Special Report 2

FUTURES: CRITICAL MINERALS

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Navigating the SADC Critical Minerals Transition Towards Preferred Futures

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African perspectives **Global insights**

Executive summary

The global shift towards renewable energy and low-carbon technologies has placed the spotlight on critical minerals, making them vital components of the sustainable future we aspire to create. As the demand for these minerals intensifies, Southern Africa finds itself at a pivotal juncture in shaping the trajectory of the green transition.

This special report is part of a series of four reports on the 'Futures of Critical Minerals in SADC: Building Anticipatory Governance'. The special 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 report delves into the urgent and complex challenges that the SADC region faces in navigating the critical minerals transition, while providing policymakers, stakeholders and the public with insights and recommendations to guide their decisions toward preferred futures.

The urgency and importance of addressing the critical minerals transition cannot be understated. The global energy transition hinges on the availability and responsible extraction of minerals such as cobalt, lithium, manganese, graphite and rare earth elements, which are essential for green technologies ranging from electric vehicles to renewable energy systems. Southern Africa's abundant mineral resources position the region as a key player in shaping the future of clean energy and sustainable development. However, the exploitation of these minerals poses multifaceted challenges that extend beyond economic considerations to encompass environmental, social and geopolitical dimensions.

This report seeks to answer critical questions that are integral to navigating the SADC critical minerals transition:

- How can SADC member states harness their mineral endowment to achieve economic growth, job creation and technological advancement while ensuring social equity, environmental sustainability and responsible governance?
- What are the driving forces and uncertainties that will shape the future of critical minerals in the SADC region, and how can policymakers anticipate and respond to these dynamics effectively?

- What potential scenarios could unfold in the critical minerals transition, and how can strategic decisions and interventions guide the region towards preferred futures that align with its economic, social and environmental aspirations?
- What policy recommendations and strategies can facilitate a collaborative approach among SADC member states, industry players, civil society and local communities to create transparent, ethical and responsible mineral supply chains?

The analysis presented in this report underscores the interconnected nature of the challenges and opportunities in the SADC critical minerals transition. It highlights the urgent need to put in place proactive measures to address the corruption, weak governance, environmental degradation and social inequalities that may arise from unregulated mineral extraction. The report emphasises the imperative for collaboration among diverse stakeholders to establish sustainable mineral supply chains that benefit economies, societies and the environment.

Furthermore, the report presents a range of scenarios that illustrate the potential futures of critical minerals in the SADC region by 2035. These scenarios underscore the significance of adopting transformative policies, innovative strategies and inclusive governance structures that can guide the region towards sustainable and equitable outcomes.

In conclusion, this report serves as a comprehensive guide for policymakers, stakeholders and the public to navigate the complexities of the critical minerals transition in Southern Africa. By understanding the relevant driving forces, uncertainties and potential scenarios, SADC member states can make informed decisions that prioritise economic growth, social equity, environmental sustainability and a prosperous future for generations to come. This report invites readers to explore the multifaceted dimensions of the critical minerals transition and discover pathways to preferred futures that align with their collective aspirations.

Abbreviations & acronyms

AfDB	African Development Bank
AMV	African Mining Vision
DBSA	Development Bank of Southern Africa
DRC	Democratic Republic of Congo
EU	European Union
EV	electric vehicle
SADC	Southern African Development Community
SAIIA	South African Institute of International Affairs
STEEP-V	social, technological, economic, environmental, political, and values
UK	United Kingdom
UN	United Nations
US	United States

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About SAIIA

SAIIA is an independent, non-government think tank whose key strategic objectives are to make effective input into public policy, and to encourage wider and more informed debate on international affairs, with particular emphasis on African issues and concerns.

SAIIA's special reports are fairly lengthy analytical papers, usually reflecting on and analysing the findings of field research.

Cover image

This aerial picture taken on February 7, 2023 shows a general view of a temporary site for soil containing nickel ore as part of an operation by Gema Kreasi Perdana in the village of Roko-Roko on Wawonii island in southeast Sulawesi, Indonesia. The dig site is part of a huge rush to Indonesia, the world's largest nickel producer, by domestic and foreign enterprises to mine the critical component used in electric vehicle batteries Adek Berry/AFP via Getty Images

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Please note that all currencies are in US\$ unless otherwise indicated.

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CHAPTER 1

Introduction

The increasing demand for critical minerals, which are essential in developing green energy technologies and transiting to a low-carbon economy, has become a pressing concern for policymakers, mining companies and global supply chains. In Southern Africa, a region rich in critical mineral deposits, it is crucial to steer this transition towards a sustainable and preferred future.

This report investigates how the critical minerals ecosystem can be navigated in the SADC region. The significance of this report lies in its application of strategic foresight by highlighting the potential to reshape the economies, societies and environmental landscapes of SADC countries. It applies futures thinking and strategic foresight with the aim to uncover the driving forces in the global critical minerals ecosystem and the specific high-impact uncertainties that inform thinking about the future. The report cautions against reliving 'used futures' where the same narratives are repeated, instead creating the foresight and underlining the need for action to 'use the future' to create alternative outcomes.

The key questions that drive this analysis include:

- How can the region manage the influx of diverse actors entering the critical minerals space while ensuring ethical mining practices and avoiding corruption risks?
- What sustained and transformative innovations are required to navigate the critical minerals ecosystem towards more viable futures?
- What are the challenges in wayfinding preferred futures, as described by our engagement with a wide range of stakeholders in the critical minerals community?
- What are the driving forces and uncertainties that will shape the future of critical minerals in the SADC region, and how can policymakers anticipate and address them?
- What used futures are assumed in the SADC critical minerals ecosystem and how can these be overcome?
- What are the potential scenarios and pathways that SADC member states can follow in the critical minerals transition, and how can these scenarios help the critical minerals ecosystem to prepare for, anticipate and imagine alternative futures of mining?
- What policy recommendations, strategies and actions can enable SADC member states to navigate the critical minerals transition towards preferred futures that align with their economic, social and environmental goals?

These questions underscore the complexities of the critical minerals transition in the SADC region, where decisions made today will have far-reaching implications for the future. As readers delve into the various driving forces in the SADC critical minerals ecosystem, they will gain a comprehensive understanding of the complexities and opportunities that lie ahead. By exploring the interconnections between social, technological, economic, environmental, political and values-based factors, stakeholders will be better equipped to make informed decisions that contribute to the region's preferred futures.

The analysis presented in this report underscores the interconnectedness of social, technological, economic, environmental, political and values factors in shaping the trajectory of the SADC critical minerals transition. It concludes with developing emerging scenarios, emphasising diverse plausible outcomes. The intention is not to predict the future but rather to illustrate how the possible interplay between critical uncertainties could result in alternative futures, allowing better-informed decisions about the future today. The four scenarios for the futures of critical minerals in the SADC region by 2035 illustrate how different combinations of key uncertainties could lead to diverse outcomes. These scenarios underscore the importance of transformative policies, innovative strategies and inclusive governance structures to guide the region towards a sustainable and equitable future.

This report serves as a roadmap for policymakers, industry leaders and communities to collectively navigate the critical minerals transition in a manner that aligns with sustainable development, economic wellbeing and environmental stewardship.

The conclusions drawn from this report emphasise the need for multi-faceted approaches to address the challenges posed by critical minerals. From fostering responsible mining practices to investing in technological innovation, promoting social collaboration and mitigating geopolitical tensions, the report provides insights into the strategies that must be adopted to navigate this transition effectively. It underscores the importance of not only technological advancements but also ethical considerations and sustainable practices to ensure that the energy transition is truly beneficial for all stakeholders.

By understanding the driving forces, uncertainties and potential scenarios, SADC member states can make informed decisions that prioritise economic wellbeing, social equity, environmental sustainability and a brighter future for generations to come.

