B20 SOUTH AFRICA 2025

Africa at the Core of Critical Minerals

Briefing Document

November 2025

B20 SOUTH AFRICA 2025 in collaboration with World Economic Forum

Chapter 1: Context and Opportunity: Africa's Critical Minerals for Global Shifts

1.1 The role of critical minerals in enabling energy and digital transition

Critical minerals have emerged as a cornerstone of global economic and resource strategies, driven by transformative macro trends reshaping industries and societies. These minerals are not only enablers of the energy transition; but also pivotal to unlocking sustainable growth, resilience and technological innovation in an increasingly interconnected world. By 2040, the global population is expected to grow by approximately 10%, reaching 9 billion people[1], while the global middle class is set to expand by 30–40%, from 3.2 billion to 5.1 billion individuals. This demographic shift will drive unprecedented demand for energy, infrastructure, and technology, creating significant opportunities for businesses to innovate and scale solutions that meet these evolving needs.

At the same time, the global push toward low carbon emissions and the rapid adoption of digital technologies is fundamentally reshaping demand for critical minerals. Low-carbon technologies such as electric vehicles, renewable energy systems, and energy storage drive exponential growth in the need for materials like copper, lithium, nickel, graphite, rare earths and PGMs. Demand for more traditional materials such as aluminum and steel are also expected to find support in low-carbon technology applications. Consumers, investors and stakeholders are increasingly prioritizing sustainability, requiring suppliers to adopt ESG-compliant practices, reduce reliance on fossil fuels and increase supply chain transparency. This shift presents a unique opportunity for forward-thinking organisations to lead in building sustainable, future-ready supply chains.

Geopolitical dynamics, including trade developments and regional instabilities, are reshaping global material trade flows, adding to this complexity. With critical mineral supply chains often concentrated in specific geographies, many governments and businesses are looking to enhance self-sufficiency and secure access to these essential resources. Initiatives such as the European Union's Critical Raw Materials Act (EU CRMA) underscore the growing importance of resilience and collaboration in navigating this evolving landscape.

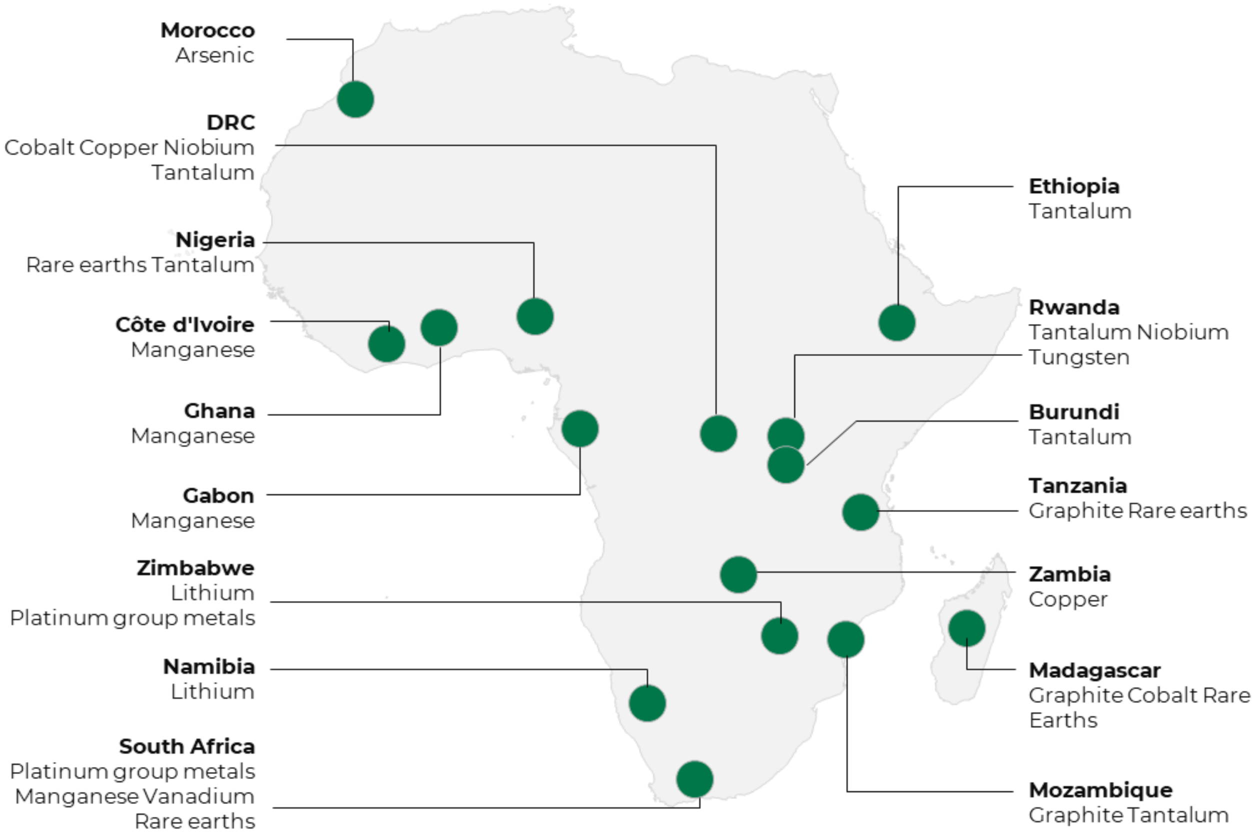
Critical minerals are not just a necessity – they are a strategic opportunity. Leaders can shape a more prosperous and sustainable global economy by embracing innovation, sustainability, and resilience.

1.2 Africa's potential and critical role in critical minerals

Africa is uniquely positioned to play a transformative role in the global energy and digital transitions, as well as in traditional industrial applications, offering unparalleled potential to meet surging demand for critical minerals. The continent holds ~30% of the world's reserves of minerals essential for low-carbon technologies and digital infrastructure[2].

Africa's mineral wealth spans a diverse set of commodities, providing both scale and supply chain resilience for industries worldwide. The continent is home to ~55% of the world's cobalt reserves, ~38% of manganese reserves; ~70% of manganese resources, ~80% of platinum, ~62% of chromium, and ~25% of natural graphite[3]. This diverse endowment positions Africa as a key player in ensuring reliable and sustainable access to these critical materials globally. It also offers the backbone needed for the future industrialization of the African continent, in a context where Africa's population is expected to experience an increase of ~0.55 billion people by 2040.

Figure 1: Critical minerals potential in Africa – Countries which produce or have reserves of critical minerals (non-exhaustive)



For some minerals, ore quality in Africa also significantly outperforms global averages. For example, copper ore grades in the Democratic Republic of Congo (DRC) and Zambia's Copperbelt region average around 2.5% Cu, compared to about 1.2% Cu in other key producing countries. These grades are significantly higher than the global average of 0.5–0.7% Cu[4]. Mozambique hosts high-grade natural graphite deposits averaging 12.9% carbon, significantly higher than China's average of 7.7% carbon[5]. Kalahari manganese field in Northern cape province of South Africa is the largest known, land-based deposit of high-grade manganese in the world and is estimated to contain approximately 4.2 billion tonnes of exploitable manganese. This is more than 77% of the world's total known land-based reserves contains an average grade of >40-60 wt%[6] compared to the global average of 20-30%[7].

By harnessing these resources effectively, stakeholders in Africa have an opportunity to shape a more sustainable and resilient global economy while advancing development priorities.

Chapter 2: Key opportunities to unlock the full potential for Africa's development and enable the global shift from the development of critical minerals

Realising Africa's full potential requires addressing several key unlocking areas that, if tackled strategically, could reveal significant economic and development opportunities. Several solutions could help unlock barriers under four main focused areas, including: **(i) financing and investment de-risking; (ii) infrastructure and midstream capacity building**; **(iii) skills development**; and **(iv) policy and regulatory environment**.

