninterrupted supply of electricity.⁶ In addition, transport and logistics costs in sub-Saharan African countries are disproportionately high in comparison with that in other developing countries due to infrastructure gaps in transit networks. This often leaves much of Africa's mineral reserves stuck inland, because individual mining operations cannot take on the full cost of infrastructure development needed to access and export minerals. In response to these challenges, African policymakers will have to foster strong partnerships with multilateral development banks and the private sector to finance and construct the foundational infrastructure needed to support mineral processing industries. To begin with, African governments should embrace renewable energy technologies such as hydropower if they are to responsibly supply the energy needed to move up the mineral supply chain.⁷ Moreover, the African Continental Free Trade Area offers an unprecedented opportunity to promote mineral value addition on the continent, given the fact that few countries have the capacity to undertake mine-to-market domestication on their own.⁸

In addition, it is necessary to incorporate various mineral resources, both primary and secondary, in the design of technologies such as batteries. Efforts should be made to better anticipate the development of viable battery solutions using raw materials other than lithium, cobalt and nickel. The cradle-to-cradle design framework is recommended.⁹

- The knock-on benefits of developing a critical minerals inventory enable a focus on restructuring the energy and industrial sectors within bioregional limitations. Considering emerging trends such as population ageing and the expected 'slowbalisation',¹⁰ capital redistribution and allocation will create pathways to transition

5 Chelsea Johnson and Landry Signé, "Africa's Mining Potential: Trends, Opportunities, Challenges and Strategies" (Policy Paper 21/10, Policy Centre for the New South, Rabat, 2021).

6 World Bank, *Africa's Resource Future: Harnessing Natural Resources for Economic Transformation During the Low-Carbon Transition* (Washington DC: World Bank, 2023).

7 Cullen Hendrix, "Building Downstream Capacity for Critical Minerals in Africa" (Policy Brief 22-16, Peterson Institute for International Economics, Washington DC, 2022).

8 Papa Daouda Diene et al., *Triple Win: How Mining can Benefit Africa's Citizens, Their Environment and the Energy Transition*, Research Report (New York: Natural Resource Governance Institute, 2022).

9 William McDonough and Michael Braungart, *Cradle to Cradle: Remaking the Way We Make Things* (New York: North Point Press, 2010).

10 Adjiedj Bakas, *Capitalism & Slowbalisation: The Market, the State and the Crowd in the 21st Century* (Amsterdam: Dexter, 2015).

from centrally predictive economic models to contextually explorative solutions enabling greater financial inclusivity. This approach allows more countries to contribute based on their available resources and capabilities.

- Another leverage point is to revisit the parameters for international trade in critical minerals by limiting minerals exchange to developed countries for further processing. Instead, more deliberate efforts are needed to invest in infrastructure and socio-economic development to enable industrialisation policies to focus on value-added manufacturing processes within environmental parameters.

Provide buffers: Unstructured time and funds

The identified leverage points for the Southern African critical minerals sector, namely providing buffers and merging small African stock markets into a regional exchange, are grounded in the recognition of key challenges and opportunities within the sector. These leverage points are driven by a rationale that aims to address specific issues and capitalise on potential benefits:

- Borrowing in foreign currency in the critical minerals sector should be discouraged to minimise foreign exchange rate risks.¹¹ This approach will reduce the exorbitant privilege of most advanced economies to re-set the terms of financial contracts.
- The numerous small African stock markets should be merged into a regional exchange to improve liquidity and attract foreign investors. By opening up the economy and including informal trade in the formal economy, stocks will be available to a broader range of investors, enabling African countries to harmonise their trading environments and establish free trade among member countries. In addition, it can encourage the growth of stock exchanges to raise capital for mining expansion.

Accountability: Collect data on the decisions of dominant actors and make it public

With the expected growth in demand for clean energy technologies worldwide, many mineral-rich countries can expect to see increased competition for their mineral resources. How this demand is managed will ultimately determine whether host countries and their citizens benefit from their mineral wealth. Not only do corruption risks in critical mineral value chains negatively affect those directly associated with the mining of these minerals, but a lack of financial accountability and transparency also has the potential to derail the global energy transition and undermine efforts to combat climate change. These corruption risks are compounded by the fact that many of the minerals central to the energy transition are concentrated in countries that historically have struggled with

¹¹ Jane Mpapalika, "Alternative Financing Instruments for African Economies", *Journal of Mathematical Finance* 10, No. 1 (February 2020): 42-57.

fragility, weak governance and corruption.¹² As countless examples from across the world have shown, corruption can delay production, reduce the mining sector's contribution to sustainable development in the form of tax revenues, increase environmental degradation and undermine the social licence to operate.¹³ While identifying and addressing risks across jurisdictions is technically challenging and resource-intensive, it cannot be assumed that status quo approaches to corruption will suffice in the era of critical minerals. Fortunately, there are several policy frameworks in the form of commitments to external actors, such as the Extractive Industries Transparency Initiative (EITI) and the OECD, that can help African countries ensure transparency and accountability.¹⁴ In short, strong guidance on transparent supply chains, increasingly conscious consumers, more responsive companies and increasingly accountable governments are the factors needed to ensure that the risks from new mineral extraction are adequately managed. As a result, the proposed leverage point to improve accountability is:

- Expedite the transition from physical cash to stable digital currencies such as cryptocurrencies and plan for increased innovations revolutionising day-to-day transactions, investments, trade, insurance and risk management. The informal economy, especially artisanal mining, can be formalised through digital currencies. Enabling high inclusion levels will promote improved tax collection and reduce the reliance on foreign direct investment for mining and industrialisation. This transition will depend on technological advancements, regulatory frameworks, cultural preferences, financial infrastructure and levels of financial inclusion. Digital currencies provide improved transparency of transactions and can help to eliminate illegal mining. An added benefit is that digital currencies offer access to the environmental impacts of mining and allow proactive solutions to emerge.

Level playing field: Equalise access to important information, income or resources

To mitigate liquidity pressure in Southern African countries and address sovereign risks, it is necessary to introduce alternative financing instruments that promote sustainable development finance. The limited use of hedging instruments intensifies growing debt burdens and vulnerability to commodity price fluctuations, leaving nations more exposed to external risks, including shocks in exchange rates. To tackle these challenges, African countries should mobilise resources by developing their local bond market and accessing alternative financing instruments, thereby hedging sovereign risks.¹⁵ By pooling resources on a regional level, African countries can positively influence their sovereign credit rating

12 Hendrix, "Building Downstream Capacity".

13 Natural Resource Governance Institute, *Preventing Corruption in Energy Transition Mineral Supply Chains* (New York: Natural Resource Governance Institute, 2022).

