FUTURE MINERALS FORUM

FUTURE MINERALS BAROMETER REPORT 2025: MEASURING PROGRESS ON CRITICAL MINERAL VALUE CHAINS

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1. Foreword

by H.E. Khalid Al-Mudaifer,

Vice Minister for Mining Affairs,
Ministry of Industry and Mineral Resources

The theme of the 5th edition of the Future Minerals Forum is "Dawn of a Global Cause: minerals for a new age of development". In keeping with the spirit of this new age, the Future Minerals Forum (FMF) Barometer represents a landmark document for the minerals industry: a tool which highlights key trends and stakeholder sentiment, tracks progress on mineral supply and makes recommendations for action to ensure the sustainable development of critical minerals value chains.

The Barometer has been developed to further the FMF's ambition of shaping the future of minerals, and turn talk into action following the Ministerial Roundtable's agreement to create an international Critical Minerals Framework. It will comprehensively track progress on the six enablers identified in that framework:

- **Policies** that support mineral value chain development
- **Financing** of the sector
- **Infrastructure** that makes minerals projects feasible
- **Sustainable** practices, responsible to both communities and the environment
- **Talent development** to enable a skilled workforce
- **Technology** for safer, more efficient and more productive operations.

It will provide visibility of progress made in developing the critical mineral value chains that drive not just the demands of traditional and new demand applications, but also the implementation of developmental opportunities in some of the world's lowest income countries, creating much needed jobs for a growing population.

Our valuable insights partnerships with four esteemed organizations have enabled us to compile the Barometer:

- Our Knowledge Partner, **McKinsey & Company**, a global management consulting firm.
- **S&P Global Market Intelligence**, a data and analytics firm.
- **Global AI**, experts in agentic AI solutions.
- **GlobeScan**, an insights and advisory firm specializing in trust, sustainability, and engagement.

We have also been privileged to gain insights from five senior leaders at major mining companies:

- **Dominic Barton** of Rio Tinto.
- **Bob Wilt** of Ma'aden.
- **Máximo Pacheco** of Codelco.
- **Duncan Wanblad** of Anglo American.
- **Robert Friedland** of Ivanhoe Mines.
- **Gustavo Pimenta** of Vale.

The Barometer is, therefore, a truly collaborative effort, reflecting the collegiate spirit of the Future Minerals Forum.

Unparalleled opportunities

We are at one of the most pivotal moments in history since the industrial revolution, with minerals playing a central role in our next phase of development.

In a world undergoing both an energy and a digitalization transition, critical minerals are key to the global economy.

It has been estimated that the world needs almost USD 5 trillion in investment by 2035 to meet mineral demand for decarbonization, digital infrastructure, and economic development. That is four times the market capitalization of the top 20 mining companies in the sector, and equivalent to the GDP of Germany.

Globally, then, there is an enormous funding challenge. But the scale of this opportunity is unparalleled in the sector's recent history and is pivotal to shaping a new age of development in Africa, Asia, Latin America and other supplier regions.

The Barometer will give clarity on country risks by providing a fact-based, balanced view on local realities, supplemented by industry stakeholder sentiment, and will lift supplier countries, giving them a voice in creating global rules and standards.

Our aim is to publish the Barometer annually, so that it can be referred to as an index of global mineral value chain creation, informing decision-making by governments, industry and investors.

We look forward to sharing our findings with them, and with you.

2. EXECUTIVE SUMMARY

Saudi Arabia and its neighboring countries in the 'Super Region' of Africa, Western and Central Asia, are home to a significant portion of the world's critical mineral deposits essential for the global energy transition. This unique geological landscape contains over half of the global reserves of minerals vital for this energy shift. However, it remains under-explored, with the lowest exploration expenditure of any region worldwide.

At the same time, critical mineral value chains remain highly concentrated: more than 45% of global refined production of materials used in electric vehicles (EVs) takes place in one region, reinforcing exposure to supply and trade disruptions, and increasing the strategic premium on diversified, resilient supplier regions.

Demand is also broadening beyond the energy transition alone. In addition to electrification, the scaling of AI infrastructure is accelerating minerals-intensive buildouts where global data center demand is projected to reach ~219 GW by 2030, growing at ~22% p.a. In parallel, rising geopolitical tensions are elevating the strategic importance of minerals in security and defense supply chains, with defense budgets expected to increase substantially until 2030, reflecting higher ambition levels set by the new NATO target.

Against this backdrop, governments worldwide are taking a more active role in securing critical mineral supply chains, driven by the strategic importance of these materials to energy security and economic growth. This includes more direct participation and intervention, reshaping investment incentives, standards, and market access across the value chain.