Table 1: Summary of key challenges and unlocks under four main focused areas

Topic	Key challenges	Identified unlocks
(i) Policy and regulatory environment	**Regulations perceived as complex** potentially increasing project development risk and investor uncertainty	Harmonized policies and streamlined approval processes
	Limited enforcement of environmental, social, and governance (ESG) standards impacting social license and sustainability	Stronger ESG standards and stakeholder engagement
	Limited regional cooperation impeding cross-border mineral value chain integration	Multilateral cooperation to integrate value chains
(ii) Financing and investment de-risking	**Financing gap** – Southern Africa attracts less than 10% of global exploration capital despite holding nearly 30% of global reserves	Blended finance and guarantees to attract investment
	Investment risk due to perceived policy uncertainty, volatile commodity prices, and geopolitical concerns	Stable policies and regional risk mitigation frameworks
	Limited bankability of artisanal and small-scale mining (ASM) ventures due to credit risk and compliance costs	De-risking and formalization support for small miners
(iii) Infrastructure and midstream capacity building	**Fragmented and insufficient transport, energy, and processing infrastructure** limiting efficient mining and export	Regional infrastructure corridors and shared assets development
	Reliance on carbon-intensive power in mining operations affecting competitiveness and ESG compliance	Renewable energy deployment and green power purchase agreements
(iv) Skills development	**Skills shortages** affecting mining, processing, and innovation capacity	Training and industry partnerships to build local skills
	Limited local value chain development restricting economic benefits and **job creation**	Development of mining ecosystems and industrial clusters

Source: World Economic Forum's White Paper on Securing Minerals for Energy Transition: Finance for Southern Africa

Through a combination of potential actions, stakeholders in Africa could unlock the full potential for success of the critical minerals sector and sustainable resource development. Realising this opportunity would benefit from collaboration among governments, industry, and international partners to build a resilient, inclusive, and future-ready mining ecosystem.

2.1 Policy and regulatory environment

A clear, coherent, and investment-friendly policy and regulatory environment is one of the most critical levers for unlocking Africa's mineral potential. Policies, including ESG frameworks, should be designed to drive value creation and attract sustainable investment, rather than imposing unnecessary barriers to growth. Stable mining codes, transparent licensing regimes, and coherent local-content or beneficiation policies are key to attracting long-term capital and determine whether value addition occurs within the continent or abroad. Zambia is one example of how targeted reforms can strengthen investor confidence and promote sustainable mining growth. The government has stabilized fiscal policies by suspending the 15% export duty on precious stones and metals[8] and introducing a Property Transfer Tax framework (2025) to encourage value addition.[9] Partnerships between the Zambia Revenue Authority (ZRA), Intergovernmental Forum on Mining (IGF), OECD, and African Tax Administration Forum (ATAF) have enhanced regulatory capacity through improved auditing and transfer pricing practices.[10]

Recent efforts such as South Africa's Critical Minerals and Metals Strategy and the African Development Bank's push for harmonised continental frameworks[11] highlight the potential role of regulation in reducing uncertainty, incentivizing midstream investment, and aligning Africa with global supply chain standards essential for the energy transition. [12] This could also be realised alongside a strategic regional cooperation. Governments could consider harmonising mining laws, strengthen governance and anti-corruption measures, accelerate approval process, formalise artisanal mining, enforce stricter environmental regulations, and invest in capacity building. An example of policy harmonisation in the EU is the Critical Raw Materials Act, which sets uniform, time-bound permitting procedures to accelerate approval of mining, processing, and recycling projects across Member States. For example, the Forum of SADC Ministers is poised to help consolidate a unified regional strategy on critical minerals and sustainable energy, enabling more effective engagement with G20 partners and global buyers.[13]

Equally important as policy design is implementation and institutional capacity. Even well-crafted frameworks require governments to be organizationally equipped to coordinate, enforce, and monitor these policies. In many African countries, mineral development intersects multiple ministries such as mining, trade, and environment leading to fragmented or siloed approaches that slow progress and dilute accountability. Strengthening inter-ministerial coordination, clarifying mandates, and investing in administrative and technical capacity can therefore help bridge the gap between policy design and on-ground execution. Studies by the International Institute for Democracy and Electoral Assistance (IDEA) highlight persistent implementation gaps and overlapping jurisdictions in mining governance across Africa.[14]

2.2 Financing and investment de-risking

Despite its significant mineral endowment, the continent attracts only **~10% of global exploration[15] capital**, a paradox that reflects financing and risk-perception gaps. The share of global exploration investment going into Africa has declined over time from ~16% in 2004 to about 10.4% in 2024.[16]

Africa faces financial gaps in both mineral extraction as well as in processing, limiting its potential.[17] According to UNCTAD's World Investment Report for 2024, foreign investment in Africa increased 75% to a record $97 billion. However, greenfield investment activity slowed, with the number of announced projects down by 5% and total value falling 37% to $113 billion, compared to $178 billion in 2023. The decline was widespread, though North Africa bucked the trend, recording a 12% increase to $76 billion, which accounted for nearly two-thirds of Africa's total project spending. In terms of sectors, construction and metal products attracted more greenfield investment, while electricity and gas supply projects saw the steepest decline ($51 billion). Meanwhile, cross-border mergers and acquisitions, which normally represent about 15% of the continent's FDI, also recorded a net decline during the year.[18]

Processing faces challenges like high capital costs, energy~~,~~ and skilled labour shortages, making investors hesitant. Lack of access to advanced technologies further complicates processing investments, with facilities often costing hundreds of millions of dollars. Morocco's $300M cathode plant[19] and Zimbabwe's $310M lithium facility illustrate the scale and complexity of such investments.[20]

Africa's financing gap is underpinned by investment risks tied to factors such as policy uncertainty, regulatory instability, and geopolitical volatility, further affecting investor confidence and restricting financing flows. For instance, 7 out of the 20 African countries are ranked at the bottom of the 2024 Fraser Institute Investment Attractiveness Index. Additionally, artisanal and small-scale mining (ASM) ventures, which play a significant role in the sector, often face limited access to credit due to compliance costs and credit risks. [21]

In parallel to policy measures, bridging this financing gap will **require innovative financing mechanisms and partnerships to de-risk investments and attract global capital**.[22] Concessional financing can help to reduce risks in mineral exploration and beyond, with affordable capital, longer terms, and first-loss support, attracting private investment and unlocking opportunities in emerging markets.[23] Alongside blended finance instruments, public-private partnerships (PPPs) and grant funding can be utilized to support investments across the value chain. **Technical assistance can support skill building, facilitate investments, and support a robust regulatory and policy framework**. In addition, while ASM supplies a material share of several critical minerals and employs millions [24], it remains largely invisible to policy and formal markets. **Formalization can create visibility**, reduce human-rights and environmental harm, and make ASM more accessible for global buyers. However, a balanced approach can be applied, starting with shared facilities or simpler regulations where needed, to avoid formalizing too quickly.[25]

The Kamoa Kakula Copper Complex in the Democratic Republic of Congo (DRC) is a prime example of how targeted collaboration can unlock funding in high-risk regions. Ivanhoe Mines, a TSX-listed company, initiated this ambitious project with Phases 1, 2, and 3 primarily financed through approximately US$6 billion in equity, ensuring the project was completed within budget and ahead of schedule. To facilitate the expansion, the Africa Finance Corporation (AFC) and co-lenders structured a debt facility that leveraged the project's balance sheet, optimizing financials to fund Phase 3, thereby de-risking the investment. This phase is poised to be the primary source of lenders' repayment. The impact of these efforts is profound: mine production has surged to 14.2mtpa, the concentrator plant is operational, the smelter is completed and awaiting commissioning, and the first 50MW from the Inga II turbines are expected by October 2025. This case study exemplifies how strategic equity financing and structured debt facilities can mitigate financial risks, ensure successful project completion and pave the way for future expansions.

2.3 Infrastructure and midstream capacity building

Africa's mining potential is constrained by **fragmented and insufficient transportation infrastructure,** namely poor road and rail connectivity to link mines in remote or difficult terrain. Africa's road density remains low by global standards, averaging just 2.76km per 100km^2, compared with 138km per 100km^2 in India and 18.6 per 100 km2 in Brazil.[26] Integration exists primarily in the SADC network; 15% of Africa's rail network is non-operational; and 13 countries lack direct rail connections to the sea.[27]

Power supply and energy infrastructure are often unreliable or insufficient, with frequent blackouts and heavy dependence on diesel generators and other fossil fuels. Mining operations in Africa are often reliant on carbon-intensive power sources, particularly in Southern Africa, where fossil fuels dominate. In other regions, such as Central and East Africa, hydropower is a significant energy source. However, the unreliability of hydropower availability frequently forces miners to rely on diesel generators as a backup, further contributing to carbon emissions and undermining ESG compliance.