14 Kathryn Sturman et al., *Mission Critical: Strengthening Governance of Mineral Value Chains for the Energy Transition*, Report (Oslo: Extractives Industries Transparency Initiative, 2022).

15 Mpapalika, "Alternative Financing Instruments".

and thereby unlock more favourable terms for foreign direct investment. This approach opens up alternative financing for emerging countries to invest bilaterally using more favourable economic terms.

Full cost pricing: Impose ‘externalities’ on the account books of actors

Simplifying international currency exchange can de-risk economies from exogenous shocks brought about by significant fluctuations in global commodity prices by relying on the US dollar for international trade. The movement towards de-dollarisation¹⁶ is gaining momentum, enabling the inclusion of various currencies to trade critical minerals. Added benefits are facilitating international trade and transactions, promoting fair trade practices and encouraging the emergence of alternative trading platforms. BRICS countries such as China, India and Brazil have agreed to bypass the US dollar¹⁷ as a vehicle of international trade and settle their bilateral trade in their own currency. Adopting an alternative approach to shift away from the US dollar in international trade provides several advantages. These include diversifying national risks, bolstering national currencies and minimising vulnerability to US sanctions by reducing exposure to fluctuations in the global financial system. This can help to stabilise host economies and foster enhanced economic resilience.

Innovation: Create novel alternatives

In the mining industry, multiple factors stimulate innovation. Mining companies must strive for competitiveness by enhancing the productivity of their assets, minimising operational expenses and enhancing the efficiency and effectiveness of mineral recoveries. In fact, due to the changing conditions of ore deposits, the technologies and processes that have underpinned the industry for decades are becoming increasingly energy- and water-intensive, thereby losing fit-for-purpose. Without industry-wide innovation and transformation, mining companies will continue to rely on legacy mining techniques that are becoming increasingly inefficient and costly to maintain.¹⁸ In addition, it is important to note that innovation is not restricted to technological changes but also extends to a company’s business model and the way it engages its stakeholders. In this regard, innovation is a vehicle for the mining sector to develop new technologies and approaches to capitalise on mineral resource opportunities. At the same time, it leads to improved environmental conservation and the ability to meet communities’ expectations. Innovations in the mining industry are an integral part of the 4IR and come in a variety of forms, namely:

- technological innovations, which include automation, digitalisation and electrification;
- energy innovations, which include the use of renewable energy and microgrids to power mining operations; and

16 Emerald Expert Briefings, “De-Dollarisation in Africa May Exacerbate Volatility”, October 2016.

17 Joseph W. Sullivan, “A BRICS Currency Could Shake the Dollar’s Dominance”, *Foreign Policy* (blog), April 24, 2023.

18 Vivek Salgaocar, “Why Innovation in the Mining Sector Is Critical for the Energy Transition”, World Economic Forum, November 2, 2022.

- social innovations, which include how mines provide value to stakeholders, engage communities and strengthen their social licence to operate.¹⁹

While these innovations are likely to improve cost-competitiveness and productivity, they present a double-edged sword for African economies that depend on the mining industry for employment creation.²⁰ Without workable long-term strategies from all stakeholders, the benefits of these technologies are likely to be unevenly distributed, as they tend to accrue disproportionality to those employees already in high-skilled employment.

Instead of focusing solely on a single technology resource stream, it is advisable to pursue the simultaneous development of all available alternatives. The projected demand for such resources exceeds current estimations and necessitates a broader bioregional and re-localised approach.

Organising for change

A comprehensive understanding of long-term consumption targets for all raw materials is crucial. This entails mapping out the replacement of entire systems and developing regional strategic foresight on critical minerals consumption trends for the next 10–30 years across all minerals. Anticipating post-capitalism means creating heterogeneous stakeholder groups to stress the interconnected relationships between the private sector and its customers, suppliers, employees, investors, communities, environmentalists and all interested persons to support stakeholders and not only shareholders. By implication, profits will accrue not only to shareholders but also to stakeholders. The expectation is not to reach a consensus among stakeholders but to forgo short-term thinking in favour of a focus on longer-term benefits.

The development of a regional Social Contract for Mining and Minerals should be ratified by SADC member states, aligned with existing agreements/strategies such as Nationally Determined Contributions, the African Mining Vision (AMV) and country-level mining plans. This should embed capacity building for anticipatory governance within a sense-making framework to navigate the increasingly complex environment. It is necessary to capacitate organisations such as the African Minerals Development Centre (AMDC) and regional mining associations to support and enable broader social objectives.

Change the rules

In sub-Saharan Africa's resource-rich economies, the 2004–2014 period saw a significant commodity price boom, leading to accelerated economic growth. This prosperity proved

19 Intergovernmental Forum on Mining, *Minerals and Sustainable Development, Innovation in Mining: Report to the 2018 International Mines Ministers Summit* (Winnipeg: International Institute for Sustainable Development, 2018).

20 Ross Harvey, "Mining for a Circular Economy in the Age of the 4IR: The Case of South Africa" (Policy Brief No. 181, SAIIA, Johannesburg, 2019).

fragile, as only a limited number of African citizens experienced substantial benefits from previous mining activities. As a consequence, with the region's average growth rate declining, many individuals have fallen into poverty in recent times. If things are to be different in the critical minerals era, policymakers will have to adopt a different policy paradigm. An examination of previous policymaking reveals that a narrow emphasis on the extractive industry's interplay with the broader economy has typically yielded unfavourable outcomes.²¹ For example, the use of mandatory quantitative local content policies that disregard capacity building is not only insufficient but also introduces distortions and rent-seeking opportunities into the economy.²² In addition, recent empirical research has shown that export control measures have not helped to develop local processing industries in the countries that have implemented them.²³ The effective management of the structural challenges arising from heightened mineral demand will hinge on the capability of African economies to enhance productivity and create employment opportunities in sectors beyond commodity exports. A significant policy approach involves diversifying asset portfolios by prioritising investments in human and physical capital, rather than solely focusing on diversifying exports.²⁴ For example, the government of Botswana spent all of its revenue from its diamond reserves over the past three decades on health, education and infrastructure. Regional integration and the development of cross-border value chains also offer a pragmatic policy option to attract downstream processing investment.²⁵ In short, a subtle balance needs to be struck between allowing sufficient flexibility in business operations to attract investment and creating local employment opportunities for local value addition.