These strategic shifts are occurring amid a slowing, but still highly active, market for mining deals. In the first three quarters of 2025, $30bn of mining M&A activity was announced, 74% of which was in Latin America, reflecting a market that is increasingly shifting investments to perceived safer jurisdictions. Over the past five years, Latin America's deal value grew over 200%, with over 50% associated with three major blockbuster deals in the past two years, while deal value in Africa fell by 79%, and the rest of the world fell by 9%. This direction of deal flow is layered with regional differences but fundamentally reflects the perceived risks miners weigh when allocating capital: Africa is rich in resources, yet struggles to compete with the stability available in Latin America's mineral-rich states.

Exploration signals are more mixed and underline both opportunity and competition. Latin America and Africa accounted for 38% of exploration budget in 2025, with growing activity in Africa; however, overall exploration funding remains weighted toward the rest of the world. While Africa offers vast areas of unexplored land rich in critical minerals, converting geological endowment into investable, producing supply requires addressing above-ground constraints and confidence barriers.

Geopolitics is now a defining feature of mineral trade and investment. McKinsey Global Institute analysis suggests that the 'geopolitical distance' of trade in minerals is considerably higher than trade in other sectors, meaning minerals often flow between economies at different ends of the geopolitical spectrum. Evidence is emerging of countries investing to manage these dependencies.

Convened within the Super Region by Saudi Arabia, the Future Minerals Forum is a government-led platform that works to enable the creation of resilient and responsible mineral value chains in supplier regions for a new age of global development. At its 2025 Ministerial Roundtable, attended by 89 governments including 16 of the G20, the FMF introduced the Critical Minerals Framework: a strategic blueprint and structured methodology for establishing sustainable and resilient global mineral value chains. The Framework identifies six critical enablers to unlock end-to-end value chains: policy & regulations, financing, infrastructure, sustainability, talent, and technology. These enablers provide common ground for approaching mineral development in a complex environment.

It will equip stakeholders with actionable insights and will:

- foster collaboration
- increase the industry's resilience
- enhance competitiveness, and
- position the Super Region to effectively meet the surging global demand for critical minerals.

FMF is the world's leading minerals gathering, bringing together senior government officials, industry leaders, multilateral organizations, NGOs, academia, trade associations, and other stakeholders across the entire mineral value chain.

The Future Minerals Barometer operationalizes this agenda by including focused analyses of supply and demand trends, identification of vulnerabilities, evaluation of geopolitical and macroeconomic impacts, and a forward-looking approach to help manage risks while securing long-term supply. It will track progress across exploration, mining, processing, infrastructure, human capital, technology deployment, sustainability and transparency, and policy effectiveness.

As a baseline, an in-depth stakeholder consultation (see Ch. 7) has been conducted to better understand the current landscape and the perceived preparedness of critical minerals value chains against the six Critical Minerals Framework enablers.

This consultation received input from 41 experts in 19 countries – including 12 in the Super Region – who provided their perspectives on the six enablers, including the key supports required and opportunities for collaboration to unlock supply. Amongst their many other expert insights, stakeholders concluded that:

- **Financing** is a key component to unlocking progress, but investment is negatively affected by perceptions of a high-risk environment with slow returns. Stakeholders are looking for patient capital, flexible funding models, and ways of de-risking the environment through cost competitiveness levers, long-term guarantees and other incentives to increase investor confidence.
- **Policy and regulation** are seen as the backbone to strengthening the value chain. Most stakeholders feel that enough policies exist, but geopolitical instability, corruption, conflicting and competitive regulatory landscapes, and inconsistent adherence and enforcement undermine progress. Stakeholders call for harmonized, easy to understand, long-term policy and standards across the region, backed by good governance and upheld by law.
- **Significant investment** is required in infrastructure and technology to support the future demands of critical mineral value chains. While the right technologies exist, their adoption is limited due to high costs, lack of skilled operators and inadequate supporting infrastructure. Stakeholders emphasize the need for diverse investment, policy support, risk management in infrastructure planning, workforce upskilling, and regional collaboration to unlock value and ensure long-term resilience.
- The **talent gap** is negatively impacted by mining's image, which requires investment in education, and programs that appeal to younger, more diverse talent. Collaboration between governments, academia, and industry is seen as essential to build talent pipelines, share expertise, and establish global hubs for mining education and innovation.
- **Sustainability** is increasingly prioritized, but unevenly implemented due to inconsistent standards, governance, measurement and reporting, and technology adoption. Stronger commitment and leadership in sustainability is needed from industry and government. Stakeholders point out the need for mindset shifts, supported by locally-relevant policies, best practice guidelines and roadmaps, and technology investments.