Many countries export raw ore rather than refined or value-added material. Local smelters and refineries are few and often operate below scale due to technical, regulatory and capital constraints preventing upgrading.[28] Specialized processing such as battery-grade graphite purification, rare earth separation, and high-purity lithium refining require advanced technical capabilities, clean/controlled environments, chemical inputs, and skilled workforce.[29]

Building **regional infrastructure** corridors can significantly improve the transportation of critical minerals. The ongoing Lobito Corridor development, which links Zambia and the Democratic Republic of the Congo to Angola, is an example of such regional infrastructure. Developing shared infrastructure such as centralized processing facilities, railways, and ports, can optimize resource use and reduce costs.[30] For example, South Africa's industrial clusters, such as Richards Bay and Namakwa SEZ, focus on shared mineral beneficiation and hydrogen production, creating economies of scale and fostering regional collaboration.[31]

The **deployment of renewable energy sources**, such as solar and wind, could help alleviate power shortages while lowering the carbon intensity of mining and processing. For example, South Africa's renewable energy expansion is part of the country's broader strategy to diversify its energy mix and reduce reliance on coal. The Integrated Resource Plan (IRP) aims to add 29,500 MW of electricity capacity by 2030, with 14,400 MW from wind and 6,000 MW from solar photovoltaic sources.[32] It is important to note that energy policy should be grounded in energy security while accelerating the transition – leveraging each country's strengths and progressively expanding renewables for a just transition.

Beyond individual mining projects, it is valuable to take **a more integrated, regional view of infrastructure and planning** through adopting a broader ecosystem perspective. Considering shared needs such as grid access, transport corridors, and processing capacity across multiple sites helps improve efficiency, resilience, and sustainability. This approach also supports shared investment opportunities and more balanced regional development. [33]

The **adoption of innovative technologies** in the critical minerals sector can be driven by targeted actions, including promoting investments in advanced processing technologies to add value locally, accelerating the modernization of geological databases for efficient resource mapping, fostering public-private R&D partnerships to drive technological breakthroughs, and implementing advanced mining technologies such as automation and AI for predictive maintenance and operational efficiency.

2.4 Skills development

The region faces a shortage of skilled talent needed in mining, processing, and innovation, creating barriers to fully harnessing the benefits of critical mineral reserves. The sector requires a workforce with STEM education and technical skills in data, automation, and processing, but only ~20% of students in the region graduated with higher education degrees in STEM, creating a significant talent gap[34]. As countries shift from extraction to beneficiation and refining, demand for specialized skills in metallurgy, mineral processing, and environmental management will grow. With a median age of 19 years[35], Africa's young population offers a talent pool from which to build the expertise needed for long-term growth if effectively developed. It is also important to note the time sensitivity of this component. When such skills are scarce, projects stall, critical resources go underutilised, and private investment flows to more capable markets. To capitalize on the current surge in critical mineral investments, countries should **initiate workforce development initiatives early to reduce the time-to-returns delay for investors.**[36]

Addressing this would require **investments in STEM-focused and mining-related training programs**, regional cooperation for specialized centres, and partnerships with international firms to enable knowledge transfer. **Public-private collaborations could develop targeted initiatives**, while early STEM education could leverage Africa's youth to build a skilled workforce for the critical minerals sector and drive sustainable economic growth. It is also important to stimulate interest across the **full mineral value chain** starting in primary school, ensuring that subjects like mathematics, physics, chemistry, and earth sciences are taught with clear linkage to mineral exploration, processing, and downstream applications. At the same time, promoting women's participation across the mining value chain helps unlock the full potential of the population and ensures inclusivity. Inclusive practices, such as gender targets, safe facilities and transports, anti-harassment policies, and pay-equity checks, can improve retention and ensure the sector benefits from Africa's full demographic potential and talent pool. Advancing women across the mining value chain can also strengthen leadership pipelines and bring more diverse perspectives into operational and strategic roles. Leadership training should also be incorporated early on, so that future graduates not only have technical skills but can take on strategic, managerial, and vision-setting roles in the sector.[37]

Chapter 3: Implementation pathways for key opportunities

Unlocking Africa's critical minerals potential could be facilitated by coordinated regional action. A **regional approach**–anchored in integrated infrastructure and harmonized standards–could create greater efficiency and scale as well as attract investment. Developing **regional clusters** around key mineral resources could offer a practical and cost-effective way to implement this approach, fostering linkages between countries, industries, and supporting ecosystems. Bilateral collaboration also has a potential role to play, enabling countries to pool resources and expertise. Ensuring integrated solution steps to enable timely project development, along with early adoption of regional standards and technologies, is key to achieving long-term efficiency and responsible growth in Africa's implementation pathways. Together, stakeholders could consider these approaches as they may help provide greater power and collective benefit, paving the way for sustainable growth across Africa's critical minerals value chains.

3.1 Cluster approach as a potential pathway

3.1.1 Cluster approach

The challenges faced by mines, governments, institutions, and companies, as outlined above, could be effectively addressed by **adopting a coordinated clustering approach**. This could entail grouping (sub)-regions according to their unique strengths and resource endowments.

Clusters are concentrated ecosystems that drive scale, innovation, and competitiveness through shared skills, infrastructure, supply chains, and technologies. Clusters can leverage specific capabilities and synergies in **four key areas: resources, processing, innovation, and logistics**.

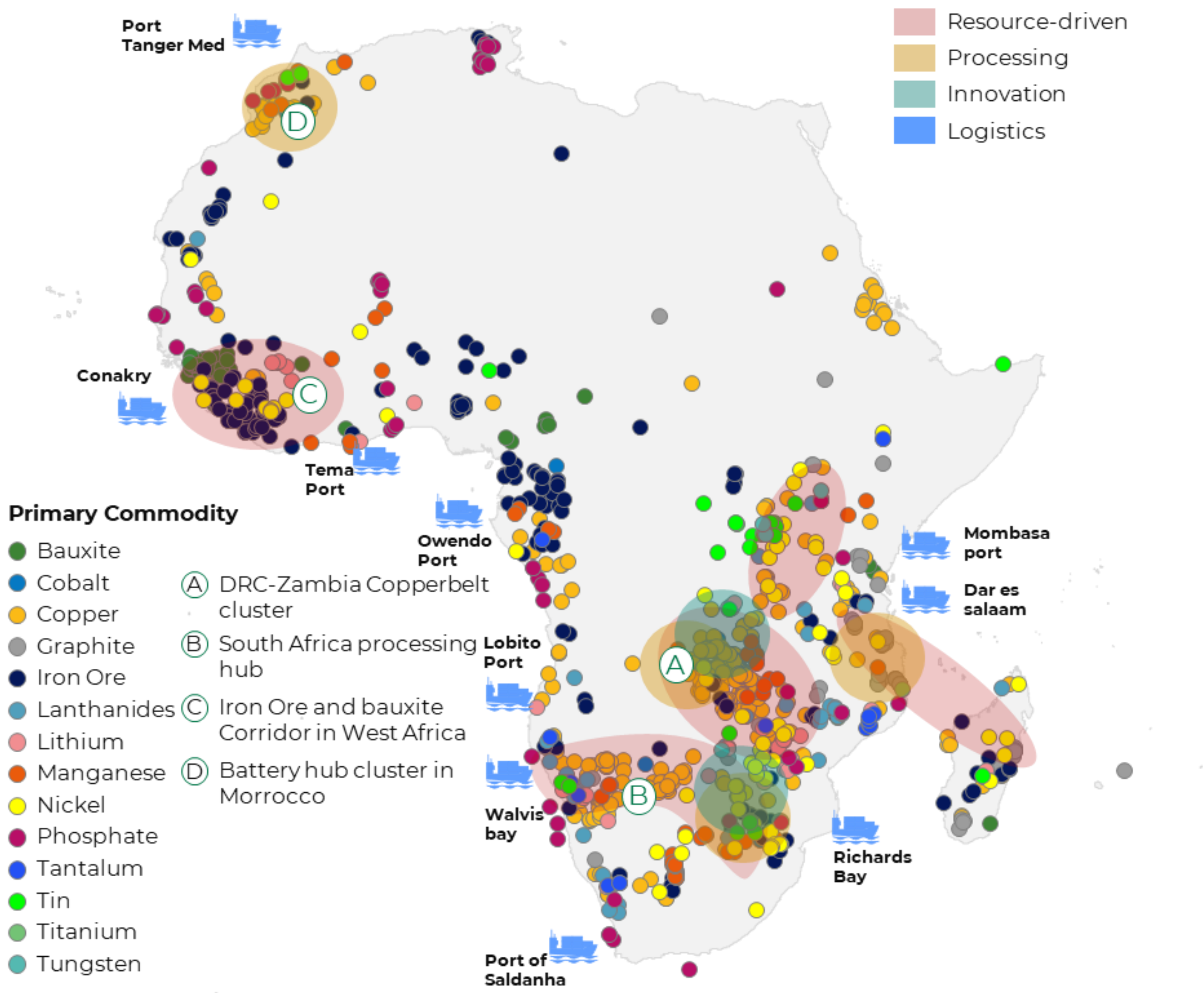
- **Resource-driven** clusters are built around large, high-quality deposits concentrated in a region with long reserve life to sustain activity.
- **Processing clusters** clearly capture value addition by processing mineral resources beyond beneficiation into value-added products, leveraging local energy, talent and technology.