Build and defend institutions: Embed fairness and enable the weak

A multifaceted approach is required to address various challenges and leverage opportunities. One significant challenge is achieving cooperation among all countries in the region regarding the production and utilisation of critical minerals. As different countries possess varying potentials and capabilities, it is essential to navigate potential incompatibilities and disagreements through dialogue and cooperation. This can be done by applying anticipatory governance processes that establish platforms for regular engagement, dialogue and collaborative decision-making that consider each country's specific needs and goals. Due to its complex nature, experimentation is required to evaluate unintended consequences in a controlled environment and make the necessary adjustments before implementing key decisions at scale.

21 Olle Östensson, "The Potential of Extractive Industries as Anchor Investments for Broader Regional Development" (Working Paper 87/2020, UNU-WIDER, Helsinki, 2020).

22 Jane Korinek and Isabelle Ramdoo, "Local Content Policies in Mineral-Exporting Countries" (Trade Policy Paper 209, OECD, Paris, 2017).

23 Barbara Fliess, Ernst Idsardi and Riaan Rossouw, "Export Controls and Competitiveness in African Mining and Minerals Processing Industries" (Trade Policy Paper No. 204, OECD, Paris, 2017).

24 World Bank, *Africa's Resource Future*.

25 Deloitte, *Africa's Role in a Clean Energy Future* (Johannesburg: Deloitte, 2022).

African countries are evaluated on narrow-focused valuation measures by centralised economic frameworks to determine financial lending and borrowing parameters, mostly placing developing countries at a disadvantage. Decentralised finance models²⁶ support the disintermediation of financial services that can facilitate the supply of credit on a peer-to-peer basis. Regulatory frameworks, including oversight architecture, will be required to ensure inclusivity and target corrupt activities. This model will help to curb tax evasion due to the open and transparent nature of the application linking tax income to cover entry and exit points when natural resource and fiat currencies are converted to crypto assets and vice versa. This model must enable technical and non-technical users and will require additional rules of engagement to understand better the mechanics, potential benefits and associated underlying risks.

The potential and capacity for exploration should be compared against global reserves and projected consumption needs. It is essential to assess whether exploration efforts align with the requirements for bioregionalism, re-localisation and future resource consumption that will ensure intergenerational fairness. Any raw material that poses a potential regional supply risk should undergo an evaluation of substitution options. Alternative materials that can serve as substitutes for such at-risk resources need to be identified and considered. Substitution options should be evaluated in relation to global reserves and projected consumption requirements. This assessment ensures that the proposed substitutes align with long-term resource availability and anticipated consumption levels.

To implement these concepts, industrial ecology principles such as thermodynamics, exergy and biomimicry²⁷ are suggested, utilising systems network theory. Uncertainty can be addressed through the use of futures thinking²⁸ and/or complexity thinking²⁹ at a foundational level.

Pivot the purpose: Align your organisation with human values

African leaders can increase regional and functional currency diversification and cooperation by gradually removing the excessive reliance on US dollar settlement for trade. This approach reduces exchange rate risks and opens up innovative options in national credit risk evaluations. Existing valuation methods focus on divided and competing ownership

26 OECD, "Why Decentralised Finance (DeFi) Matters and the Policy Implications" (OECD, Paris, 2022).

27 Biomimicry Institute, "What Is Biomimicry?", <https://biomimicry.org/what-is-biomimicry/>.

28 Futures thinking can be defined as a strategic approach to explore and critically consider future scenarios in order to define the most preferable ones for people and society. The aim of futures thinking is to provide policymakers, and more broadly decision makers in any field, with the capacity to proactively anticipate changes, recognise opportunities and ease the transition toward desirable futures. Marita Canina, Carmen Bruno and Eva Monestier, "Futures Thinking", in *The Palgrave Encyclopedia of the Possible* (Cham: Springer International Publishing, 2020), 1-7.

29 Complex adaptive systems thinking offers a way of "interconnected" thinking about the world that allows us to see the dynamic behaviour and patterns of change that such systems display. Complex adaptive systems thinking challenges commonly held assumptions about the nature of a problem and conventional solutions that are based on control and demand-based planning and decision-making approaches, anticipates surprises and accepts that there are no quick fixes for solving complex real-world problems. R Preiser, "Key Features of Complex Adaptive Systems and Practical Implications for Guiding Action" (CST Policy Briefing, Centre for Transitions, Stellenbosch, 2018).

models linked to financial metrics. By including socio-ecological adjusted valuations, models can revolutionise deal-making by redefining the concepts of fairness by incorporating Indigenous knowledge systems.³⁰ Indigenous communities and their contributions, such as safeguarding the natural world, offer first-hand knowledge of climate adaptation techniques that promote resilience.

Change the paradigm: Transform thinking and language through systemic leadership

Shifting from a short-term, outcome-oriented approach to actively engaging in a ‘mining futures’ dialogue process is instrumental in cultivating a paradigm shift towards a broader perspective of value beyond mineral revenues. This transition entails delving into a foresight-based policy innovation process, which involves exploring strategic future scenarios to inform decision-making for the long term. By adopting this approach, the mining sector can proactively assess and respond to future challenges and opportunities.

A crucial aspect of this paradigm shift is prioritising outcomes that benefit youth. To ensure intergenerational fairness, it is essential to evaluate policies and initiatives through the lens of their impact on younger generations. This involves measuring the extent to which opportunities and resources are distributed equitably across age groups. Additionally, actively involving young people in mainstream economic activities is vital in fostering their meaningful participation and empowerment.

By embracing foresight-based policy innovation processes and prioritising outcomes for youth, the mining sector can navigate future uncertainties while promoting inter-generational equity and inclusive economic development. This approach recognises the significance of long-term decision-making and the imperative of involving the youth in shaping sustainable mining futures.