CHAPTER 2

Navigating the SADC critical minerals transition and preferred futures

As per the research design, this project included three stakeholder workshops centred on exploring and mapping viable futures of critical minerals in the SADC region through the Futures Literacy Lab and Three Horizons Framework methodologies. As a part of the Three Horizons Framework activities, participants articulated preferable (desirable) visions of the future for the region related to the mining, trade and use of critical minerals by 2035.

These visions constitute Horizon 3 of the Three Horizons methodology and represent aspirations and goals for a better world to replace the current, failing system (Horizon 1). Notably, generating these visions offers a shared understanding of long-term goals. This can help to identify areas of needed innovation, as well as guide goal-setting and strategic planning.

As articulated by workshop participants, preferred futures of critical minerals in SADC by 2035 constitute:

A Financial regulatory framework for inclusion and broad-based development

There is increased availability of concessional funding with risk-sharing mechanisms across multilateral development banks (such as the African Development Bank [AfDB], BRICS and the Development Bank of Southern Africa [DBSA]) to encourage investment in the sustainable mining of critical minerals in SADC. The financial regulatory framework is redesigned to be more inclusive, fostering a fair and accessible financial system that supports economic growth and development.

Decentralised and resilient communities

By 2035, at least 50% of rural communities in the SADC region have achieved food, water and energy security (eg, through micro-grids), fostering adaptability and resilience to climate change. Mining activities in the region prioritise human rights, ensuring the wellbeing and safety of workers as well as the needs of local communities.

Sustainable mining and supply chains

The SADC region has successfully developed region-wide and beneficiation-focused critical mining supply chains, ensuring responsible and sustainable practices while maximising socio-economic benefits.

Effective control of illicit financial flows

Measures and structures to control and mitigate mining-related illicit financial flows leaving the SADC region have been implemented, ensuring that resource utilisation supports broad-based development.

Regional integration and trade

The SADC region functions as a unified trading bloc, dealing with regional rather than country-level exports, thus promoting economic cooperation and growth.

In articulating preferred futures for critical minerals in SADC, participants applied the Causal Layered Analysis methodology to reshape long, deeply held assumptions through critical thinking, disrupting established myths/metaphors and constructing a novel and often desirable narrative.

As displayed in Table 1, the reverse myths/metaphors developed by participants constitute transformative visions that have the potential to catalyse systemic change. Broadly, they reflect the deep desire to re-negotiate a social contract for the interaction between energy, mineral resources, technology, economics, the environment and humanity.

TABLE 1	MYTHS/METAPHORS GENERATED BY PARTICIPANTS DURING A REVERSE CAUSAL
	LAYERED ANALYSIS

Nature and environmental stewardship are central to all we do	Man = nature
Reuse it or lose it	The earth represents aspects of ourselves
'Spaceship Earth': We only have one planet; life is to be respected; earth/nature has value in itself, not just as a resource for humans	Leave a planet for our children
Always remember that life is to be lived for yourself and others	There is no Planet B
Mine once. Recycle responsibly. Benefit forever.	The movie Mad Max (a dystopian future)

Source: Compiled by workshop participants and authors

Sustained and transformative innovations

Table 2 illustrates sustained innovations that prolong the current system, while Table 3 illustrates transformative innovations that pave the way for the emergence of radically different Horizon 3 systems. Both innovations are thematically organised across governance and process, infrastructure and technology, politics, social and sustainability, and economics. The overwhelming majority of sustained and transformative innovations (47%) related to governance and process issues across the SADC region, namely the need to scale regional collaboration and develop and strengthen mining and capacity building policy.

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THE THREE HORIZONS FRAMEWORK WORKSHOP					
Governance & process	Infrastructure & technology	Politics	Social & sustainability	Economic	
Reporting requirements that reflect ESG ^a standards (ie, the London Metal Exchange)	Access to technologies to monitor environmental challenges, including with ASM	Enhanced regional and continental regional cooperation strategies to counter global threats to mineral development/ African supply chains	Ensuring local communities and citizens benefit from the mines by creating jobs, addressing inequities and poverty, especially for women and youth	Sovereign wealth funds for enhanced stability	
Regulatory & fiscal regime that adequately incentivises needed exploration to enable diversification of supply (10-12% success rate of exploration)	Improved geological survey capacity (to also support an attractive investment environment)		New, more environmentally responsible forms of mining, incl. tech innovations	Diversifying supply through driving exploration, eg, of rare earth minerals & cobalt	
Fit-for-purpose legislation/ governance for critical minerals	Mines increasingly generate their electricity and, in some cases, also provide energy to adjacent communities		Thriving NGO sector	Innovative financing instruments for local entrepre- neurs and local miners	
Better foresight & anticipation	Innovative technologies to track responsible mining activities			Variable developments in symmetry (economics) – bicycle vs. the car	

TABLE 2SUSTAINED INNOVATIONS AS CONTRIBUTED BY PARTICIPANTS DURINGTHE THREE HORIZONS FRAMEWORK WORKSHOP

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Governance & process	Infrastructure & technology	Politics	Social & sustainability	Economic
Innovative ways of tackling corruption	The growth of underwater cables linking the SADC region from Dar es Salaam to Lobito via fibre-optic cables			Export of mineral resources in the un-beneficiated form
Increased transparency and decentralised decision- making	A SADC Regional Centre of Excellence for RD & I ^b in mining technologies			Cross-regional partnerships (ie, SADC with other African regional economic communities) to leverage mineral resources for supply chain development
Cooperation around environmental standards on greenhouse gas emissions				
Increase internal change to promote external change - capacity building and skills for the future				
A regional strategy on 'criticality' from the SADC perspective				
Demand a very high ESG and social licence to mine from companies				
Good policies (MPRDA ^c , AMV)				
Eradicate corruption, nepotism, lack of transparency				
Dropping the current 'sovereignty' approach in pursuing regional development				
Regional and institutional arrangements				
Further trust-building between key stakeholder groups (government, private sector, civil society/ communities)				

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Governance & process	Infrastructure & technology	Politics	Social & sustainability	Economic
To address skills issues: MRAs ^d for talent movement across countries of the SADC region				
The protocols are a hindrance to working efficiently. Invest in regional approaches				

a Environment, social and corporate governance

- b Research, Development & Innovation
- c Mineral and Petroleum Resources Development Act of South Africa
- d Mutual Recognition Arrangements

Source: Compiled by authors

TABLE 3TRANSFORMATIVE INNOVATIONS AS CONTRIBUTED BY PARTICIPANTS DURING
THE THREE HORIZONS FRAMEWORK WORKSHOP

Governance & process	Infrastructure & technology	Politics	Social & sustainability	Economic
Strengthened industrial policies, with cooperation across countries	Material substitution innovation in battery technologies, eg, Tesla developing batteries less dependent on cobalt	SADC joins global partnership discussions on supply chains to ensure the voices of countries of the region are heard collectively (eg. seek a place at G20 or in other international forums)	Expansion of mineral rights & diversification/ reform of ownership - more mechanisms for community participation/ engagement	Derisking or risking – using alternative currencies as opposed to the US dollar (global currency)
Regulatory & fiscal regime that adequately incentivises needed exploration — to enable diversification of supply (10–12% success rate of exploration)	Blockchain to improve supply chain transparency, eg, De Beers uses Tracr to trace diamond supply chains	Key geopolitical partners that currently dominate green value chains need to support meaningful partnerships that support value addition in Africa	More mechanisms for community participation/ engagement	Circular economy: reuse & recycling

Governance & process	Infrastructure & technology	Politics	Social & sustainability	Economic
A SADC ESC performance matrix that sets the benchmark for investors and meets regional ESC ambitions		Collaboration between SADC states to support regional value chains - trade- offs need to be negotiated in good faith	Shift the silo approach to be more collaborative by making mind and cultural shifts	Developed SADC metals exchange for capital raising for projects linked to minerals and energy classification of resources that go beyond borders
A SADC Green Strategy that has clear milestones, with time horizons, about the future that the region wants (energy, technologies, mobility, etc.)			Consumption behaviours need to be disrupted - more efficient consumption	Concerning circularity: a multi- year plan that takes a whole-of- supply-chain approach
Having a systems approach				
Post-mining succession planning				
A regional skills anticipation plan to ensure young people can access the jobs of the future				
Rethinking the trade and industrial instruments at the SADC level to be fit for the future we want				
Supporting skills development and innovation ecosystems to support the needs of next- generation mining and mineral value chains				
To address skills issues: MRAs ^d for talent movement across countries of the SADC region				
The protocols are a hindrance to working efficiently. Invest in regional approaches				

Source: Compiled by authors

In addition to the transformative and sustained innovations detailed in Tables 2 and 3, participants contributed to pockets of the future in the present (also termed seeds) concerning the future of critical minerals in SADC. These pockets or seeds represent fringe activity in the present system that introduces novel ways of doing things and can – over time – coalesce to shift the dominant system.¹ As detailed in Table 4, seeds contributed by participants include the use of technologies such as blockchain to improve mineral supply chain governance and normative shifts around energy use, gender and biodiversity.