- **Innovation clusters** are focused on the development and adoption of innovative products and solutions, such as artificial intelligence, robotics and digitalization, to improve the capabilities of the mineral value chain. These regions typically have a critical mass of suppliers, OEMs and R&D.
- **Logistics clusters** are strategically positioned near critical mineral deposits to optimise transportation time and costs through shared infrastructure. Key characteristics of logistics clusters include robust transportation networks, including railways, roads and ports.

A pre-requisite for all clusters is having the appropriate enabling regulatory framework. The strength of clusters lies in their capacity to harness regional advantages, attract investment, and drive sustainable development. Shared infrastructure reduces costs and unlocks synergies, while integrated renewable energy and water systems enhance ESG performance. Downstream plants and local suppliers can capture more in-country value if procurement targets and trading hubs are established early. In parallel, centralized training programs and partnerships with universities could help build a skilled workforce within a cluster. With bold early decisions and investments, processing clusters can unlock greater value from raw materials, while innovation clusters can generate homegrown solutions to both local and global challenges.

3.1.2 Unlocking regional clusters

Figure 2: Potential critical minerals clusters in Africa



The four cluster archetypes are already present in Africa, some of which could expand their impact through targeted measures. To form any of these clusters, a phased approach is critical. Rather than expecting all initiatives to materialize simultaneously in a "big bang" manner, smaller-scale projects should be developed step by step. These projects can demonstrate tangible impacts, validate the effectiveness of initiatives, and prove their replicability. This incremental approach will build confidence among stakeholders and attract further investment.

A. DRC-Zambia Copperbelt cluster

Resource-driven: The Copperbelt in Africa is a mineral-rich cluster spanning across **Zambia** and the southern **DRC**, recognized globally for its world-class high-grade copper and cobalt deposits, with sizeable deposits of lithium, manganese and other secondary materials. Copper is at the centre of dual energy and digital transition, on top of being critical in traditional applications.

Copper production in Africa is experiencing robust growth, driven by significant expansions in the DRC and Zambia, which are contributing to the continent's annualized output of 4.2 Mt in 2025 despite the mining output was affected by seismic activity.[38] Major projects such as Ivanhoe Mines' **Kamoa-Kakula and Kipushi** expansions in the DRC are backed by **multi-billion-dollar investments** aiming to substantially increase production.[39]

Despite strong mining activity in copper[i] and cobalt, **improving logistics remains a challenge for stakeholders seeking to unlock the region's full potential**. Strengthening transport infrastructure, streamlining port operations, and enhancing supply chain reliability could help overcome current disruptions such as trucking strikes, transport shortages, and port congestion that have delayed shipments.[40]

To address logistical challenges, several measures could be considered. For instance, introducing one-stop border posts at key locations, such as the Kasumbalesa border post,[41] could help reduce congestion and minimize delays at border crossings. Upgrading and developing critical trade routes, including the Lobito and TAZARA railway lines and the Lusaka-Ndola dual carriageway, through public-private partnerships (PPP), could help enhance infrastructure and improve transport efficiency. Additionally, partnering with technology companies to adopt digital systems for managing documentation, enabling real-time shipment tracking, and utilizing freight telematics could streamline operations, support just-in-time transport models, and reduce delays and wastage[42]

Power generation and transmission remain major bottlenecks for the Copperbelt region. Southern Africa still relies on hydropower for around 86% of its electricity, making it highly vulnerable to drought-related disruptions that have recently strained supply.[43] To address these issues, the country could expand grid-connected renewable sources, particularly solar and wind, through collaborations with local players.[44] Strengthening high-capacity cross-border transmission infrastructure such as the Kalumbila–Kolwezi Interconnection Project (KKIP), which will establish a new 330 kV high-voltage link between Zambia and the DRC, will be essential to improving regional power exchange and ensuring reliable electricity supply across the Copperbelt.[45]

B. South Africa processing hub

Processing beyond beneficiation: South Africa has a strong history in processing, specializing in the production of steel, stainless steel, and the value-adding processing of precious metals like gold and platinum. South Africa also possesses strong upstream endowments of manganese[ii], PGMs, chrome, vanadium, lithium and copper which position it well to take on a more prominent role in regional processing, especially in the battery storage industry. On top of that, rising EV sales in South Africa will stabilize demand for the output of such future processing capabilities.

South Africa and Zimbabwe together form a powerful platinum cluster, dominating the global industry through their complementary strengths. South Africa, holding approximately 70-80% of the world's platinum reserves and accounting for 67% of global production, is the undisputed leader, supported by its advanced refining infrastructure that processes 76% of the world's platinum. Zimbabwe, while smaller in scale, is a rising player, contributing 11% to global production and expanding its capacity through strategic projects like the Darwendale and Mimosa expansions. Zimbabwe's new smelter (38-megawatt furnace), capable of processing 380,000 tons of concentrate annually,[46] enhances regional collaboration by accommodating output from other mining firms, while South Africa's excess refining capacity ensures efficient value addition. Together, these nations form a robust platinum ecosystem, meeting a significant share of global demand and driving economic growth in the region. This synergy positions Southern Africa

---

[i] The Kamoa-Kakula mine experienced a temporary disruption in output following seismic activity in May 2025

[ii] Kalahari field largest known, land-based deposit of high-grade manganese in the world

as a critical hub for the platinum industry, with the potential to expand its global influence as demand for platinum rises, particularly in clean energy and industrial applications.

For example, the Lobito Corridor in Southern Africa serves as a compelling case study of how regional collaboration and phased infrastructure development can unlock economic potential. By connecting resource-rich areas to processing hubs and export markets, the Lobito Corridor demonstrates how targeted investments in infrastructure and logistics can catalyse industrial growth. South Africa could draw lessons from this model to develop its processing clusters in a similarly strategic and phased manner, while abiding by market conduct regulations (such as antitrust laws) to ensure fair competition and creating synergies that benefit the entire industry.

To accelerate development, a streamlined approval process for constructing battery storage facilities could significantly attract investment. Additional incentives, such as tax credits or export subsidies aimed at manufacturers, could further boost local production. [47] Scaling up R&D on battery materials, MEAs/fuel cell catalysts, and advanced beneficiation methods, alongside establishing certification & testing facilities to meet global quality standards like CSIR–VITO Energy Storage Testbed, could validate local production and processing of new technology .[48] The presence of consumers could further support the development of the battery storage industry thanks to offtake agreements with OEMs and increase the bankability of projects.

As the industry is highly energy-intensive while the country has faced high electricity costs and severe power shortages (despite minor improvement)[49], **multiple solutions could unlock the availability and affordability of power**. These include expansion of renewable energy, storage capacity and grid infrastructure upgrade for reliability, and/or private or captive power generation enabling for processing zones.[50] Furthermore, rolling out demand-side management in this sector could enable flexibilities based on available capacity, allowing industries to adapt energy consumption in response to broader energy system needs.

Unlocking a processing cluster in South Africa also requires targeted skills development and industry collaboration. Expanding TVET and MQA programs[51] to include hydrometallurgy, process automation, and battery precursor processing, leveraging modern centres of specialization, can help build the required advanced technical capacity. Public–private partnerships with training providers (e.g., MetSkill and Prisma)[52] and on-the-job learning in processing plants can bridge skill gaps, while policy incentives for beneficiation training could contribute to securing a skilled workforce for the country's critical minerals sector.

For example, Valterra's platinum has two development programs: Advanced Graduate Development Programme for professional/ technical development and Engineering Skills Training Centre for artisanal skills development engineering school addresses the artisanal skills gap through its Advanced Graduate Program, developed with universities. The program combines competency testing with rotational assignments, providing students with both theoretical knowledge and practical experience. This initiative ensures workforce readiness by equipping graduates with the skills needed to meet industry demands. [53]

By adopting a phased approach, leveraging regional examples like the Lobito Corridor, and addressing key enablers such as energy, skills, and R&D, South Africa can position itself as a leading processing hub for critical minerals and battery storage technologies in the region and beyond.

C. Iron ore and bauxite corridors cluster in West Africa

Logistics: Inland deposits are often underdeveloped due to challenging logistics. The Trans-Guinean Railway (over 600 km) is a transformative piece of infrastructure that connects the Simandou iron ore deposits in Guinea's interior to the planned Morebeya deep-water port. [54] Much like the Lobito Corridor in Angola which links the Atlantic port of Port of Lobito to the mining heartlands of the DRC and Zambia and enables shipments of copper and other minerals via rail rather than long road routes, the Trans-Guinean Railway presents an opportunity for Guinea's iron-ore and bauxite clusters.[55] For Simandou, it can provide a dedicated heavy-haul corridor to the coast, enabling large-scale production and export. The railway's route passes through areas close to these bauxite-rich zones, potentially allowing for the integration of bauxite transport into the railway's operations.