The industrial ecosystem is undergoing a shift from a mindset of boundless growth to one that acknowledges limits and boundary conditions. As we await the development of a new industrial-technological-economic system that meets these evolving demands, this transitional phase can be characterised as contraction-based economics that impacts all sectors of the global ecosystem over a span of approximately 20 years. The initial knee-jerk reaction is to guard against this transition because it implies that economic recessions will be the default. It assumes that the only available plausible futures exist in binary, mutually exclusive models. The reality is that there is a myriad of alternative futures when one can shift paradigms that are open to possibilities. The current industrial business model operates under the assumption that continuous growth is possible on a finite planet, leading to an ever-increasing demand for minerals. Technological advancements have also

³⁰ Morne Mostert, “Value, Values and Valuations: Beyond the African Debt Cancellation Paradigm: A Recalculated Global Debt Exchange”, Club of Rome, November 19, 2020.

raised the requirements for material purity, driving up production costs and reducing the profitability of mining minerals.

Developing a new paradigm and system, such as the resource-based economy (RBE), to address the challenges in the critical minerals and mining sector in the SADC region is a complex undertaking. It requires a fundamental shift in energy and raw material consumption patterns and a re-evaluation of our approach to materials sourcing. The aim is to shrink the industrial footprint and transition from a growth-based economic model to one that does not rely on continuous growth. As the existing system deteriorates, a new, smaller system will gradually emerge and evolve.

Another paradigm shift to be considered is to move away from trade-offs between economic prosperity and environmental impacts. According to the World Bank, by 2035, more than half of the global youth population will be in Southern Africa.³¹ This creates unprecedented pressure to expand investments and opportunities to increase the labour absorption rate across new and existing sectors in the region. The SADC region is urged to implement policies that anticipate and respond to social, political and economic future needs, considering the knock-on impacts of the demographic cycle, and to leverage the demographic dividend.

³¹ World Bank, "Realizing a Brighter Future for a Young, Energized, and Connected Africa", August 14, 2023.

Strategic framework

Drivers of change

The research provides a snapshot of the current conditions and key stakeholders affecting the mining of critical minerals in the SADC region. This snapshot is put in motion by further analysing the drivers of change, garnering insights and mapping these into alternative framings to describe the futures of critical minerals in the region. To create foresight, the drivers of change interplay with events and issues with varying degrees of uncertainty, so creating plausible alternative futures.

Key trends were distributed across the social, technological, economic, environmental, political, and values (STEEP-V) analysis done for this report. Participatory action research and futures studies methodologies were applied in a series of stakeholder workshops, centred on exploring and mapping viable futures of critical minerals in the SADC region through a process of conducting a series of Futures Literacy Labs by applying the Causal Layered Analysis and Three Horizons Framework foresight methods. Workshop participants ranked these trends based on impacts and levels of uncertainty:

- increased geo-economic competition (China/US/EU) for dominance of green tech value chains;
- the ability of flexibility, as demonstrated by SADC states, to manage trade-offs associated with the creation of regional value chains;
- the momentum of urgency or ambition of the global policy action to address climate change impacts;
- the increased demand for renewable energy giving rise to low-carbon technological change in energy generation and storage applications;
- the ability of SADC states to establish attractive investment conditions, to promote the mining of critical minerals in the region; and
- other.

The workshop participants were experts in this domain, each holding assumptions about constants, possible tipping or longevity points in trends, actors with specific plans or intentions to act, cycles of change and quantitative projections. These assumptions were challenged in three futures workshops through the process of discovering and testing support for mental models and conclusions. Although there are no facts about the future, inferences about alternative futures are relied upon, supported by some evidence and assumptions. Therefore, revealing and managing uncertainties form the basis for creating

plausible alternative futures. The emphasis is on not selecting the 'right' uncertainties and drivers of change and, by implication, removing the illusion of determinism. One of the underlying benefits of strategic foresight is moving beyond the illusion of being 'right' and becoming more attuned to responding flexibly to high-impact key uncertainties by developing contingencies that may prove invaluable in navigating uncertainty and complexity.

The categorised high-impact key uncertainties and drivers of change were synthesised into higher order domains of change. This is a useful step in truly understanding the futures of mining critical minerals in the region and generating a prelude to action, thereby shaping and influencing possible transition pathways. The key uncertainties identified remind the mining ecosystem to recognise that uncertainty and ambiguity are inherent, even useful aspects of long-term plausible futures.

Therefore, the synthesised drivers of change for the future of mining critical minerals in the region are:

- 1 **Institutional Decay:** The collapse of regulatory frameworks and inadequate governance in institutions give rise to unprecedented levels of corruption and maladministration.
- 2 **Institutional Renaissance:** Well-managed institutions attract foreign direct investment and, in addition, build the trust necessary for collaboration, partnerships and innovation practices needed to place people before profit and the environment.
- 3 **Greedflation:** Rising levels of corruption are a prelude to a post-capitalist economy where prices increase to take advantage of inflation to boost profit margins, even if production costs have not risen enough for price increases to be justified.
- 4 **Cooperative Economy:** Stakeholder groups are woven together through deep trust and use a sense of solidarity and concern for the community and the environment to promote economic alternatives that create economic wellbeing and regenerative economies. Collective action increases productivity and positively influences economic circumstances within bioregional boundaries.

These domains feed directly into the Preferred Future section, as well as the development of strategic actions and priorities to achieve this future.

Draft strategic priorities

In the language of strategy, a set of priorities (ie, objectives) is needed for a SADC critical minerals plan to make its vision and aims a reality and embark on the journey of 'creating' a transformed system with preferred future conditions.

Specific to the future of critical minerals and metals in SADC contexts, these priorities are:

Invest in and develop advanced geological surveying capacities

Invest in and develop surveys to map geological resources. This approach will strengthen information about the availability and distribution of critical minerals in the region. By gaining deeper knowledge about the available critical minerals, governments and industry stakeholders will be empowered to implement data-driven decisions, embed resource anticipation and better anticipate future demands. This approach will lead to more resilient economies. It can also reduce commodity price fluctuations and set the foundation for an RBE through proactive sustainable mineral resource management to promote and sustain intergenerational fairness.