DURING THE THREE HORIZONS FRAMEWORK WORKSHOP				
Pockets of the future in the present				
Centre of Excellence on Advanced Battery Technologies set up in Lubumbashi, Democratic Republic of Congo (DRC)	Namibian science & technology collaboration on beneficiation RD&I related to mining and industrial development could be strengthened			
An integrated African Stock Exchanges Association that leads to funding for African junior resource mining companies	The EU has protocols that are binding in a regional economic community where members must comply			
Coal mines used for hydroponic agriculture	The AfDB and DBSA are already regional banks that can increase collaboration and alignment in the development of the green minerals sector in the region with others like BRICS, IDC ^a			
Compacts for developing batteries involving the DRC and Zambia	Blockchain and other innovations to support responsible supply chains for potentially problematic minerals (e.g., coltan & cobalt in the DRC)			
Development of battery technology that reduces dependence on critical minerals, e.g., Tesla is developing a battery without rare earth elements	Areas being reserved for biodiversity			
Some rivers and natural ecosystems are given human rights/legal rights	Mining companies like Anglo are installing green energy systems to propel their operations (eg, green hydrogen mining haul trucks)			
Carpooling to go to work	AngloPlat growing cacti on degraded mine land to produce green, synthetic diesel			
Blockchain technology to improve critical mineral supply chain governance, eg, Glencore uses blockchain to trace battery cobalt sources	People installing their solar panels			
Deep-sea mining for critical minerals, eg, DeepGreen is a start-up developing technology to mine the sea floor for critical minerals	Developments for attracting and retaining women in mining			

TABLE 4POCKETS OF THE FUTURE IN THE PRESENT / SEEDS AS CONTRIBUTED BY PARTICIPANTSDURING THE THREE HORIZONS FRAMEWORK WORKSHOP

a Industrial Development Corporation of South Africa

Source: Compiled by authors

 Laura Pereira et al., "Seeds of the Future in the Present: Exploring Pathways for Navigating Towards Good Anthropocenes", in The Urban Planet: Knowledge Towards Sustainable Cities, ed. T Elmqvist (Cambridge: Cambridge University Press, 2018).

CHAPTER 3

Wayfinding preferred SADC futures of critical minerals

The transition to a net-zero economy will be mineral intensive. It will, therefore, place tremendous pressure on the mining sector to provide the vast quantities of minerals needed to enable the energy transition. Due to the capital-intensive nature of the mining sector and the extended project lead times of new mine development, price volatility and supply bottlenecks will be difficult to avoid in the energy transition.² While improvements in material efficiency and technological innovations could address shortages in critical mineral supplies in the long term, pre-existing geopolitical tensions and other supply chain constraints could also hinder the pace of the energy transition in the short and medium term.³ Furthermore, today's investment and production plans are insufficient to support an accelerated energy transition, as they are more oriented towards incremental responses to climate change.⁴ Market volatility will be compounded by several critical vulnerabilities, including, but not limited to, high geographic concentration, long project lead times, stringent environmental standards and declining resource quality.⁵ How policymakers and mining companies respond to these challenges will determine whether critical minerals will catalyse the energy transition or be a sticking point.

While improvements in material efficiency and technological innovations could address shortages in critical mineral supplies in the long term, pre-existing geopolitical tensions and other supply chain constraints could also hinder the pace of the energy transition in the short and medium term

The security of critical mineral supply chains is becoming increasingly important in energy security dialogues. This is because various geological, geopolitical or market disruptions risk derailing the green transition, while these projects' long development times can cause price volatility in global markets. The rush to mine critical minerals presents risks and opportunities for government and mining companies, particularly in mineral-rich

4 IEA, The Role of Critical Minerals in Clean Energy Transitions (Paris: IEA, 2022).

² Prasad Ananthakrishnan et al., "Metals Demand from Energy Transition May Top Current Global Supply", International Monetary Fund (blog), December 8, 2021.

³ Dolf Gielen, "Critical Materials for the Energy Transition" (Technical Paper 5/2021, International Energy Agency, Abu Dhabi, 2021).

⁵ McKinsey & Company, "The Raw Materials Challenge: How the Metals and Mining Sector Will be at the Core of Enabling the Energy Transition", January 10, 2022.

developing countries, many of which are in Africa. These countries are likely to see a continued increase in demand for these critical minerals and could manage this demand in a manner that contributes to their economic development. Indeed, the growing importance of these critical minerals in the green transition is prompting policymakers to consider energy security holistically by addressing new and existing vulnerabilities in their supply chains. Therefore, it is essential to understand how demand patterns for these critical minerals might evolve and ensure that supply-side measures accommodate any such changes.⁶

The technologies involved in the green energy transition are constantly evolving, which makes forecasting the exact nature of the future critical minerals mix a challenge.⁷ A notably different combination of green energy technologies will likely emerge from the various policy, technological and market processes currently in progress. For example, using different chemistries for electric vehicle (EV) batteries and the subsequent move away from lithium-ion batteries could significantly affect the overall demand for critical minerals such as lithium and cobalt. However, innovations of this nature can also lead to more efficient use of these critical minerals, thereby bringing advantages in environmental protection and safety. This is just one example of how the early adoption and development of new technologies with lower demand for critical minerals make predicting the market dynamics of these minerals a significant uncertainty. In short, various innovations, resource constraints and regulation policies will determine whether the scenario that occurs involves comparatively higher or lower demand for critical minerals than current forecasts suggest.

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As the quality of critical mineral deposits declines, the methods involved in extracting and processing them will likely become more energy intensive, which could offset any gains made on the decarbonisation front.⁸ Therefore, the pressure on policymakers to improve and act upon their social and environmental performance is severe. In addition, the waterand energy-intensive nature of critical minerals mining must be addressed to supply clean energy technologies sustainably.⁹ Moreover, understanding and managing how the mining of critical minerals impacts local communities are crucial. Given the strategic importance

9 World Bank, Minerals for Climate Action.

⁶ World Bank, Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition (Washington: World Bank, 2020).

⁷ World Bank, *Minerals for Climate Action*.

⁸ Rim Berahab, "The Energy Transition Amidst Global Uncertainties: A Focus on Critical Minerals" (Policy Brief 37/22, Policy Centre for the New South, Rabat, 2022).

of these critical minerals for the green transition, a failure to adequately address broader environmental and social disruptions could provoke a reaction against the mining of these critical minerals. This, in turn, could jeopardise the development of the minerals needed to facilitate the green transition.

Meeting the challenge of large-scale green energy technologies requires a reliable supply of critical minerals and less market volatility and price disruption. As mentioned earlier, the overall demand for these critical minerals is uncertain, as demand will fluctuate with technological changes, market conditions and geopolitical trends. Understanding how each critical mineral profile varies and how this informs changes in technology and market dynamics is therefore crucial for policymakers and mining companies. For instance, uncertainty around the trajectory of future demand for critical minerals can undermine the investment appetite of the private sector, which will cause delays in extracting and processing the critical minerals needed for the green transition. The extended project lead time could further heighten the risk of mismatches between supply and demand, leading to drawn-out periods of price volatility and market reluctance to commit to large-scale investments in production.¹⁰ In short, it is crucial to ensure that supply can meet demand in a manner that reduces the environmental costs of mineral extraction while ensuring that critical minerals are available on a reliable basis.