Unlocking this logistics cluster would require skills development. Workforce training programs, such as CEPIAG in Guinea, are essential to meet the immediate and long-term needs of the alumina and bauxite industries.[56]

D. Battery hub cluster in Morocco

Processing: Morocco is rapidly becoming a hub for battery value chain, establishing Morocco as a potential processing cluster. In June 2025, it inaugurated its first lithium-ion battery materials manufacturing plant in Jorf Lasfar, via COBCO.[57] Gotion High Tech is building a gigafactory in Kenitra, expected to start operations in third quarter of 2026 with an initial capacity of 20 GWh, and later phases could expand to 100 GWh.[58] BTR New Material Group is developing cathode-material industrial units in Tangier Tech City, with the first 25,000-ton phase expected to be operational by September 2026 (northern Morocco)[59]. Meanwhile, Managem, a large Moroccan mining and hydrometallurgy player, has partnered with Renault Group to supply 5,000 tonnes of low-carbon cobalt sulphate annually for seven years starting in 2025, enough to support about 15 GWh of battery production each year.

These large-scale expansions in Morocco's battery value chain **could benefit from corresponding developments in logistics infrastructure, energy supply, and workforce capacity**.

Morocco's strategic geographic proximity to Europe, along with its favourable trade agreements, modern ports, and strong logistics connectivity, makes it an attractive destination for businesses aiming to serve the European EV and battery markets. However, as the Tanger Med Port is projected to surpass its nominal container capacity, port expansion becomes essential to accommodate the growing trade in specialized chemicals and battery minerals.[60] In addition, dedicated rail freight corridors linking major ports with industrial parks are needed to ensure efficient, cost-effective, and sustainable movement of raw materials and finished products across the country. [61]

Morocco is one of the leaders in renewable energy in Africa with solar PV and wind contributing over 38% of its power mix as of 2024. As battery manufacturing is highly energy-intensive, Morocco's expanding low carbon renewable portfolio provides a reliable and cost-competitive power base.[62]

Morocco boasts a highly skilled labour force in mining and processing, supported by leading engineering and technical institutions such as Mines Rabat, University Mohammed VI Polytechnic, and the Mohammadia School of Engineering. Industry leaders like Managem and OCP Group actively train and employ local talent, while government programs such as OFPPT (Vocational Training and Occupational Promotion Bureau (Office de le Formation Professionnelle et de la Promotion du Travail) [63]and the Morocco Career Center Program[64] further enhance vocational skills and workforce readiness. Together, these initiatives provide Morocco with a robust pool of engineers and technicians capable of supporting advanced mineral processing and emerging battery value chains.

3.2 Speed-to-market pathway

3.2.1 Policy and regulatory environment

Streamline regulatory processes

Accelerating critical minerals development in Africa could benefit from stakeholders assessing opportunities to streamline regulatory processes across nations. Current compartmentalisation within government departments often lead to duplicated reviews, which delay license permitting slowing down project development[65]. Establishing cross-government task forces and one-stop-shop licensing authorities could reduce time and complexity involved in obtaining necessary permits for mining and infrastructure projects. In Zambia for instance, the new Mining Regulations & Compliance Act introduces a Unified One-Stop Licensing mechanism, which consolidates all departmental approvals under one authority.[66] This approach not only accelerates project execution timelines, but also enhances attractiveness for investors by reducing the perceived regulatory risk.

Policy sharing and harmonisation

Stronger policy sharing and harmonisation among African nations could create a more predictable and stable regulatory landscape. A lack of policy sharing may create inconsistencies and uncertainties that can slow down project development and deter investors[67]. Knowledge-sharing mechanisms such as AfIDA's Catapult Accelerator[68], which helps governments fast track project preparation and financing, can help ensure best practices proliferate and scale across borders. By harmonising policies, African countries could furthermore create unified regulatory frameworks that simplify compliance for companies operating across multiple jurisdictions. Continental initiatives such as the African Continental Free Trade Area, which covers

54 countries and a total market value of over $3.4 trillion[69], is an example demonstrating how regulatory convergence and shared reporting standards enhance speed-to-market pathways.

3.2.2 Financial and investment derisking

Public-Private Partnerships (PPP)

PPPs are a viable solution for financing critical mineral projects in Africa facing an annual infrastructure financing gap of $130-170 billion[70]. By combining public sector support with private sector efficiency and innovation, PPPs could provide the necessary capital and expertise to develop large-scale mining projects that might otherwise be unfeasible due to high costs and risks. For instance, governments could attract investment through tax incentives, guarantees, and offtake agreements, while private partners contribute technical expertise, advanced technologies and private capital investments into projects. There is also potential for an opportunity to align infrastructure development with new mining projects, as the bankability of such projects–through future tax revenues–can enhance government creditworthiness and enable broader infrastructure financing. Namibia's Kokerboom Solar Project, a private solar plant supplying a mining operation under a concession model, illustrates how mining-linked PPPs can align energy transition goals with industrial growth[71].

Homegrown investment solutions

Africa's critical minerals development depends on patient, long-term capital to fund large projects spanning 18 years on average[72], far beyond commercial banks' typical shorter lending horizon. Mobilising domestic financing through deeper capital markets and stronger local institutions could therefore be essential. South Africa's pension system shows how regulated pension and sovereign funds can provide stable, long-term funding for clean energy infrastructure [73]. Other initiatives to consider include strengthening DFIs and local banks' mining-risk expertise, tokenisation-based financing tied to ESG and AI metrics, African-listed fundraising for junior miners, and regional mineral-trading platforms, which could reduce dependence on foreign capital and retain more value within the continent. Together, these measures would enhance financial resilience, attract sustainable investment, and accelerate Africa's industrial and energy transition [74].

3.2.3 Infrastructure and midstream capacity building

Regional and cluster-based approaches

Regional and cluster-based infrastructure integration could play a significant role in accelerating Africa's critical minerals development. Most infrastructure projects remain fragmented, leaving 600 million people in Sub-Saharan Africa still lacking electricity despite abundant renewable and conventional resources[75]. Shared transportation networks, energy supply systems, and processing facilities can create synergies across mining projects, reducing costs and expanding market access. Corridors such as Abidjan-Lagos demonstrate how cross-border logistics can enhance regional trade and competitiveness. Greater regional coordination in planning and financing cross-border assets is needed to unlock economies of scale. The Glencore-SNEL partnership at Inga Dam illustrates both the opportunity and vulnerability of isolated national grids. Collaboration among Angola, Zambia, and the DRC under regional initiatives shows how integrated energy networks can improve efficiency. In South Africa, the $1.3 billion Lebalelo Water Project illustrates how mining offtakers can anchor shared infrastructure. Its long development timeline underscores the need for stronger project preparation, standardized regulatory frameworks, and knowledge-sharing platforms such as AfiDA's Catapult Accelerator.

Leveraging existing infrastructure

Rather than investing solely in new infrastructure, leveraging and optimising existing regional transport and energy networks, such as the North-South Corridor, TAZARA, Nacala, and Lobito corridors, can support mining projects and avoid greenfield construction delays. Prioritizing upgrades over new builds would deliver quicker results and stronger regional connectivity. Zambia's active participation in the Southern African Power Pool and its efforts to link with the Eastern African Power Pool and DRC interconnectors demonstrate how cross-border energy systems can strengthen energy access and trade.

3.2.4 Skill building

Work-ready technical skills

Building a technically skilled workforce is essential for the success of Africa's critical minerals sector. Shifting from theory to practice through vocational programs in mining engineering, geology, and mineral processing will better align capabilities with industry needs. Partnerships between companies and academic institutions can ensure training reflects real operational needs through training hubs co-managed by employers. Setting skills priorities across the upstream, midstream, and downstream value chain, and expanding local technical colleges, as seen in Saudi Arabia's industrial skills model, would ensure training supply matches industrialisation goals.

Early-stage pipeline & awareness

Developing early-stage talent pipelines can support the development of local capabilities and attract young professionals. With over 60% of the African population under 25[76], structured early engagement can help secure the next generation of mining professionals by creating interest in STEM fields linked to mineral exploration, processing, and downstream applications. Collaborations with trusted bodies such as the Mining Qualifications Authority can help raise awareness through school outreach and STEM clubs, helping students obtain awareness about relevant subjects early, such as mathematics, physics, and chemistry. Scholarships and financial support for mining-related studies can expand the talent pool and reduce entry barriers.