Build and continuously capacitate mineral stewardship competencies for an RBE

Include alternative perspectives such as geospatial and ecosystem management to maximise societal value and minimise impacts on humans and the environment. Invest in institutions to ensure that human development is prioritised to facilitate the evolution of the social contract. Implement eco-efficient processes and stimulate the participation of marginalised groups. This can be done by increasing value-add industries in the region by establishing practices beyond mining for a circular economy towards an RBE. Capacitate institutions with the knowledge and technology (such as blockchain) to track the movement and consumption of all the different minerals/metals/materials as the industrial ecosystem value chain progresses to manage environmental and societal impacts proactively. The improved resilience of RBEs will allow for broader and deeper participation in the mining sector and thereby diversify the economy, making it less vulnerable to commodity price fluctuations.

Invest in and develop critical minerals regional value chains

Through collaboration and integration among Southern African countries, regional value chains can be strengthened by promoting a revolutionary social contract for mining and utilising critical minerals. Regional value chains can be further enabled by leveraging each country's comparative advantage, such as resource availability, infrastructure and human capital, to complement the regional shared social contract. Through sharing research, innovation practices, skills development and technology transfers, the region can enhance cooperation and competition and create a new relationship with energy, mineral resources, technology, economics, the environment and each other. New economic systems can emerge, such as the cooperative economy, which follows a more balanced perspective while leveraging prosocial behaviour. This highlights the design imperative that promotes the self-sufficiency of communities, sustainability and entrepreneurship while limiting overconsumption and excessive profit-making.

Embed anticipatory governance in regional structures to improve long-termism

Capacitate regional structures such as industry associations, mining chambers and mining departments with anticipatory governance and strategic foresight capabilities to

anticipate future trends, challenges and opportunities in the critical minerals sector. These insights can be used to proactively inform policy decisions. This approach facilitates early intervention, risk mitigation and the formulation of policies that support the long-term sustainable development of the critical minerals sector. It also helps to illuminate the various political implications of responding to events in the present at earlier rather than later stages of development by experimenting with ready-made and multiple safe-to-fail options of speculative future imaginaries. The focus is to continuously couple human society with the environment where the long-term survival of humanity is linked to the stability of biodiversity life systems on a planetary scale.

Strengthen governance through regulatory frameworks and transparency

Political will and commitment among Southern African leaders are crucial for driving the necessary reforms in the critical minerals sector. By addressing regional governance issues, strengthening regulatory frameworks and fostering transparent and accountable practices, the region can effectively navigate the future of the critical minerals in Southern Africa and promote more equitable outcomes. Investment in and building the capacity of institutions, especially in mining value chains, will reduce corruption and maladministration and foster trust between government, citizens and the private sector to create new social contracts. The strengthened institutions will pave the way to navigate alternative economic models where people and the environment is considered before profit.

Draft strategic activities

To achieve these priorities, various strategic activities are proposed in the tables below, describing what can be done and by whom. In this case, it is particularly important to identify and articulate this because it is not a case of only one entity/institution being needed to create a preferred future but rather a range of actors at different levels. Various institutions and actors can work at and within different levels and spheres of influence. Where there is overlap (eg, where the same activity is identified for several actors), the potential for powerful strategic action is evident. It is also important to acknowledge that the strategic activities are cross-cutting and critical in supporting the five strategic priorities detailed earlier.

The below strategic activities are organised according to 10 identified actors/stakeholders:

- intergovernmental bodies (AU, AMDC);
- governments and policymakers;
- private sector and labour unions;
- mining, geological and metallurgy experts (mining researchers, academics, innovators);
- UN country offices as part of funding partners, country strategy, international comparison programmes, UN Economic Commission for Africa, UN Industrial Development Organization, UN Environment Programme, UN Development Programme;

- Regional communities (SADC Secretariat, SADC Business Council);
- independent non-governmental organisations and civil society (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, Southern Africa Resource Watch, EITI);
- Think tanks and research consortiums;
- Mining industry associations (eg, Mining Industry Association of Southern Africa [MIASA]), mining chambers, minerals councils and mining networks; and
- national mining and geological survey authorities/regulators.

Invest and develop advanced geological surveying capacities

TABLE 1 STRATEGIC ACTIVITIES TOWARD INVESTMENT IN SADC GEOLOGICAL SURVEYING CAPACITIES			
Strategic priority: Invest in and develop advanced SADC geological surveying capacities			
Action	Champion	Supporting entities	How will we monitor this?
Create regional geological survey council.	African Minerals Development Centre	SADC Secretariat, governments, Universities, Mining Industry Association for Southern Africa	Establishment of SADC Critical Minerals Geological Survey
Conduct a comprehensive assessment of current geological surveying capabilities in SADC member states to identify strengths, weaknesses and areas for improvement.	<ul style="list-style-type: none"> • Geological Survey of Botswana • Geological Survey of Namibia • South African Council for Geoscience • Zimbabwe Geological Survey 	SADC Secretariat, governments, African Minerals Development Centre, Mining Industry Association for Southern Africa	Establishment of AU Green/Critical Minerals Observatory, geological surveying capabilities comprehensive assessment report
Establish partnerships with international organisations, research institutions and technology providers to access cutting-edge geological surveying technologies, tools and expertise. This is also for knowledge-sharing purposes.	SADC member state governments	UN country offices, SADC Secretariat, AU	Number of formal partnerships announced and signed MoUs
Develop standardised protocols and guidelines for conducting geological surveys, ensuring consistency and comparability of data across SADC member countries.	Council for Geoscience	SADC member state governments, SADC Secretariat, academia, think tanks	Publications of SADC geological surveys, standardised protocols and guidelines

Action	Champion	Supporting entities	How will we monitor this?
Engage with private sector entities, mining companies and natural resource exploration companies to leverage their investments in geological surveying and promote public-private partnerships.	SADC member state governments	SADC Business Council, private sector, Mining Industry Association for Southern Africa	Number of announcements on investments in SADC geological surveying entities
Upskill and build the capacity of local geologists, surveyors and technicians in modern geological surveying techniques, data analysis and interpretation.	SADC member state government departments of higher education and TVET	Academia, private sector, think tanks	Quality and quantity of graduates with work-based learning experience
Conduct pilot projects in selected regions to demonstrate the effectiveness and benefits of advanced geological surveying techniques.	Mining companies	SADC member state governments, Mining Industry Association for Southern Africa	Published research demonstrating advancements in SADC member states, geological surveying techniques

Strategic activities for mineral stewardship competencies and developing a resource-balanced economy