Appreciating that critical minerals have wide-ranging demand risks can also provide insights into possible recycling opportunities.¹¹ The transition to a green economy will require several strategies to decrease material demand, and recycling is one of these strategies. Recycling energy storage technologies and their critical mineral components can help to make supply chains more resilient and ensure more sustainable use of resources.¹² Recycling the critical minerals contained in products reduces the need for further mineral extraction, thereby helping to reduce the negative environmental impacts of critical mineral production and processing. For example, extending the lifespan of EV batteries by repurposing them for applications in other sectors will reduce the need to produce new batteries. However, it is essential to note that while recycling can play an important role in the long term, it can do less in the short term to help resolve scarcity concerns, given the lack of existing materials to recycle, along with costs and other technological obstacles to its full-scale adaptation.

Driving forces in the SADC critical minerals ecosystem

In addition to the challenges articulated earlier, fundamental driving forces emerged in conjunction with the principle of co-creation. In futures/foresight parlance, these key uncertainties are 'known unknowns' – literally, factors and issues that shape the future without it being known in which way. It means things that can either go one way or the

¹⁰ Berahab, "Energy Transition Amidst Global Uncertainty".

¹¹ Angus Soderberg, "Critical Mineral Recycling: What Does it Offer?", New Security Beat (blog), May 15, 2023.

¹² World Bank, Minerals for Climate Action.

other and have a high impact. They are also referred to as 'driving forces shaping the future' (drivers of change) and are nearly always interconnected and interrelated. Table 5 lists the driving forces in the SADC critical minerals and mining ecosystem. The list highlights uncertainties in the social, technological, economic, environmental, political and values (STEEP-V) categories, also known as a STEEP-V analysis.

TABLE 5KEY DRIVING FORCES FOR THE CRITICAL MINERALS AND MINING ECOSYSTEMIN SOUTHERN AFRICA

STEEP-V analysis for SADC critical minerals and mining ecosystem

Social

Entrance of a diverse set of actors into the critical minerals space

The energy transition presents a significant opportunity for industries and governments to undertake lucrative projects. A more considerable risk appetite accompanies this opportunity on behalf of new and established mining actors. The danger is that these actors, eager to exploit the critical minerals opportunity, disregard essential checks and balances in their rush to mine. In addition, several inexperienced consumer companies, such as EV manufacturers, are moving into the mining sector to secure their mineral supply chains. The entry of new industry actors and government actors will naturally increase corruption risks and the likelihood that compliance shortcuts might be taken. For example, greater state involvement in the mining sector might allow corrupt officials to misappropriate funds and provide licences to companies willing to engage in corrupt practices. Furthermore, there is concern regarding a potential 'race to the bottom' in regulatory standards to attract investment.

Social licence to operate at risk

Increased demand for critical minerals could push mining into environmentally and socially sensitive areas. Consequently, mining companies could face increased pressure from communities, regulators and consumers over where and how they mine. In addition, increased demand could drive a surge in artisanal mining, which has its own distinct challenges. Therefore, it is essential to maintain a robust social licence to operate – especially given that miners will seek to develop new operations in previously unmined areas. Mining companies have attempted to foster a positive social legacy through corporate social responsibility initiatives for decades, yet they have struggled to earn communities' trust. In the critical minerals era, mining companies will have to redefine their roles and collaborate more deeply with communities to develop a sustainable legacy if they are to overturn the largely negative perception of the mining sector – especially in the Southern African region.

Technological

Mechanisation, digitalisation and artificial intelligence

The Fourth Industrial Revolution and its associated trends, including mechanisation, digitalisation and artificial intelligence, are a significant uncertainty. While these technologies can unlock productivity gains, they are also likely to make the mining sector increasingly capital-intensive, reducing prospects for further job creation. As technology develops, mining's contribution to employment will likely decline due to more capital-intensive mechanised operations. The labour implications of the digital transformation of the mining sector are likely to grow in significance. Therefore, policymakers and education institutions need to ensure that the training provided keeps pace with these changes and anticipates the need for more industry-appropriate skills. In this regard, it will be crucial to develop and implement skills-development programmes that align with the diversification of the mining sector to absorb the decline in labour demand because of increased mechanisation and digitalisation.

Accelerated innovations in clean energy technologies

The technologies involved in the energy transition are rapidly improving and evolving through innovation and increased application. For this reason, accurately predicting how the energy transition will unfold is challenging. Accelerated advances in battery chemistry technologies create the risk of obsolescence for firms and countries entering the battery manufacturing industry. Furthermore, innovations in material performance could significantly alter the demand for a specific mineral. For example, EV industry leaders such as Tesla have already started work on developing alternative battery technologies that rely less on cobalt. There is a strong possibility that the demand for specific minerals will shift as changes in policy or technology emerge. As a result, policymakers must consider the risk that investments made for one battery chemistry may become stranded. This risk is particularly acute for African countries. In response, SADC countries can partly insulate themselves by developing chemistries suited to the region's needs and geological profile. In addition, SADC countries must collaborate with local and foreign mining companies and research partners to create appropriate battery technologies for the global market.

Economic

Critical mineral supply shortages

Currently, mineral supply and investment plans fall short of what is required to transform the energy sector, raising the risk of a stunted and more costly energy transition. The prospect of a rapid increase in demand for critical minerals, coupled with insufficient investments in exploration and mining, raises serious questions about the availability and security of supply. Mines are struggling to keep up with the demand for critical minerals, and specific mineral markets are already suffering from supply imbalances, eg, copper. Despite sufficient resource deposits for most minerals, an exponential increase in demand has yet to be matched by a rapid expansion in supply, casting doubt on the economic feasibility of the global energy transition. This is mainly due to prohibitive factors, such as insufficient capital investments, challenging geological conditions (lower ore grades, etc.), long project development timelines and price volatility. All these factors mean that miners and investors are not allocating capital at the level required to keep pace with projected demand, thereby jeopardising the energy transition.

Mineral protectionism

The security of critical mineral supply chains is becoming increasingly important in energy security dialogues. This is because various geological, geopolitical or market disruptions risk derailing the green transition, while the long project development times of such projects can cause price volatility in global markets. The rush to mine these critical minerals presents risks and opportunities for governments and mining companies, particularly in mineral-rich developing countries, many in Africa. These countries are likely to see a continued increase in demand for critical minerals and could manage this demand in a manner that contributes to their economic development. Indeed, the growing importance of critical minerals in the green transition is prompting policymakers to consider energy security holistically by addressing new and existing vulnerabilities in their supply chains. Therefore, it is essential to understand how demand patterns for critical minerals might evolve and ensure that supply-side measures are implemented to accommodate any changes.

Pricing

The transition to a net-zero economy will be mineral intensive. It will, therefore, place a great deal of pressure on the mining sector to provide the vast quantities of minerals needed to secure the energy transition. Due to the capital-intensive nature of the mining sector and the extended project lead times of new mine development, price volatility and supply bottlenecks will be challenging to avoid in the energy transition.

Perpetuation of historical economic inequalities

There are opportunities and risks for SADC countries with large reserves of critical minerals. While these countries will likely face environmental and social challenges because of increased mining activity, this demand could contribute to economic growth and sustainable development if appropriately managed. However, mineral-rich economies' transformation will largely depend on policymakers' ability to navigate the risks associated with an overreliance on resource development, ie, the resource curse. Many mineral-rich African countries have experienced disappointing socio-economic development in the past. One reason for this is the lack of durable linkages between mineral wealth and the broader economy, which often means that value addition in the supply chain occurs outside the country. The limited effectiveness of mineral wealth in fostering economic development increasingly leads to the resurgence of resource nationalism because citizens (rightly) question the benefits of mining for the broader economy.