The Future Minerals Forum aims to publish an annual State of the Sector Survey to measure progress against the enablers, capturing the perspectives of business leaders, investors, and policymakers in the mining industry, specifically from geographies across the Super Region.

Overall, to develop its eight projects, the FMF has created three coordination groups, and recruited the support of 131 experts, including 42 nominees from governments and international organizations. Progress in these projects will be tracked in the FMF Barometer Dashboard.

The Future Minerals Barometer will track progress across the six enablers, providing governments and industry leaders with the insights needed to make investment and policy decisions.

3. Introduction

Why the Barometer Matters

By tracking progress across the enablers, the Barometer will provide governments and industry leaders with the insights needed to make investment and policy decisions that enable the upscale and acceleration of mineral supply. It will also help in understanding initiatives being undertaken by international agencies such as The World Bank or the Development Bank of Southern Africa in developing large-scale projects such as the Lobito Corridor.

The Barometer will ensure the critical minerals sector stays ahead of global challenges by equipping stakeholders with actionable insights and fostering collaboration. It will increase the industry's resilience, enhance competitiveness, and position the Super Region to effectively meet the surging global demand for critical minerals, aligning the industry towards shared goals.

A comprehensive approach to developing sustainable mineral value chains

At its 2025 Ministerial Roundtable, the Future Minerals Forum introduced the Critical Minerals Framework (CMF) – a strategic blueprint and structured methodology for establishing sustainable and resilient global mineral value chains.

Such value chains include key stages such as exploration, mining, logistics, processing, and manufacturing. Each plays a crucial role in ensuring the industry's overall efficiency and sustainability, supported by cooperation with governments, companies, and communities.

To summarize the state of play of critical mineral development across the Super Region, FMF is leading the development of a Barometer that provides vital intelligence to decision makers such as governments, companies and investors.

The CMF focuses on the need for several critical enablers to unlock the potential of end-to-end mineral value chains:

Policy and Regulations

Establish stable policies to support mineral value chain development, aligned with international standards to attract and maintain investor confidence.

Financing

Secure and manage significant investments through innovative financing solutions, including public-private partnerships and green finance.

Infrastructure

Build multi-modal infrastructure encompassing roads, railways, and ports to lower costs for individual assets and improve the feasibility of mining projects through shared infrastructure.

Sustainability

Develop strong environmental and social governance frameworks and adopt technologies that enable traceability systems.

Talent

Invest in education, develop local training programs, and foster research and development partnerships to address skill shortages.

Technology

Upgrade geological data systems and partner with global experts to access technologies that boost operational efficiency in production assets in each step of the mineral value chain.

This provides common ground for approaching mineral development in a complex environment. It serves to align users' activities with international standards, attract investment, and strengthen their competitive position. By adopting the Framework's structured methodology, stakeholders can more effectively navigate the complexities of the mining sector, ensuring projects are economically viable as well as environmentally and socially responsible, thereby driving development within the Super Region.

Introducing the FMF Barometer

The Future Minerals Forum's Barometer is a vital tool that provides a holistic overview of the critical minerals sector.

Its primary objectives include tracking the delivery of **exploration, mining, processing and infrastructure development, progress in human capital growth, deployment of new technology, improvement in sustainability and transparency, as well as policy efficiency and effectiveness.**

By focusing on these enablers, the Barometer aims to ensure supply chain resilience within the Super Region and its connections to the global market.

It simplifies complex market dynamics into actionable insights, providing:

- Focused analyses of supply and demand trends
- Identification of vulnerabilities in global and regional supply chains
- Evaluation of geopolitical and macroeconomic impacts
- A forward-looking approach to help manage risks while securing long-term supply.

Focus on the Critical Minerals Framework's enablers

The Barometer supports the development of end-to-end mineral value chains in the Super Region by monitoring progress against the six enablers.

To illustrate the importance of these enablers:

- Multi-modal **infrastructure** improvements and development across roads, railways, and ports, and availability of power and water are crucial to reducing costs and enhancing the viability of mining projects. However, these are usually hampered by **financing** costs.
- A strategic approach could **attract and manage substantial investments**, drawing both public and private investments, as infrastructure projects often involve large-scale upfront capital investments and extended payback periods[1].
- **Sustainability** and traceability are key to ensuring responsible, ethical operations. Transparency in mining revenue often ends at its contribution to the national budget, leaving local communities without tangible developmental benefits. Poor traceability is also a major challenge for users of critical minerals that do not have visibility over their supply chains, given the increasing supply chain transparency requirements to support global ESG initiatives[2].