TABLE 2 STRATEGIC ACTIVITIES TOWARDS MINERAL STEWARDSHIP AND DEVELOPING A RESOURCE-BALANCED ECONOMY			
Strategic priority: Build and continuously capacitate mineral stewardship competencies for a resource-balanced			
Action	Champion	Supporting entities	How will we monitor this?
Develop a comprehensive SADC mineral stewardship framework: Establish a framework that outlines principles, guidelines and strategies for responsible mineral resource management building on the SADC protocol on mining, ensuring sustainable development, environmental protection and social inclusiveness.	SADC Secretariat Directorate of Industrial Development and Trade	Academia, SADC governments, AMDC, African Development Bank (AfDB), international development agencies, SADC Business Council	Publication and implementation of comprehensive SADC mineral stewardship framework

Action	Champion	Supporting entities	How will we monitor this?
Establish a critical minerals governance cohort within the SADC Secretariat: Create a dedicated body responsible for overseeing and implementing mineral stewardship activities, including monitoring compliance and promoting sustainable practices. This will be made up of different experts from the necessary sectors to build a resource-based economy.	SADC Secretariat Directorate of Industrial Development and Trade	SADC member state governments, AMDC, NGOs, international development agencies, SADC Business Council	Establishment of dedicated programme for critical minerals governance in SADC Secretariat Directorate of Industrial Development and Trade or other similar intergovernmental body
Drive and promote socially inclusive decision-making processes that involve local communities, Indigenous groups and other stakeholders in mineral resource management.	Private sector	Independent non-government organisations, trade unions, governments, civil society	Number of signed stakeholder agreements that outline decision-making protocols with local mining communities that show the tangible benefits of the mining
Support small-scale and artisanal mining: Develop programmes to formalise and support small-scale and artisanal miners, providing them with training, access to finance, and improved working conditions. Implement measures to address environmental and social challenges associated with these mining practices.	Private sector	Trade unions, governments, NGOs	Number of regional and national programmes developed
Establish mechanisms for fair and equitable benefit-sharing from mining activities to enhance socio-economic development in mining communities.	Private sector	Trade unions, governments, NGOs	Publication of established mechanisms and equitable benefit-sharing agreements
Support innovation in resource recycling and recovery: Promote research and innovation in resource recycling and recovery technologies to maximise the recovery of valuable minerals from waste streams and by-products. Develop innovative processes for recovering critical and strategic minerals from secondary sources, such as electronic waste and mine tailings.	Private sector and academia	SADC member state governments, academia, NGOs, AMDC, think tanks	Establishment of a Geological Services for SADC and a Centre of Excellence on Sustainable Resources Management for the AU

Strategic activities towards investment and development of critical mineral regional value chains

TABLE 3 STRATEGIC ACTIVITIES TOWARD INVESTMENT AND DEVELOPMENT OF CRITICAL MINERAL VALUE CHAINS			
Strategic priority: Invest in and develop critical mineral regional value chains			
Action	Champion	Supporting entities	How will we monitor this?
Strategic regional value chain development: SADC countries should adopt a systemic approach to critical mineral value chains that considers not only extraction but also processing, manufacturing, and advanced version of the circular economy. By fostering strategic partnerships with both local and international actors, SADC nations can create a synergy between mineral wealth and industrial development.	SADC member state government departments of mineral resources	SADC Secretariat Directorate of Industrial Development and Trade, private sector, academia, NGOs, AMDC, Development Bank of Southern Africa (DBSA)	Research publications on strategic projects to improve strategic regional value chain development. Number of processing, manufacturing, and advanced circular mining activities announced.
Establish strategic partnerships with regional industry stakeholders: Forge partnerships with mining companies, industry associations, and private sector entities involved in critical minerals extraction and beneficiation to foster collaboration, knowledge sharing, and investment in regional value chains.	SADC member state government departments of mineral resources	MIASA, SADC Business Council, NGOs, private sector, DBSA	Number of partnerships and investments announced with mining companies, industry associations, and private sector entities to establish regional value chains
Tailored Local Content Policies: Local content policies should be crafted with precision, accounting for specific mineral contexts, market dynamics, and socio-economic conditions. Flexibility in policy design will prevent the missteps of one-size-fits-all regulations and foster inclusive economic participation.	SADC member state government departments of mineral resources	SADC Secretariat Directorate of Industrial Development and Trade, MIASA, SADC Business Council, NGOs, private sector, unions	Number of countries with published local content policies and critical minerals strategies

Action	Champion	Supporting entities	How will we monitor this?
Local beneficiation and processing: Encourage the establishment of downstream industries that add value to raw minerals within the SADC region. This includes investing in mineral processing facilities, such as smelters, refineries and chemical plants. This will lead to the region capturing a larger share of the value chain, creating employment opportunities and promoting industrial development.	SADC member state governments	Private sector, SADC Business Council, mining associations, DBSA	Increased local beneficiation and processing statistics
Metal exchanges: Set up a continental metal exchange to facilitate transparent and efficient trading of critical minerals. These exchanges can serve as platforms for price discovery, market access, risk management and reducing price fluctuations/volatility. They should have robust regulatory frameworks and operate with transparency and accountability.	SADC member state governments	SADC Secretariat, AfDB, private sector, SADC Business Council, DBSA	SADC member states start to trade on a continental metals exchange
Facilitate infrastructure development: Identify mining infrastructure gaps and invest in the development of transportation networks, power supply and logistics infrastructure necessary to support critical mineral extraction, processing and transportation within the region.	SADC member state governments departments of mineral resources	SADC member state department of infrastructure, transportation and public works, SADC Secretariat Directorate, Infrastructure, private sector, SADC Business Council, AfDB, DBSA	Research publications showing increased cooperation and financing of regional mining infrastructure
Promote investment in critical mineral processing facilities: Encourage domestic and foreign direct investment in the establishment of processing facilities within the SADC region to add value to raw critical minerals, reduce reliance on exports of raw materials and create employment opportunities for communities.	SADC member state government departments of trade and industry	Government national treasury, SADC Business Council, AfDB, DBSA, private sector	Number of facilities and research publications on increased capability and for minerals processing

Action	Champion	Supporting entities	How will we monitor this?
Engage with financial institutions and investors: Collaborate with the AfDB, DBSA, investment funds and other financial institutions to mobilise capital and attract investment for expanding critical minerals value chain projects. Provide incentives and support mechanisms for financing infrastructure development and processing facilities.	SADC member state government departments of mineral resources	SADC Business Council, AfDB, DBSA, private sector	Increased financing and investment of regional critical minerals value chains