Environmental

Increased environmental degradation of local communities

Resource extraction can create many problems for local communities in proximity to mining operations, such as air pollution, environmental damage, increased water strain and displacement. Despite growing attempts to combat such challenges through initiatives such as the Extractive Industries Transparency Initiative, the mining sector contributes to significant environmental degradation. This issue is especially pronounced at the community level. One example relevant to critical minerals mining is the energy-intensive nature of production and its potential ecological effects. Due to declining resource quality, the production and processing of critical minerals involve increasingly higher emissions. Discoveries reveal mineral deposits with lower ore grades, which require more extraction and thus produce more emissions to mine the same volume of minerals. This point is particularly pertinent to critical minerals, many of which occur in low concentrations and require energy-intensive processing.

New mining projects in environmentally sensitive areas

The surge in demand for critical minerals could incentivise more mining activity in environmentally sensitive areas. Growing mineral demand and decreasing ore quality can encourage governments to issue new mining licences in more ecologically sensitive areas. In response to this risk, the Natural Resource Governance Institute has suggested the establishment of mining no-go zones to prevent further environmental destruction and biodiversity loss. For example, water stress is an ecological issue crucial in many critical mineral extraction processes. Most critical minerals have high water requirements and are mined in areas that experience frequent droughts – a point especially relevant for the SADC region. Critical minerals such as lithium not only require high water use in areas facing pre-existing pressures related to the supply of fresh water. In addition, many copper deposits are within or near biodiversity areas and Indigenous peoples' lands.

Political

Increased geopolitical tensions

As the energy transition continues to unfold, the supply of critical minerals is becoming an issue of geopolitical importance. Geopolitical trends include the development of new trade patterns and the ability of a single actor or group of actors to build a dominant position in the market to control prices or supplies of certain critical minerals. For example, countries such as China, the DRC and Indonesia have all implemented export restrictions on critical minerals for varying objectives and with mixed results. The distribution of critical mineral reserves could reveal new trade patterns and lead to further regional interdependencies. Australia and countries in Africa and Asia have the potential to become global hubs for these minerals, which would create new shipping routes. However, while there are opportunities for African suppliers to benefit from this new geopolitical landscape, there is also the risk that African countries might suffer collateral damage as significant countries such as the US and China compete to secure these critical mineral supplies on the continent.

Resurgence of corruption in the extractives sector

Many mineral-rich countries fail to benefit from their mineral wealth due to corruption, national governments' rent-seeking behaviour and a lack of transparent institutions. This problem is particularly prevalent in African countries that are over-dependent on revenues generated from the export of minerals. While supply chain due diligence initiatives have been developed, new modes of corruption could emerge. Many African mining operations are in regions with political instability, weak institutions and weak rule of law. For example, many countries dependent on the revenues generated from critical minerals are near the bottom of the UN's Human Development Index. In addition, many countries where critical minerals are mined score below average in perceived corruption risk measures, as Transparency International reported. This reality emphasises the need for transparent and responsible mineral wealth management as the energy transition ramps up.

Values

Growing scrutiny of environmental, social and governance standards

Rising stakeholder expectations mean that stakeholders are paying closer attention to a company's commitment to combatting climate change. Stakeholders increasingly press mining and manufacturing companies to find solutions to supply chain issues and play their part in correcting social and environmental injustices that may occur in mining or production. This presents companies with a trade-off between supplying the critical minerals needed for energy transition and limiting the impacts of mining and manufacturing companies will be to source critical minerals accepted by various stakeholders as responsibly sourced and traded. Simultaneously, these manufacturing companies will have to ensure they can access an adequate supply of critical minerals in a context of increasing supply chain complexity and geopolitical tensions. Without sustained efforts to improve environmental and social performance, companies might be unable to exclude critical minerals supplies that have not met the highest supply chain due diligence requirements.

Changing perceptions around recycling and the circular economy

There is growing recognition of the importance of circular economy strategies in helping to reduce critical mineral demand. In other words, there is a need not only to secure more critical mineral supplies but also to make these minerals more sustainable by extending the lifetime of their usage. Transitioning to a circular economy involves many strategies to decrease material demand and increase recycling rates. Circular economy strategies include shifting from ownership to usership models, enabling preferences for longevity and durability in product design and building pride in second-life usages. While increased recycling is a crucial part of a booming circular economy, there are several major challenges to overcome to make recycling a feasible strategy for the long term. As much as demand can be reduced by adopting new technologies and implementing circular economy strategies, a substantial need remains for increased mineral extraction. Therefore, priority must be placed on reducing the demand for critical minerals through recycling and new technologies while reducing the harmful environmental impacts of mining. In short, the solutions enabling the energy transition cannot only be technological but must also address values.

Source: Compiled by authors

High-impact key uncertainties

The stakeholders rated the significance of the 'High-Impact Key Uncertainties' in the SADC region concerning the critical mineral endowment's potential to benefit its citizens.

Figure 1 depicts the Mentimeter voting results, indicating the most pressing high-impact key uncertainties on a scale of highest impact and/or uncertainty:

- Geo-economic competition (China/US/EU) for dominance of green tech value chains.
- Ability of SADC states to manage trade-offs associated with the creation of regional value chains.
- Urgency/ambition of global policy action on climate.
- Renewable energy/ low-carbon technological change.
- Ability of SADC states to establish attractive investment conditions.
- Other.





Geo-economic competition (China/US/EU) for dominance of green tech value chains

The intense competition among China, the US and the EU for dominance in green tech value chains has far-reaching implications. This involves economic significance, environmental leadership, innovation, technological advancements, national security and geopolitical influence. However, it also carries risks such as trade disputes, protectionism and economic tensions. The outcome of this competition will shape the global green economy, technological progress, environmental leadership and broader geopolitical dynamics.

Ability of SADC member states to manage trade-offs associated with the creation of regional value chains

Countries in the region face the challenge of managing trade-offs between domestic industries and external partnerships as they aim to promote economic integration and regional value chains. Striking a balance is crucial to achieve greater industrialisation, job creation and technological advancements and to foster sustainable economic growth. Neglecting these trade-offs may lead to sector marginalisation, dependence on external markets and conflicts among member states. The consequences of this uncertainty are substantial, impacting economic development, social welfare and political stability in the SADC region.

Urgency and ambition of global policy action on climate

The escalating climate crisis necessitates immediate and bold action to mitigate its catastrophic effects. There is an urgent need to curb greenhouse gas emissions, transition to renewable energy and implement sustainable practices. Ambitious measures are crucial, as incremental actions may be insufficient. The commitment of nations to adopt and implement ambitious climate policies will determine the ability to limit global warming. Without urgency or ambition, irreversible damage to ecosystems, severe weather events, rising sea levels and biodiversity loss may occur, disproportionately affecting vulnerable communities. Conversely, decisive action with ambitious policies can lead to a resilient, sustainable and equitable future, fostering technological innovations, creating green jobs and safeguarding the well-being of future generations.

Renewable energy and low-carbon technological change

The rapid development, deployment and integration of renewable energy technologies are crucial for decarbonisation and achieving ambitious climate targets. Factors such as cost-effectiveness, scalability and reliability play a key role in their widespread adoption and competitiveness in the energy market. The uncertainty surrounding the trajectory of renewable energy and low-carbon technological change has wide-ranging implications for energy security, greenhouse gas emissions, air quality, and energy systems' resilience. However, it also presents economic opportunities through job creation, innovation and sustainable economic growth.