3.3 Adoption of ESG standards and future-focused sustainable technologies and digitalisation pathway

3.3.1 Policy and regulatory environment

Policy alignment for ESG

Collaboration between the public and private sectors will be essential to promote the effective adoption and implementation of ESG standards. For companies, key priorities include resource stewardship (energy, water management, emissions reduction) for operational sustainability and collaboration with community for sustainable impacts (for example, working with government). For the public sector, governments are expected to play their part in ensuring that mining investments contribute to broader societal benefits. Accordingly, the alignment of policies to support the integration of ESG standards in mining operations is critical for sustainable development. Policy frameworks that encourage the adoption of ESG practices involve setting clear guidelines and benchmarks for environmental protection, social responsibility, and corporate governance, supported by transparent reporting to ensure companies adhere to standards and are held accountable for their performance. Such alignment will not only ensure the long-term sustainability of growing industries but also allow them to more quickly access developed markets with high standards for ESG compliance, including the EU's CBAM, which cover over €80 billion in annual carbon-intensive imports. Regional frameworks such as EU's Battery Regulation[77] promote such standardization of regulations across borders, making it easier for companies to navigate the regulatory environment.

3.3.2 Financial and investment derisking

Digital and AI policy frameworks

Developing digital and AI policy frameworks could play an essential role in fostering innovation in Africa's mining sector while managing operational and ethical risks. Defining clear standards for data privacy, cybersecurity, and responsible use of AI in decision-making processes can strengthen trust and attract investment. Tanzania's ARIFA initiative demonstrates how AI can improve mineral exploration, optimize operations, and enhance environmental monitoring[78]. By establishing a transparent regulatory environment and digital infrastructure can accelerate the adoption of advanced technologies that improve efficiency, safety, and sustainability across the mining value chain.

Market distortion mitigation

Addressing market distortions that challenge investment in ESG-compliant projects can play a crucial role in attracting sustainable capital. Phasing out non-renewable subsidies, introducing carbon pricing, and redirecting incentives toward renewables can create a level playing field and incentivise companies to invest in cleaner technologies. South Africa's revised carbon tax regime, set to reduce tax-free allowances and increase stricter carbon prices from 2026, illustrates how fiscal policy can shift investment toward cleaner energy and lower-carbon operations.[79] Such initiatives ensure market forces support, rather than hinder, sustainable industrial growth directing companies towards sustainable practices. Infrastructure and midstream.

3.3.3 Infrastructure and midstream capacity building

Energy resource utilization

Utilising Africa's abundant renewable energy resources, such as geothermal, hydro, solar, and wind, can power mining operations sustainably through reliable and clean energy while reducing costs and emissions. The 115 MW hybrid power station at Mali's Fekola Gold Mine (30 MW solar, battery, and thermal) greatly offsets diesel consumption and carbon emissions, proving the viability of off-grid renewables for mining[80]. In the DRC, the government's blockchain-based "E-trace" system aims to track cobalt exports, strengthening supply chain transparency[81]. Côte d'Ivoire's launch of a digital mining cadastre further illustrates how permitting systems are evolving to support faster infrastructure deployment[82]. These developments reflect a broader trend toward digitally enabled and ESG-aligned infrastructure supporting Africa's critical minerals value chain.

3.3.4 Skill building

Digital, automation & AI enablement

Building a digitally skilled workforce is critical to sustain future competitiveness and ensure safe, efficient mining operations. Providing training within digital, automation, and AI ensures workers are equipped with the skills needed to operate and maintain advanced systems while building resilience to technology-driven disruption. Vocational training programs can offer specialized courses in digital tools, automation, and AI aligned with industry needs as well as close skills gap and make work safer. Raising awareness of how these technologies advance ESG objectives can help reduce the perceived trade-off between sustainability and profitability, strengthening both workforce capability and sector performance.

Conclusion

In conclusion, the discussions carried out in different contexts and timelines have reaffirmed Africa's significant potential to become a leading player in the global critical minerals landscape. The key solutions to unlock this potential – from strengthening regional infrastructure and logistics to improving policy coordination, governance, and local value addition – have been well identified.

The paper also outlines proven approaches to harnessing the opportunities arising from the development of critical minerals – opportunities that can advance both Africa's economic transformation and the global supply needed for the energy transition. Realising these opportunities will require clear leadership intent, informed choices, and a coherent policy and regulatory framework. A phased approach will be essential in certain areas, calling for long-term vision rather than short-term considerations. Beyond policy, enabling factors such as infrastructure, skills development, and institutional capacity will be key. Above all, the development of the critical minerals sector must be grounded in harmony, integrity, certainty, and a strong commitment to safety and security to attract and sustain the scale of investment required.

The next imperative for stakeholders is implementation: to move from strategy to action through coordinated efforts among governments, industry, and development partners. This could involve adopting a cluster approach to develop midstream and downstream capabilities, harmonise cross-border regulatory frameworks, and ensure project development timelines align with rapidly evolving global demand. Lastly, the adoption of sustainability standards and the application of future-focused sustainable technologies and digitalisation are essential to ensure transparency, long-term efficiency, and responsible growth.

By pursuing these measures, Africa has the opportunity to not only supply raw materials but to capture greater economic value through processing, manufacturing, and innovation – transforming its resource endowment into long-term economic value, regional integration, and sustainable development, securing a central role in the global critical minerals ecosystem.

Acknowledgement

The Business 20 and The World Economic Forum's Centre for Energy and Materials would like to thank the experts and stakeholders who generously contributed their time, insights, and experience during the workshop sessions that supported the development of this briefing paper. In particular, we thank McKinsey & Company, Minerals Council South Africa, Valterra Platinum, Toyota South Africa Motors, the Africa Finance Corporation (AFC), and the Industrial Development Corporation of South Africa (IDC) for their valuable input and active participation.

The views expressed in this paper do not necessarily reflect those of the individuals or the organizations they represent.

[1] Office of the Director of National Intelligence. (2021, March). *Demographics and human development.* In *Global Trends 2024: A more contested world.* https://www.dni.gov/index.php/gt2040-home/gt2040-structural-forces/demographics-and-human-development

[2] Kitaw, M. (2025, March 19). *Africa's strategic positioning in the global green revolution and critical minerals race*. Brookings Institution. https://www.brookings.edu/articles/africas-strategic-positioning-in-the-global-green-revolution-and-critical-minerals-race/

[3] U.S. Geological Survey, National Minerals Information Center. (2025, January 31). *Mineral Commodity Summaries 2025 Data Release (ver. 2.0, April 2025)* U.S. Geological Survey. https://doi.org/10.5066/P13XCP3R

[4] World Copper Ltd. (2023, December 1). *Building the next generation of sustainable copper mines in safe jurisdictions.* https://worldcopperltd.com/wp-content/uploads/2023/12/WorldCopper-Winter-2023-Dec_1.pdf

[5] McKinsey Minespans

[6] Ntsimbintle Holdings. (n.d.). *The Kalahari Manganese Field.* https://www.ntsimbintle.co.za/our-business/the-kalahari-manganese-field

[7] U.S. Geological Survey. (2024, January). *Manganese Commodity Summary*. https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-manganese.pdf

[8] ENSafrica (2025, February 23). *Africa Business in Brief*. https://www.ensafrica.com/news/detail/9736/africa-business-in-brief

[9] International Comparative Legal Guides. (2025, September 16). *Mining Laws and Regulations Zambia* 2026. https://iclg.com/practice-areas/mining-laws-and-regulations/zambiahttps://iclg.com/practice-areas/mining-laws-and-regulations/zambia

[10] Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development. (2025, January 20). *Boosting Zambia's Mining Revenue Through Tax Audits, Transfer Pricing Legislation and License Valuation*. https://www.igfmining.org/impactstory/boosting-zambia-mining-revenue-tax-audits-transfer-pricing-license-valuation

[11] African Development Bank Group. (2025, August 18). *Critical Minerals for Africa's Inclusive Growth and Development*. https://www.afdb.org/en/documents/critical-minerals-africas-inclusive-growth-and-development

[12] Department of Mineral and Petroleum Resources. (2025). *Critical Minerals and Metals Strategy South Africa.* https://www.gov.za/sites/default/files/gcis_document/202505/critical-minerals-and-metals-strategy-south-africa-2025.pdf

[13] Southern African Development Community. (2023, March 18-20). *SADC Council of Ministers Meeting.* https://www.sadc.int/node/4810

[14] International Institute for Democracy and Electoral Assistance. (2024). *Mineral Resource Governance in Africa: A Comparative Study.* https://www.idea.int/sites/default/files/2025-02/mineral-resource-governance-in-africa-a-comparative-study.pdf