Strategic activities towards embedding anticipatory governance in regional structures to improve long-termism

TABLE 4 STRATEGIC ACTIVITIES TOWARDS EFFECTIVE INCLUSIVE GOVERNANCE AND COORDINATION MECHANISMS			
Strategic priority: Embed anticipatory governance in regional structures to improve long-termism			
Action	Champion	Supporting entities	How will we monitor this?
Strengthen institutional capacity: Enhance the capacity of institutions responsible for anticipatory governance and coordination by providing training, technical assistance and resources for futures thinking and systems thinking. Develop mechanisms for knowledge sharing, emerging practices exchange and peer learning among institutions to build anticipatory governance.	SADC member state government departments of planning monitoring and evaluation	SADC Policy, Planning and Resources Mobilisation (PPRM) Directorate, SADC Secretariat Directorate of Industrial Development and Trade, NGOs, academia, think tanks	<ul style="list-style-type: none"> • Number of departments and people trained in anticipatory governance • Establishment of community of practice on anticipatory governance for critical minerals
Foster citizen participation and engagement: Implement mechanisms to ensure meaningful participation of citizens in decision-making processes at regional and national levels. Promote transparency, accountability and citizen feedback mechanisms to strengthen the connection between governance institutions and the public.	Civil society organisations	Independent NGOs, governments, SADC Secretariat, think tanks	Research publications on increased community ownership and benefits to mining communities through assessments of independent transparency and accountability institutions

Action	Champion	Supporting entities	How will we monitor this?
<p>Develop regional strategic foresight capacities: Establish a dedicated regional strategic foresight unit within SADC to systematically analyse future mining trends, identify emerging challenges and opportunities and develop scenario-based strategies. Integrate anticipatory governance principles, such as future-oriented thinking, early detection and monitoring of emerging trends, policy experimentation and adaptive management, feedback systems and coordination of financial and physical facilitates for information sharing, joint problem-solving and the pooling of resources. This unit should engage with diverse stakeholders and facilitate the integration of foresight findings into regional policy frameworks.</p>	<p>SADC member state government departments of mineral resources</p>	<p>SADC Policy, PPRM Directorate, SADC Secretariat Directorate of Industrial Development and Trade, NGOs, academia, think tanks, AMDC, international development agencies</p>	<p>Establish a dedicated regional strategic foresight unit within SADC Policy, Planning and Resources Mobilisation (PPRM) Directorate</p> <p>Research reports on increased uptake of regional foresight capabilities; increase in futures and strategic foresight training certifications</p>
<p>Encourage policy coherence: Foster policy experimentation, innovation and coherence across different sectors and thematic areas by establishing mechanisms for cross-sectoral coordination and collaboration. Encourage the alignment of regional policies and frameworks, such as those related to climate change, trade, infrastructure development and social inclusion, to ensure a holistic and integrated approach to long-term planning.</p>	<p>SADC Secretariat Directorate of Industrial Development and Trade</p>	<p>SADC member state government departments of mineral resources, MIASA, SADC Business Council, NGOs, think tanks, academia</p>	<p>Published policy documents on AMV country plans by all 16 SADC member states</p>

Strategic activities for strengthening governance through regulatory frameworks and transparency

TABLE 5 STRATEGIC ACTIVITIES FOR STRENGTHENING GOVERNANCE THROUGH REGULATORY FRAMEWORKS AND TRANSPARENCY

Strategic priority: Strengthen democratic and economic governance through regulatory frameworks and transparency			
Action	Champion	Supporting entities	How will we monitor this?
Establish regulatory impact assessments: Conduct regular regulatory impact assessments to evaluate the effectiveness and impact of existing regulations. These should consider social, economic and environmental spheres to identify any unintended consequences or gaps in the regulatory framework. Use the findings to refine and improve regulatory systems.	Think tanks	SADC member state government departments of mineral resources, international development agencies, academia, MIASA	Publication of regulatory impact assessments on public portal
Robust Governance Frameworks: Policymakers must prioritise comprehensive governance frameworks that ensure transparency, accountability, and environmental stewardship in critical mineral extraction. The establishment of independent regulatory bodies and adherence to international standards, such as the EITI and the OECD Due Diligence Guidance, will be pivotal in upholding these principles.	SADC member state government departments of mineral resources	SADC Secretariat Directorate of Industrial Development and Trade, NGOs, EITI, OECD, think tanks	<ul style="list-style-type: none"> • Publication of robust governance frameworks and policy documents. • Establishment of independent regional regulatory bodies • Research publications on increased transparency, capability and lower levels of corruption, illicit financial flows

Action	Champion	Supporting entities	How will we monitor this?
<p>Enhance transparency and access to information: Strengthen measures that promote transparency in decision-making processes, such as publishing regulatory proposals, draft regulations and public consultations. Develop mechanisms to ensure public access to information on regulations, regulatory processes and regulatory bodies. Establish civic tech platforms for engaging with stakeholders, including civil society organisations, businesses and the public, to gather feedback and inputs on regulatory issues.</p>	<p>SADC member state government departments of mineral resources</p>	<p>SADC Secretariat Directorate of Industrial Development and Trade, NGOs, EITI, OECD, think tanks, civil society</p>	<p>Establishment of the AMDC African Green Minerals Observatory</p>
<p>Strengthen compliance and enforcement mechanisms: Develop robust standardised compliance and enforcement mechanisms to ensure effective implementation of regulations. Provide adequate resources and capacities to regional and national regulatory bodies to conduct inspections, investigations and enforcement actions.</p>	<p>SADC Secretariat Directorate of Industrial Development and Trade</p>	<p>SADC Secretariat Directorate of Industrial Development and Trade, NGOs, EITI, OECD, think tanks, civil society, international development agencies</p>	<ul style="list-style-type: none"> • Create a prioritised mining and minerals resources directorate at the SADC Secretariat • Published research on SADC critical minerals robust standardised compliance and enforcement mechanisms • SADC member state announcements of providing adequate resources and capacities to regional and national regulatory bodies

Conclusion

The escalating demand for critical minerals offers Africa a unique chance not only to drive sustainable development and foster resource-led industrialisation but also to embrace a transformative paradigm shift. This shift calls for fundamental changes in our energy and raw material consumption patterns, prompting a re-evaluation of material sourcing strategies. The ultimate goal is to reduce the industrial footprint and transition away from a growth-centred economic model toward a more sustainable and balanced approach that does not depend on perpetual growth. As the current system faces challenges, a novel, more streamlined system will gradually emerge and evolve, prioritising long-term sustainability and resilience. Embracing this new paradigm will enable SADC member states to navigate the future with foresight and purpose, ensuring a prosperous and sustainable trajectory for generations to come.