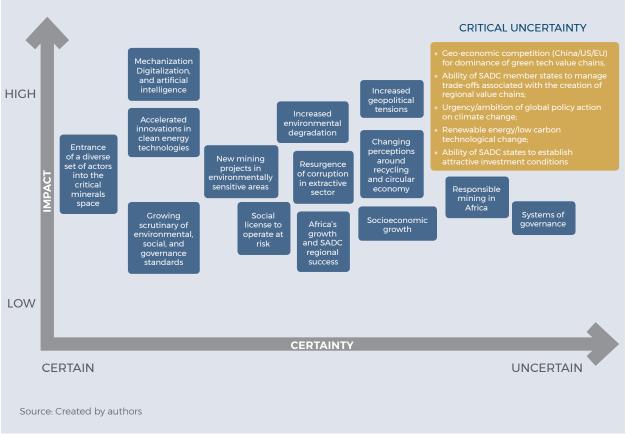
Ability of SADC states to establish attractive investment conditions

Creating an environment that attracts and retains foreign direct investment is essential for promoting industrialisation, job creation and technology transfer. Factors such as stable political environments, transparent regulations, robust legal systems, efficient infrastructure and skilled labour forces are crucial to entice investors. Uncertainty regarding the ability of SADC member states to address these factors effectively poses risks to the region's competitiveness and sustainable economic growth. Failing to establish attractive investment conditions may deter investors, limit capital inflows, impede technology transfer and restrict the development of primary industries. Conversely, successfully addressing this uncertainty can unlock the region's economic potential, stimulate innovation, generate employment opportunities and promote greater regional integration.

Figure 2 Prioritising driving forces



- 1. Prioritise the driving forces by IMPACT. Sort between HIGH, MEDIUM and LOW IMPACT
- 2. Prioritise the driving forces by CERTAINTY



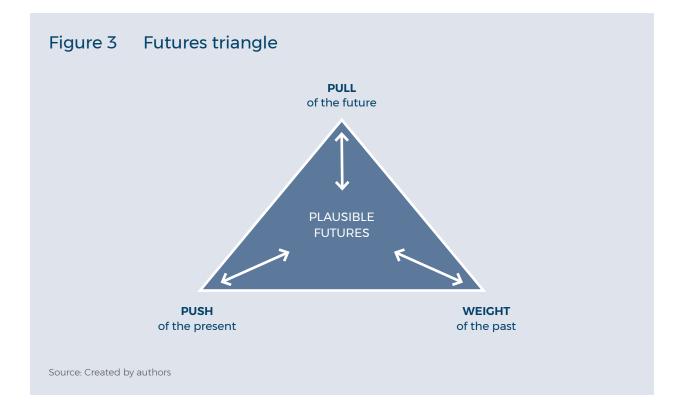
The need to overcome used futures: The colonised futures

Anticipating plausible futures by applying a foresight research method, namely the futures triangle, demonstrates the occurrence of used futures when the angle presenting the weight of the past is disproportionate to the angles of the pull of the future and the push of the present. More significantly, this method highlights that alternative plausible futures are possible when the interior angles are realigned to magnify the pull of the future and the push of the push of the present.¹³

SADC faces tumultuous enabling and disabling constraints, pushing and pulling in opposing directions, creating the unique scope for plausible alternative futures to emerge.

The push of the present highlights the repositioning and realignment of global value chains caused by the post-COVID-19 economic recovery and rising geopolitical tensions between

¹³ Sohail Inayatullah, 'Causal Layer Analysis: Poststructuralism as a Method', Futures 30, no. 8 (1998): 815-29



economic powerhouses. This shift is changing the momentum of globalisation, as evidenced in reduced global trade giving rise to 'slowbalisation'.¹⁴ The new macroeconomic era caused by rising inflation and higher interest rates will undoubtedly influence global consumption patterns, further opening opportunities to revisit existing industrialisation options and the ecological impacts thereof. These tectonic shifts present the SADC region with the ideal platform to turn the tide on stagnant transformation caused by natural resource drain coupled with an imperative to maintain the existing destructive model of corruption and illicit financial flows. It is necessary to expedite regional and industrial integration by revisiting the power dynamics of advanced economies and realigning the utilisation of natural resources sustainably and equitably.¹⁵

These tectonic shifts present the SADC region with the ideal platform to turn the tide on stagnant transformation caused by natural resource drain coupled with an imperative to maintain the existing destructive model of corruption and illicit financial flows

¹⁴ Alicia Garcia-Herrero, "Slowbalisation in the Context If US-China Decoupling", Intereconomics 57, no. 6 (2022): 352–58.

¹⁵ Mark Curtis, <u>Doublethink: The Two Faces of Norway's Foreign and Development Policy</u>, Report (Oslo: Norwegian Forum for Environment and Development, January 2010).

The SADC region has a wealth of critical minerals needed to develop integrated green energy sources, creating additional revenue and employment opportunities. The scramble for Africa's natural resources emphasises the heightened demand for technological enablers of the energy transition. It forces African leaders to rethink and reconsider macroeconomic convergence, increased financial integration and monetary cooperation and investment to achieve deepened economic integration and inclusion.

The push of the present interconnects with the pull of the future. The toss between climate action and economic growth is at a crossroads, necessitating a call to action to engage differently with the future. SADC and global leaders can create alternatives to 'use the future'. By implication, to 'use the future' condenses the concept of space and time to experiment with plausible options, thereby navigating away from used models of imperialism and modern forms of colonisation to more socially just and equitable options.¹⁶

The weight of the past is deeply embedded in social and cultural constructs depicting dominant groups subordinating and exploiting others. An unintended consequence of colonialism is that it shapes thinking and being in all spheres of the social fabric. Unfortunately, new forms of colonial domination are a great injustice. They are also part of day-to-day life, manifesting in permanent features and institutions through business-as-usual systems and practices. To achieve transformational change, it is necessary to leverage the intersection of power dynamics, politics and the vested interests of the existing system. A significant role of strategic foresight is to unearth the key assumptions underlying the collective histories of current practices to ascertain relevance and create the platform for alternatives to emerge. Conjecturing alternative futures creates a safe environment to negotiate competing perspectives and interests in solution-oriented terms.

The weight of the past is manifested in heuristics based on existing information, inadvertently used to manage complexity and uncertainty, often resulting in unintended outcomes. The same dominant ideas and value systems are reproduced through decision-making and choices. Evidence demonstrating the embeddedness of new forms of colonialism points to the 101 resource extraction companies operating in 37 African countries and listed on the London Stock Exchange, controlling a combined value of \$1.05 trillion of resources on the continent.¹⁷ The intentional extraction of natural resources and exploitation of revenues from the African continent are mitigated by offering aid to support Africans living in abject poverty. Yet Africa is rich in natural resources and should not depend on foreign aid. As Curtis argues,¹⁸ the UK and other Northern governments have consistently opposed processing raw materials in Africa. He contends that these governments, along with institutions such as the World Bank, have advocated for Africa to remain a primary resource provider, exporting unprocessed raw materials and allowing other (Northern) countries to profit from the processing of these

¹⁶ Curtis, Doublethink.

¹⁷ Mark Curtis, "The New Colonialism: Britain's Scramble for Africa's Energy and Mineral Resources", War on Want, July 1, 2016.

¹⁸ Curtis, "The New Colonialism".

materials. This longstanding approach to mining in Africa has yielded limited benefits for African economies, workers and communities.¹⁹ This system of extraction and exploitation continues, but it does not benefit the continent or its people.²⁰

Hickel²¹ convincingly argues that, in 2015, the Global South experienced a net appropriation that was not adequately compensated for through trade but was instead transferred without compensation. The findings show that, during that year, the North's net appropriation from the Global South amounted to 12 billion tonnes of raw materials, 822 million ha of land, 21 exajoules of energy (equivalent to 3.4 billion barrels of oil) and 188 million person-years equivalents of labour (equivalent to 392 billion hours of work). In this context, net appropriation refers to resources not being compensated for in equivalent terms through trade; instead, they are transferred without charge. Moreover, this appropriation is significant, constituting a substantial portion (averaging about a quarter) of the North's overall consumption.

Systems can die or give way to new ways of doing by changing the leverage points or unpacking all the layers of privilege to evoke and embed sustainable systemic change. Barriers such as global shadow financial systems facilitating illicit financial flows and corporate tax avoidance include the exposure of shell companies, secrecy laws and tax havens, all of which impede change to this extractive system. Another unintended consequence of colonisation is that it creates the ideal conditions for scarcity principles to flourish.