[15] International Energy Agency. (2024, May). *Global Critical Minerals Outlook 2024*. https://iea.blob.core.windows.net/assets/ee01701d-1d5c-4ba8-9df6-abeeac9de99a/GlobalCriticalMineralsOutlook2024.pdf

[16] Baskaran, G. (2025, May 9). *Underexplored and Undervalued: Addressing Africa's Mineral Exploration Gap*. Center for Strategic and International Studies. https://www.csis.org/analysis/underexplored-and-undervalued-addressing-africas-mineral-exploration-gap

[17] Jentel, L., & Cloete, D. (2025, February). *Digging Deeper: Embedding Minerals Sovereignty in Africa's Mining Value Chains* (Policy Insights No. 161 – Corrected Version). South African Institute of International Affairs. https://saiia.org.za/wp-content/uploads/2025/02/PI-161-FP-Jentel-Cloete-CORRECTED-VERSION.pdf

[18] United Nations Conference on Trade and Development. (2025, June 19). *Africa: Foreign Investment Hit Record High in 2024*. https://unctad.org/press-material/africa-foreign-investment-hit-record-high-2024

[19] El Jechtimi, A. (2024, March 29). *China EV battery maker BTR to build cathode plant in Morocco.* Reuters. https://www.reuters.com/business/china-ev-battery-maker-btr-build-cathode-plant-morocco-2024-03-29/

[20] Chingono, N. (2024, July 18). *Zimbabwe's Kuvimba signs $310 mln lithium mine deal*. Reuters. https://www.reuters.com/markets/commodities/zimbabwes-kuvimba-signs-310-mln-lithium-mine-deal-2024-07-18/

[21] Fraser Institute. (2025, July). *Fraser Institute Annual Survey of Mining Companies 2024*. https://www.fraserinstitute.org/sites/default/files/2025-07/annual-survey-of-mining-companies-2024_0.pdf

[22] World Economic Forum. (2025, August). *Securing Minerals for the Energy Transition: Finance for Southern Africa*. https://reports.weforum.org/docs/WEF_Securing_Minerals_for_the_Energy_Transition_2025.pdf

[23] Baskaran, G. (2025, May 9). *Underexplored and Undervalued: Addressing Africa's Mineral Exploration Gap*. Center for Strategic and International Studies. https://www.csis.org/analysis/underexplored-and-undervalued-addressing-africas-mineral-exploration-gap

[24] World Bank. (2020). 2020 State of the Artisanal and Small-Scale Mining Sector. Washington, D.C.: World Bank. https://www.delvedatabase.org/uploads/resources/Delve-2020-State-of-the-Sector-Report-0504.pdf

[25] Perks, R. (2025, February 14). *A new era of renewal in artisanal mining*. World Bank; World Bank Group [Repost article from the Sunday Times South Africa from February 9, 2025]. https://www.worldbank.org/en/news/opinion/2025/02/14/a-new-era-of-renewal-in-artisanal-mining

[26] Helgi Library. (n.d.) *Road density (km of road per 100 km² of land area) in Brazil.* https://www.helgilibrary.com/indicators/road-density-km-of-road-per-100-km2-of-land-area/brazil

[27] Infrastructure News. (2025, August). *Infrastructure Growth Is Key to Africa's Mining Resurgence.* https://infrastructurenews.co.za/2025/08/05/infrastructure-growth-is-key-to-africas-mining-resurgence

[28] Nkomfe, L. (2025, August 29). *Challenges hindering economic benefits – FAPA*. Mining Weekly. https://www.miningweekly.com/article/challenges-hindering-economic-benefits-fapa-2025-08-29

[29] Cefai, S., Wang., V., & the Fast Markets Team. (2025, February 27). *African graphite supply in 2025: Market shifts, challenges and strategic importance*. Fastmarkets. https://www.fastmarkets.com/insights/african-graphite-supply-in-2025-market-shifts-challenges-and-strategic-importance

[30] Ijjasz-Vasquez, E., Signé, L., & Songwe, V. (2025, September 26). *Strength in numbers: Regional action for Africa's positioning in critical minerals.* Brookings Institution. https://www.brookings.edu/articles/strength-in-numbers-regional-action-for-africas-positioning-in-critical-minerals

[31] Nkosi, T. (2024, March 5). *Namakwa Special Economic Zone.* South African Government. https://www.gov.za/blog/namakwa-special-economic-zone

[32] U.S. Department of Commerce, International Trade Administration. (2024, January 26). *South Africa – Energy: Country Commercial Guide.* https://www.trade.gov/country-commercial-guides/south-africa-energy

[33] Banerjee, S. G., Romo, Z., McMahon, G., Toledano, P., Robinson, P., & Pérez Arroyo, I. (2015). *The Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa.*https://documents1.worldbank.org/curated/en/429771468008719026/pdf/The-power-of-the-mine-a-transformative-opportunity-for-Sub-Saharan-Africa.pdf

[34] OECD. (2024). *Africa's Development Dynamics 2024*. https://www.oecd.org/en/publications/africa-s-development-dynamics-2024_df06c7a4-en.html

[35] IntelPoint. (2025). *With a median age of 19 years, Africa has the youngest population, while Europe has the oldest population (43 years)*. https://intelpoint.co/insights/with-a-median-age-of-19-years-africa-has-the-youngest-population-while-europe-has-the-oldest-population-43-years

[36] B20 South Africa. (2025, September). *Energy Mix and Just Transition*. https://www.b20southafrica.org/wp-content/uploads/2025/09/B20_Energy_Mix__Just_Transition_Digital-Version.pdf

[37] Haripersad, D. (2025, August 8). https://www.miningweekly.com/article/gold-miner-closing-gender-gap-2025-08-08#:~:text=At%20South%20Deep%2C%20there%20have%20already%20been,2024%2C%20is%20helping%20to%20support%20this%20momentum *Women in Mining: Gold miner closing gender gap.* Creamer Media's Mining Weekly. 24) https://www.miningweekly.com/article/gold-miner-closing-gender-gap-

2025-08-08#:~:text=At%20South%20Deep%2C%20there%20have%20already%20been,2024%2C%20is%20helping%20to%20support%20this%20momentum

38 **McKinsey Minespans**

39 **Copperbelt Katanga Mining. (2025, March 16).** *Zambia and DRC to Lead Africa's Copper Industry Expansion in 2025*. https://copperbeltkatangamining.com/zambia-and-drc-to-lead-africas-copper-industry-expansion-in-2025/

40 **Shi, C., Zhang, S., & Zhao, S. (2024, August 22).** *Logistics challenges in Africa continue despite Zambia-DRC border resolution.* **Fastmarkets.** https://www.fastmarkets.com/insights/logistics-challenges-africa-continue/

41 **Venter, L. (2025, April 10).** *Trade imbalance drives up costs*. **Freight News.** https://www.freightnews.co.za/article/trade-imbalance-drives-up-costs

42 **Ecofin Agency. (2025, September 30).** *Zambia By Force of Geography, is Becoming an Africa's Logistics Hub.* https://www.ecofinagency.com/news-infrastructures/3009-49126-zambia-by-force-of-geography-is-becoming-an-africa-s-logistics-hub

43 **Reuters. (2024, April 23).** *Zambia seeks power imports for key mining sector.* **Creamer Media's Engineering News.** https://www.engineeringnews.co.za/article/zambia-seeks-power-imports-for-key-mining-sector-2024-04-23

44 **Power Technology. (2025, March 25).** *Copperbelt to invest $500m in solar power and transmission line upgrades.* https://www.power-technology.com/news/copperbelt-energy-solar-congo

45 **Copperbelt Katanga Mining. (2025, May 9).** *Zambia Approves Cross-Border Power Line to DRC Amid Growing Mining Demand*. https://copperbeltkatangamining.com/zambia-approves-cross-border-power-line-to-drc-amid-growing-mining-demand

46 **News24. (2025, July 24).** *Implats triples platinum smelting in Zimbabwe with new plant*. https://www.news24.com/business/companies/implats-triples-platinum-smelting-in-zimbabwe-with-new-plant-20250724-0470

47 **Dube, S. (2024, September 3).** *South Africa Has the Critical Minerals, But Is That Enough to Become a Global Battery Storage Powerhouse?* **Earth Journalism Network.** https://earthjournalism.net/stories/south-africa-has-the-critical-minerals-but-is-that-enough-to-become-a-global-battery

48 **Council for Scientific and Industrial Research. (n.d.).** *CISR's energy storage testbed factsheet.* *https://www.csir.co.za/sites/default/files/Documents/CSIR%27s%20Energy%20Storage%20Testbed%20factsheet.pdf*