1) As such, FMF, in partnership with the World Bank, is working on the development of funding mechanisms for infrastructure projects in high-risk / high-return regions.

2) FMF is working on the development of a transparency initiative in partnership with the International Standards Organization.

- **Talent** is essential for fostering a competitive and sustainable industry. Mining companies still face skill shortages that hinder the development of a robust industry[3].
- Modernizing geological data and collaborating with global **technology** experts can significantly improve data accuracy, attract more investors and enhance global competitiveness.
- Effective **policy** is critical to building institutional capacity in least developed countries and enabling responsible, accelerated mineral development. To support this, a Policy and Intelligence CoE is being established in partnership with the Intergovernmental Forum (IGF), which will provide governments with good-practice tools to review and streamline their regulatory structures.

State of the Sector Survey

To measure progress against the enablers and inform the Barometer, FMF aims to develop a State of the Sector Survey capturing the perspectives of business leaders, investors, and policymakers in the mining industry, specifically from geographies across the Super Region which have traditionally not been covered comprehensively.

The survey will reveal changes over time in stakeholder confidence levels in the factors enabling critical minerals value chain development, as well as deliver structured and authoritative perspectives on key issues. By comparing practices across jurisdictions, it will provide on-the-ground insights into industry performance and regional needs that will be vital input for decision makers from industry, finance and government. By combining rigorous analytics with stakeholder sentiment, the research will empower industry leaders to understand the real issues impacting project development, identify areas of intervention, make informed decisions, foster international collaboration, and drive economic value creation within the Super Region.

FMF aims to publish an annual State of the Sector Survey, to provide a view of how key stakeholders view the industry's development over time.

As a first step, an in-depth stakeholder consultation has been conducted to better understand the current landscape and the perceived preparedness of critical minerals value chains against the six key CMF enablers. Insights from this consultation are found in Section 7 of this report.

3) FMF is supporting the development of a Center of Excellence on Talent in partnership with CSIR.

4. Industry Insights: CEO Perspectives

Each year in Riyadh, the Future Minerals Forum brings together leaders from government, business, multilaterals, NGOs, academia, and trade associations in a government-led, action-focused, and multistakeholder platform. We sought the views of six CEOs who have participated in FMF, on why the Critical Minerals Framework will enable the development of value chains that can supply both local and global needs.

Rio Tinto

Dominic Barton

Chair, Rio Tinto

We are living through one of the most consequential periods in modern history, a true inflection point. The global energy transition and rapid advances in technology are reshaping economies at extraordinary speed. Both of these forces will require much more metals than we have available to supply. But an equally important — and sometimes underestimated — force is the accelerating economic development across the Global South.

Rising urbanization and industrialization in India, ASEAN, Africa, and the Middle East are profoundly increasing demand for materials such as iron ore, copper, aluminium, lithium, nickel, and zinc. For some commodities, these development dynamics are in many cases a more powerful driver of demand than the energy transition itself. More than half of the projected growth in demand for key materials over the next decade is expected to come from emerging economies, reflecting rising incomes and rapid urbanization. In markets such as India and ASEAN, rising steel demand linked to infrastructure and industrial expansion is expected to outpace the contribution of the energy transition alone.

Across these trends, one truth is clear: while the world has ample geological endowment, it does not have enough developed, permitted, and investable mineral supply available in the timeframes required. The bottleneck is not geology; it is the time, complexity, and uncertainty involved in converting resources into producing assets. Across several major commodities — particularly copper, lithium, and iron ore — actual supply build-out has consistently fallen short of earlier projections, reflecting longer project timelines, permitting complexity, and rising capital intensity. How we address the widening gap between geological resources and timely, investable supply will shape the next two decades of our industry — and, given the centrality of minerals to global development, the trajectory of the world economy itself. Geopolitical fragmentation will only deepen this challenge by further restricting supply chains and adding uncertainty to investment and trade.

A Vision for the Next 10–20 Years

Looking ahead, the minerals sector will be central to global development. Countries cannot achieve their economic or industrial ambitions — let alone their energy goals — without reliable access to minerals. While recent focus has been on critical minerals, competition will extend across most commodities.

Meeting demand will require producing more and producing differently. Breakthroughs in exploration, technology-enabled productivity, recycling, and lower-carbon operations will be vital, as will new approaches to land and water stewardship that support stable, sustainable operations.