To shape the future, it is necessary to understand for whom the default future is designed. By implication, the future of SADC is already colonised through the repetition of the same narratives without thinking or considering alternatives

Evidence, facts and existing information inform the push of the present and the weight of the past. However, there is no information about the future; only different images and visions of the future exist. To shape the future, it is necessary to understand for whom the default future is designed. By implication, the future of SADC is already colonised through the repetition of the same narratives without thinking or considering alternatives.

¹⁹ Curtis, "The New Colonialism"..

²⁰ Jason Hickel et al., "Imperialist Appropriation in the World Economy: Drain from the Global South through Unequal Exchange, 1990-2015", *Global Environment Change* 37 (March 2022).

²¹ Hickel et al., "Imperialist Appropriation".

SADC leaders and communities face the daunting task of engaging with the future by creating alternative ways of knowing, being and doing that are true to Africa. This can be done by supporting individual and collective agency and local self-actualisation by widening opportunities through industrialisation and infrastructure development.

The plausible futures emerging from these forces demand alternative paradigms based on meaning, cooperation and change from global leaders to reposition natural resources and communities towards a different transformation path for Southern Africa.

Overcoming used futures: The current system

During the Three Horizons Framework exercise with expert Southern African critical minerals stakeholders, four failures of the current system, ie, the 'status quo', were articulated. These failures constitute Horizon 1 of the Three Horizons framework and describe the current state, values, present needs and even 'best practice' approaches that are increasingly no longer fit for purpose.

Broadly, the identified failures of the current critical minerals system in SADC, as articulated by participants, are:

- **Structural transformation challenges**: Southern Africa struggles to achieve structural transformation through mineral resources, which is hindering its overall development.
- Lack of trust and collaboration: Key stakeholder groups, including the private sector, public sector and civil society, lack trust and fail to collaborate effectively, thereby undermining progress.
- **Profit internalisation and environmental/social cost externalisation**: The private sector can internalise profits and externalise environmental and social costs with minimal consequences, creating an imbalance in the burden of mining activity and accountability for transformation.
- **Poor governance and accountability**: Corruption, non-accountability and poor governance challenges prevail, contributing to illicit financial flows, transfer mispricing and limited policy coherence (particularly at the regional level).

However, the participant group did identify some elements in the current system as worth conserving:

- Southern Africa's potential to leverage its demographic dividend and produce highly skilled individuals who can contribute to both the continental and the global (green) workforce; and
- Southern Africa's cultural dialogue, social compacts and budding regional cooperation, in addition to the AMV, support sustainable natural resource management in Africa.

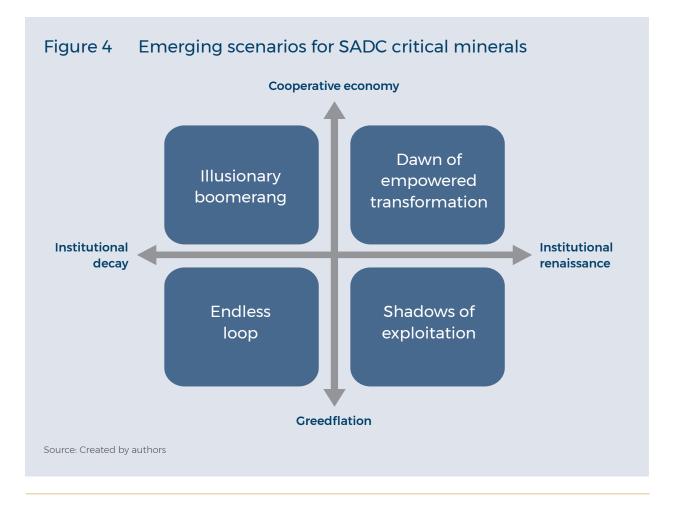
Mapping these failing characteristics and conservation-worthy elements is significant to make explicit assumptions about current paradigms and, consequently, to allow a reframing of what we think, want and need to do to transform the current system to achieve desirable alternatives.²²

Andrew Curry and Anthony Hodgson, "Seeing in Multiple Horizons: Connecting Futures to Strategy", Journal of Futures Studies (2008): 10.

CHAPTER 4

Emerging scenarios for SADC critical minerals futures by 2035

Dator's four futures framework, also known as the four archetypes of the future, provides different scenarios for envisioning possible futures. The framework helps consider a broad range of possible futures beyond the conventional dichotomy of utopian versus dystopian scenarios. It encourages thinking about multiple dimensions of the future, such as social, technological, environmental and political factors. This comprehensive exploration helps avoid simplistic or linear thinking about the future and enables a more nuanced understanding.²³ Using the stakeholders' contributions in the workshop, key factor-based scenario techniques were applied, namely the creative narrative method through intuitive logic. The four scenarios illustrate different potential pathways for the futures of critical minerals in the SADC region in 2035, considering factors such as economic growth, resource availability, governance and sustainability. The intention is not to predict the future but to illustrate how critical key uncertainties could interplay, resulting in alternative futures.



23 Jim Dator, "Alternative Futures at the Manoa School", Journal of Futures Studies 14, no. 2 (2009).

Scenario 1: Dawn of Empowered Transformation

Institutions in the SADC region are revitalised with vibrant youth who are highly skilled and equipped with the technical knowledge and foresight to embed new social compacts. All stakeholders, such as private investors, labour, government institutions, civil society and the mining sectors, protect democratic institutions, where tolerance, goodwill and accountability are core.

Institutional investment and development are multifaceted, touching on all aspects of society. The potency of auditing and reporting standards for all organisations, especially in mining value chains, has been strengthened. It has resulted in less corruption and more investments made in socio-economic development. Due to increased investments in human development, organised crime has reduced dramatically and police services are more reliable. Youth are more interested in institutional development activities and less inclined to turn to crime and social unrest.

Legal and regulatory frameworks have transitioned proactive measures to implement regulations on the mining of critical minerals and the environmental impacts thereof. The environmental regulations are revolutionary, assigning intergenerational rights to natural resources and implementing decisions in the best interests of current and future generations.

Due to the vast investment in human capital, deeper collaboration is achieved among all stakeholders, increasing the cooperative economy. The improved institutions have instilled trust between stakeholders and allowed the mining industry and communities to navigate alternative development models. This has enabled a transition from 'profit before people' to a model of co-creation and regeneration. Property rights and ownership models with international communities are renegotiated to ensure that all stakeholders, including the environment, are included.

The African people are liberated and decolonised. Finally.

Scenario 2: Shadows of Exploitation

Institutions such as financial regulators, treasury and government bodies are riddled with corruption and maladministration. Service delivery by government institutions has become a distant memory. Ordinary citizens are left to fend for themselves and have limited options – migrate to cities with better prospects or join protestors and demand better services. Both options involve living in desperate conditions, with limited access to clean water and housing. Survival of the fittest is the order of the day.

Some well-connected individuals have access to senior government and private sector actors and manage to secure economic wellbeing by being part of the cooperative economy. It is proving to be highly profitable for them because the proceeds of mining projects are distributed to the well-connected few. The cooperative economy has exceeded predicted growth rates and, in so doing, attracts unprecedented levels of foreign direct investment supporting mining activities in the region. Mega profits are made in the cooperative economy, and those fortunate enough to be part of it benefit greatly.

Social justice movements rise by drawing support from international organisations to address the injustice, increasing inequality and environmental devastation brought about by mining activities. The actors in the cooperative economy agree to provide a small contribution in the form of aid to those living in abject poverty. This gesture of good faith eases social unrest and provides the necessities to get by. Youth remain unable to access quality education and cannot find employment in the mines. This is because mining activities are mostly automated, using robotics and focusing on efficiency gains. The tax base is eroded and government institutions cannot provide the necessary infrastructure to support citizens.