However, the sector currently faces significant uncertainties. Previous attempts on the continent to enhance local value addition in mineral supply chains yielded mixed results. Additionally, the mining industry's environmental and social impacts pose challenges, leading to opposition and frustration in local communities that bear the brunt of the negative consequences while benefiting the least from mining investments. Moreover, the mining sector itself, along with the broader green technology ecosystem linked to the energy transition, is undergoing rapid changes.

While it is essential for SADC member states to respond effectively to current opportunities and risks, it is also crucial to acknowledge that unforeseen disruptors, 'known-unknowns' and 'unknown-unknowns' will shape the sector's development in unpredictable ways. In this dynamic and evolving landscape, the ability to navigate the future and exercise futures literacy and anticipatory governance is vital for both private and public sector actors. These skills enable stakeholders to anticipate and proactively respond to emerging trends and uncertainties, ensuring their actions align with long-term adaptable goals and contribute to sustainable outcomes.

Southern Africa holds vast mineral resources, presenting an opportunity to capitalise on its potential. Developing the mineral sector in SADC can not only benefit the region and continent but also contribute to global mineral supply security by reducing dependence on concentrated production regions. SADC economies, as primary producers of raw materials, have a pivotal role to play in this process. Their ability to move up the value chain by developing local mineral processing capacity hinges on effectively harnessing their abundant resources while considering the social and environmental implications for local communities. Addressing governance challenges that act as barriers to investment is also crucial for successful mineral development in Africa.

In this era of transition and transformation, SADC countries must seize the opportunity to shape their mineral sectors in a sustainable and inclusive manner. By aligning policies and strategies with the long-term futures-informed goals of the energy transition and investing in critical minerals, SADC can position itself as a key player in the global green technology revolution. Strategic partnerships, innovation and effective governance will be essential to unlock the full potential of its mineral resources and achieve long-term economic wellbeing, environmental sustainability and social development. However, the special report warns that following linear economy models will deepen the inequalities of the past, and it is recommended that SADC member states develop an advanced version of the circular economy in the mining ecosystem. The circular economy can be viewed as a stepping stone towards further advancements and is the most promising area of study for developing a true replacement for the current fossil fuel-based energy and mining systems.

It is evident that a new paradigm and system are required when faced with the failures of the current critical minerals system. These include structural transformation challenges, lack of trust and collaboration, profit internalisation, environmental and social cost externalisation and poor governance and accountability. A complexity-informed understanding of global industrial systems in transition is the foundation for developing and implementing the recommended RBE in the SADC region. This should be underpinned by considerations such as resource accounting, embodied energy analysis, dynamic equilibrium management, strategic design, statistical entropy, material flow analysis, biophysical signatures and the evolution of technology applications.

Building an RBE for the future of energy and mining ecosystems requires a comprehensive and adaptive approach that acknowledges the critical role of minerals in green technology. However, the current level of investment in critical mineral extraction and processing falls short of what is needed. To attract the required investments, policymakers must give clear signals on the speed of the energy transition and the growth prospects of clean-energy technologies.

To achieve fair trade and pioneer new mining frontiers, a shift towards bioregionalism in regional value chains and the adoption of a bioregional mining approach are essential. This approach prioritises the harmonisation of mining activities with local ecosystems and communities, promoting sustainability and responsible resource management.

Furthermore, creating a new social contract for critical minerals in the SADC region requires building anticipatory governance and enhancing decision-making processes through sustainable resource management, technological innovation and skills development. By fostering collaboration and adopting a systemic innovation mindset, strong interventions with a transformative impact can be co-created, leading to resilient and innovative systemic change.

The report highlights the need to rethink financial innovations towards fair trade in the critical minerals sector. Discouraging borrowing in foreign currency reduces foreign exchange rate risks and curtails the privileged position of advanced economies to reset

financial contract terms. Furthermore, merging small African stock markets into a regional exchange improves liquidity, attracts foreign investors and fosters harmonised trading environments and free trade among member countries. Another crucial aspect is revisiting international trade parameters by limiting mineral exchange to developed countries for further processing, while investing in infrastructure and socio-economic development to promote value-added manufacturing processes within environmental boundaries.

To expedite the transition to a more inclusive and efficient financial system, embracing stable digital currencies such as cryptocurrencies is essential. This shift can revolutionise day-to-day transactions, investments, trade, insurance and risk management. Formalising the informal economy, particularly artisanal mining, through digital currencies enhances tax collection, reduces reliance on foreign direct investment and promotes financial inclusion. Advances in technology, regulatory frameworks, financial infrastructure and cultural preferences will play a pivotal role in this transition. Moreover, digital currencies offer transparency, help to eliminate illegal mining and provide insights into the environmental impacts of mining, enabling proactive solutions to emerge.

By embracing these innovative financial approaches, the SADC region can foster fair trade, promote sustainable development and establish a more inclusive and resilient critical minerals sector. These transformative measures will require collaborative efforts from policymakers, industry stakeholders and the wider community to ensure the successful implementation of a more equitable and forward-thinking financial ecosystem.

To this end, this report has put forth five strategic priorities for shaping the futures of critical minerals in SADC. These are to:

- invest and develop advanced geological surveying capacities;
- build and continuously capacitate mineral stewardship competencies for a resource-balanced economy;
- invest and develop critical minerals regional value chains;
- embed anticipatory governance in regional structures to improve long-termism; and
- strengthen democratic and economic governance through regulatory frameworks and transparency.

In conclusion, the journey towards a sustainable and prosperous critical minerals sector in the SADC region necessitates the collective efforts of governments, stakeholders and communities. By embracing the outlined strategies and leveraging the potential of anticipatory governance, the SADC region can navigate the critical minerals transition and pave the way for a future that balances economic development, social well-being and environmental sustainability.



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