49 **Minerals Council South Africa. (2025, April 4).** *Electricity Update: February to March 2025.* https://www.mineralscouncil.org.za/all-categories?id=2461%3Aelectricity-update-february-to-march-2025&task=download.send

50 **OECD (2025, June 5).** *OECD Economic Surveys: South Africa 2025 – Chapter 4: Reforming South Africa's electricity sector.* https://www.oecd.org/en/publications/oecd-economic-surveys-south-africa-2025_7e6a132a-en/full-report/reforming-south-africa-s-electricity-sector_05fdccb6.html

51 **Mining Qualifications Authority. (n.d.).** *Home page.* https://mqa.org.za/

52 **MetSkill. (n.d.).** *Training Course Prospectus: Metskill Offers a Number of Skills Programmes and Qualifications Which Can Run as Part of Leadership Programmes..* https://metskill.co.za/training/

53 **Valterra Platinum. (n.d.).** *Graduates, scholarships, and bursaries.* https://www.valterraplatinum.com/careers/graduates-scholarships-and-bursaries

54 **Un Pont vers la Prospérité. (n.d.).** *TransGuinean Railway and Simandou Project*. https://unpontverslaprosperite.com/en/

55 **Silimina, D. (2025, March 17).** *Trade Infrastructure: How the Lobito Corridor is paving the way for economic growth.* **Development and Cooperation.** https://www.dandc.eu/en/article/lobito-corridor-will-transform-trade-zambia-angola-and-drc-it-provides-faster-export-route

56 **Karkare P., & Cissé, M. (2025, October).** *Briefing Note No. 199: Skills training to support Guinea's industrial transformation*. **ECDPM, UNIDO, LKDF**. https://beamexchange.org/resources/2312

57 **Industries.ma. (2025, June 25).** *COBCO Launches Morocco's First Lithium-Ion Battery Materials Manufacturing Plant in Jorf Lasfar*. **Moroccan Industry Magazine.** https://industries.ma/en/cobco-launches-moroccos-first-lithium-ion-battery-materials-manufacturing-plant-in-jorf-lasfar

[58] **Eljechtimi, A. (2024, June 7).** *Gotion High Tech Morocco gigafactory to start production in 2026.* **Reuters.** https://www.reuters.com/technology/gotion-high-tech-morocco-gigafactory-start-production-2026-2024-06-07/

[59] **Hadri, S. (2025, May 29).** *Industry: With Cobco and BTR, Morocco powers up its batteries*. **TelQuel.** https://telquel.ma/2025/05/29/industry-with-cobco-and-btr-morocco-powers-up-its-batteries_1934495

[60] **Eljechtimi, A. (2024, June 10).** *Morocco's Tanger Med port expects to exceed nominal container capacity*. **Reuters.** https://www.reuters.com/business/moroccos-tanger-med-port-expects-exceed-nominal-container-capacity-2024-06-10

[61] **Eljechtimi, A. (2025, April 24).** *Morocco launches $10 billion rail expansion plan*. **Reuters.** https://www.reuters.com/world/africa/morocco-launches-10-billion-rail-expansion-plan-2025-04-24

[62] **International Energy Agency. (2022).** *World Energy Outlook Special Report: Africa Energy Outlook 2022*. https://iea.blob.core.windows.net/assets/220b2862-33a6-47bd-81e9-00e586f4d384/AfricaEnergyOutlook2022.pdf

[63] **World Bank. (2020, May).** *Morocco - Skills Development for Employment: The Role of Technical and Vocational Education and Training*. https://documents1.worldbank.org/curated/en/919151593565793405/pdf/MoroccoSkills-Development-for-Employment-The-Role-of-Technical-and-Vocational-Education-and-Training.pdf

[64] **IREX. (n.d.).** *Morocco Career Center Program*. https://www.irex.org/project/morocco-career-center-program

[65] **Natural Resource Governance Institute. (2025, February 17).** *Improving Mining Permits in Africa: Transparency and Reform*. **Mining Indaba.** https://miningindaba.com/articles/improving-mining-permits

[66] **Dentons. (2025, March 18).** *Zambia's mining law overhaul: Minerals Regulation Commission Act No. 14 of 2024.* https://www.dentons.com/en/insights/articles/2025/march/18/mining-law-overhaul

[67] **Lalu, B. (2025, July).** *Accelerating Infrastructure Development in Africa: Strategies to Reduce Lead Times.* **Public Investment Corporation: Research and Innovation.** https://www.pic.gov.za/DocMedia/PIC%20Research%20and%20Innovation%20Accelerating%20Infrastructure%20Development%20in%20Africa%20July%202025.pdf

[68] **African Infrastructure Development Association (2023).** *AfIDA 2023 - Q1 News Letter*. https://afida-africa.org/wp-content/uploads/2023/04/n230321-AfIDA-Q1-News-Letter_c.pdf

[69] **World Bank. (2020, July 27).** *The African Continental Free Trade Area*. https://www.worldbank.org/en/topic/trade/publication/the-african-continental-free-trade-area#:~:text=The%20AfCFTA%20is%20the%20world's%20largest%20free,sanitary%20standards%20and%20technical%20barriers%20to%20trade

[70] **Africa-Europe Foundation & AUDA-NEPAD. (2025).** *The Missing Connection: Unlocking Sustainable Infrastructure Financing in Africa – A Technical Whitepaper.* https://back.africaeuropefoundation.org/uploads/AEF_NEPAD_Technical_Paper_2487fc9068.pdf

[71] **Africa Energy Portal. (2024, February 9).** *Solar power: from southern Namibia, Solarcentury injects 60 MWp into SAPP*. https://africa-energy-portal.org/news/solar-power-southern-namibia-solarcentury-injects-60-mwp-sapp

[72] **Asian Infrastructure Investment Bank & G20. (2025, September).** *Addressing Impediments to Growth and Development in Africa: An Infrastructure Development Perspective*. https://g20.org/wp-content/uploads/2025/10/Addressing-Impediments-to-Growth-and-Development-an-Infrastructure-Development-Perspective-Note-by-AIIB1.pdf

[73] **Goosen, M. (2025, July 1).** *Africa eyes pension funds to drive energy, infrastructure investment*. **Energy Capital & Power.** https://energycapitalpower.com/africa-eyes-pension-funds-to-drive-energy-infrastructure-investment/

[74] **Africa Financa Corporation. (2025).** *State of Africa's Infrastructure Report: Mobilizing Domestic Capital.* https://www.africafc.org/our-impact/our-publications/state-of-africa-infrastructure-report-2025

[75] **International Energy Agency (2022).** *Africa Energy Outlook 2022: Key Findings*. https://www.iea.org/reports/africa-energy-outlook-2022/key-findings

[76] **Mpemba, C., & Munyati, C. (2023, August 16).** *Youth Perspectives: How Africa's Youth will drive global growth*. **World Economic Forum.** https://www.weforum.org/stories/2023/08/africa-youth-global-growth-digital-

economy/#:~:text=Chido%20Munyati%20Africa%20is%20a%20continent%20teeming,continent's%20population%20under%20the%20age%20of%2025.

[77] European Chemicals Agency. (n.d.). *Understanding the Batteries Regulation*. https://echa.europa.eu/understanding-batteries-regulation

[78] Africa Research Institute for AI. (n.d.). *AI-Driven Mineral Intelligence and Sustainable Mining for Economic Transformation in Tanzania*. https://arifa.org/research/research-projects/1/project

[79] Cocks, T. (2024, November 15). *South Africa's revised carbon tax to be harsher with more offsets, Treasury says*. Reuters. https://www.reuters.com/sustainability/south-africas-revised-carbon-tax-be-harsher-with-more-offsets-treasury-says-2024-11-15/

[80] BayWa r.e. (n.d.). *World's largest off-grid hybrid system in the mining industry (2025).* https://www.baywa-re.com/en/case-studies/largest-off-grid-solar-battery-system-for-mining-industry

[81] Nhede, N. (2025, October 2). *DRC's CEEC Unveils New Digital Mineral Traceability Platform*. https://energycapitalpower.com/drcs-ceec-unveils-new-digital-mineral-traceability-platform/#:~:text=The%20Democratic%20Republic%20of%20Congo,at%20African%20Mining%20Week%202025

[82] Tossou, E. (2025, September 24). *Côte d'Ivoire Embraces Digital Mining Cadastre Trend.* https://www.ecofinagency.com/news-digital/2409-48941-cote-d-ivoire-embraces-digital-mining-cadastre-trend#:~:text=In%20C%C3%B4te%20d%27Ivoire%2C%20mining%20companies,have%20already%20adopted%20similar%20systems