The actors in the cooperative economy form enclaves and develop infrastructure for their benefit to make mining activities more efficient. The enclaves become financially stronger and eventually control the purse strings of the economy.

Scenario 3: The Endless Loop

The course of history is shaped by those who emerge triumphant. Not only does this statement hold for Africa but, unfortunately, its inhabitants are also unable to break free from the shackles of colonisation. History repeats itself repeatedly – people find themselves confined by the past, just as the past remains.

Institutions cannot gear themselves up for present and future demands and remain stuck in historical economic models of service delivery. The world has evolved, and new eras have emerged where developed infrastructure is needed to give ordinary citizens access to digital and knowledge economies. Sadly, infrastructure development has not materialised, leaving citizens with remnants of the colonised era.

The 'scramble for African' minerals continues, and may the best man or, in this case, country win. Developed economies are focused on creating resilient supply chains to manage energy supply while decarbonising their economies proactively. Geopolitics are heavily at play, and African leaders face many options from foreign investors to mine natural resources. At face value, this seems like a good problem to have. Economic growth and prosperity remain key objectives but, at the same time, the environmental impacts of aggressive mining practices cause havoc.

Institutions and regulators are all spineless and unable to challenge and divert reckless decisions by governments where profit is placed before people and the environment. Key policy decisions are geared towards maximising profits in the mining sector to allow

governments to earn incomes and service their debt liabilities. The mining sector is not obligated to address the impacts of mines on communities and is not bound by regulatory frameworks and structures.

All trust has eroded between citizens and the government. The government and the mining sectors are the winners in this scenario, leaving ordinary citizens behind.

Scenario 4: Illusionary Boomerang

Due to 'greedflation', foreign investors make considerable profits in the short term. Governments share minimal benefits and now have the economic means to manage the excessive debt burden. As a result, more funds are available to invest in institutions to promote socio-economic development. Sensible government spending policies address education and infrastructure challenges. Trust is restored through the development of institutions and active citizen engagement. Educational institutions collaborate with the mining sector to ensure that skills development is appropriate to allow maximum labour absorption in the mining sector. In addition, the entrepreneurial spirit is evoked, giving rise to an increase in competitive exports. As income per capita increases, the tax base broadens through organic growth, diversifying the economy.

The greed bubble is short lived, as everyone and anyone jump on the bandwagon. Profit margins are inflated for goods and services, giving rise to hyperinflation. The cost of living increases as profit maximisation becomes the norm. The elitist growth path becomes less populated, creating enclaves of prosperity. The remaining citizens are forced to move back into poverty and low-income brackets. Displeased by the short-lived spouts of financial freedom, vigilantes and warlords emerge, breaking down what has been built and seeking illegal forms of income generation through unauthorised mining activities that are detrimental to the environment.

Reflection

The scenarios were enriched and deepened by the insights of subject matter experts in the critical minerals and mining industry. In addition, the scenarios and report were broadened by 'using the future' in learning-while-doing workshops to create alternative visions with workshop participants. The collaborative nature of the research helps to inform public policy- and decision makers about the pathways for alternative futures for mining critical minerals in the SADC region.

The scenarios show that alternative futures are possible and can be navigated towards by applying anticipatory governance to experiment with the future in the present. In addition, individual and collective agency was brought to the fore in the workshops, which is displayed in the general eagerness to unshackle current systems, thereby making way for alternatives. The scenarios show that alternative futures are possible and can be navigated towards by applying anticipatory governance to experiment with the future in the present. [I]ndividual and collective agency was brought to the fore in the workshops, which is displayed in the general eagerness to unshackle current systems, thereby making way for alternatives

While navigating the driving forces and high-impact key uncertainties, workshop participants realised the need to overcome used futures in an increasingly complex and uncertain environment. It remains impossible to predict the future of mining critical minerals in the SADC region, and therefore no sureties about it can be provided. However, the scenarios deepen understanding of the high-impact uncertainties and provide powerful visions about the future grounded in empirical reality.

CHAPTER 5

Conclusion

The mining of critical minerals in the SADC region has a rich and lopsided history, as demonstrated in the country case studies. As economies aspire to decarbonise, the increased demand for critical minerals will create the proverbial 'scramble for Africa' as developed countries with deep pockets seek to secure their supply chains. African countries have an opportunity to leverage their natural resources for the betterment of all citizens and not just a select few. This will require leaders to learn from history and other countries, such as Australia, to create foresight to proactively navigate this uncertain and fast-moving world.

Our comprehensive analysis has shed light on the interconnected nature of the driving forces, uncertainties and potential scenarios that will shape the future of critical minerals in the region. It is imperative that SADC member states, industry stakeholders, civil society and local communities come together to navigate this transition towards preferred futures that align with economic prosperity, social equity and environmental sustainability.

The consequences of inaction are dire, and include the perpetuation of corruption, environmental degradation, social inequalities and economic dependency on unregulated mineral extraction

The implications of our research findings are far-reaching and underscore the need for proactive measures and collaborative efforts to address the challenges and opportunities presented by the critical minerals transition. The consequences of inaction are dire, and include the perpetuation of corruption, environmental degradation, social inequalities and economic dependency on unregulated mineral extraction. Moreover, failing to capitalise on the region's abundant mineral resources could result in missed opportunities for economic wellbeing, job creation, technological innovation and sustainable development.

In light of the research findings, several policy alternatives emerge for consideration.

Status quo

Continuing with the current trajectory (used futures) of unregulated mineral extraction and weak governance may lead to intensified environmental degradation, social unrest and economic instability.

Reactive measures

Implementing reactive measures such as imposing export bans or imposing stricter regulations without considering the broader socio-economic implications could hinder economic wellbeing and exacerbate conflicts.

Collaborative governance

Establishing multi-stakeholder partnerships, transparency initiatives and accountable governance structures could enhance regional collaboration and foster responsible regional mineral supply chains.

Sustainability transitions

Prioritising sustainability transitions through investment in education, skills development, clean technologies and diversified economies can create resilient and inclusive societies.

Based on our rigorous research, we strongly advocate for the following recommendations to guide the SADC region towards preferred futures in the critical minerals transition.

Establish transparent governance

SADC member states should collaboratively establish transparent governance frameworks that promote ethical mineral supply chains, combat corruption and ensure responsible mineral extraction practices.

Enhance regional collaboration

Foster collaboration among governments, industry players, civil society and local communities to co-create policies and strategies that balance economic wellbeing, social equity and environmental sustainability.

• Invest in skills development

Prioritise investments in education and skills development programmes to equip the workforce with the technical knowledge needed to support the green energy transition and unlock economic opportunities.

Implement responsible environmental practices

Enforce stringent environmental regulations and promote the adoption of clean technologies to mitigate the negative impacts of mineral extraction on ecosystems and local communities.

Diversify economic portfolios

Encourage SADC member states to diversify their economies beyond mineral extraction by investing in industries such as renewable energy, manufacturing and technology to promote long-term economic resilience.

Ensure intergenerational fairness

Encourage SADC members states to develop futures literacy and futures thinking capabilities that enable the critical minerals ecosystem to re-imagine mining to include future generations and so build long-term social justice and human well-being.

• Strengthen regional cooperation

Enhance regional cooperation through platforms such as the AMV to facilitate knowledge sharing, policy harmonisation and the equitable distribution of benefits from mineral resources.

• Embrace inclusive development

Prioritise social inclusion, gender equality and community participation in decisionmaking processes related to critical mineral extraction to ensure that all stakeholders benefit from economic wellbeing.

This special report serves as a clarion call for action to all stakeholders invested in the region's future. The research findings underscore the urgency of addressing the challenges posed by the critical minerals transition while seizing the opportunities it presents. By implementing the recommended policies and strategies, SADC member states can lead the way towards sustainable development, social equity and environmental stewardship. The time for action is now, and the collective efforts of governments, industry players, civil society and local communities can pave the path towards a brighter, greener and more prosperous future for all. Let us unite in our commitment to navigate the critical minerals transition and shape the preferred futures we aspire to achieve.



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