Equally important is demonstrating that mining can be a long-term partner with society. Mining must create enduring benefits — through employment, capability building, and safe operations, and effective closure and rehabilitation. This is how we reinforce that materials, when managed properly, can underpin lasting prosperity. The combined forces of traditional economic growth, expanding new energy systems, and continuing technological change will shape mineral demand for decades to come.

Three Challenges We Must Confront

First, the supply–demand gap is widening. Project development remains too slow, permitting is complex, and infrastructure and investment are not keeping pace.

Second, societal expectations continue to rise. Communities expect transparency, environmental excellence, and benefits that endure.

Third, geopolitical fragmentation is reshaping mineral supply chains, demanding new forms of cooperation and resilience.

Why Collaboration Matters

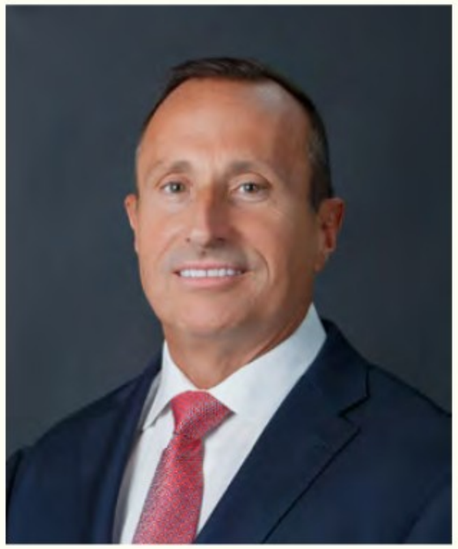
In this context, "together we stand, divided we fall" is not rhetoric — it is reality. No single nation or company can meet global mineral needs alone. Governments must create stable, predictable environments for investment; companies must operate responsibly and innovate; and civil society must help ensure shared value but also not block progress. From the Rio Tinto perspective, deep collaboration across borders, sectors, and communities is essential to delivering the materials the world needs.

The Role of FMF

The Future Minerals Forum has emerged as a critically important global platform, capable of convening this broad coalition. And we are very excited to be part of the Forum and this platform. Its model — with the Future Minerals Barometer as an important component — provides insights into the trends, pressures, and opportunities shaping the global minerals landscape. It is one part of the collective understanding we need to navigate an increasingly complex environment.

The choices we make together now will define not only our industry's future but the trajectory of global development itself.

MAADEN



Bob Wilt

Chief Executive Officer, Maaden

Mining – the tech industry you need to see coming

Mining has always been the foundation of industrial progress. Every empire, every industrial boom, every "next big thing" was built on materials that were dug up from the ground.

And now, with AI supposedly about to change the universe, the story's exactly the same - it all still starts with mining. Copper, lithium, rare earths, and aluminum are the heart of technologies that power our future: batteries, semiconductor and data centers.

Without minerals, AI is just a buzzword with no hardware to run on.

And the world knows it, which is why copper demand is expected to reach approximately 33 million metric tons a year by 2035, and demand for Rare Earth Elements could jump sevenfold by 2040.

We all know, these minerals are not going to magically appear out of thin air. But here's the thing the industry is not talking about: **we are nowhere near ready to deliver what the world needs.** And our biggest challenge isn't equipment, capital or technology - it's people.

We need more people. And we need different people.

For a long time, mining has struggled to attract a new generation of fresh talent – but it has never shaken the stereotypes that continue to plague it: dirty, dark, damaging. This image presents a significant barrier to talent attraction. But the reality is that today's industry looks nothing like that. Today, choosing a career in mining means stepping into one of the most advanced, tech-driven industries on the planet. An industry that needs coders, drone pilots, automation specialists, AI engineers and data scientists.

And it's not just about filling roles. We need people who think differently. Not "dig it up and clock out," but people who understand that the world's future literally depends on the work we do. People who will challenge the status quo - including ours. People who push boundaries, drive new heights of performance and rethink what this industry can become.

To do this, we must get people to think differently about mining.

First – this is not your grandparent's mining industry. Choosing mining means joining one of the world's most technologically advanced industries - driven by sensors, automation, robotics, AI-enabled operations and more acronyms than most tech startups.

Second, this is an industry with explosive growth ahead – not a sunset sector, not a dusty corner of the economy. Mining offers long-term career opportunities, rapid innovation and global mobility. A sector where talent can build meaningful, future-proof careers.

Third, people need to recognize that mining is now a critical pillar of the global technology ecosystem - supplying the minerals that make modern life possible and powering the breakthroughs in energy, computing, mobility and AI that will define the decades ahead. No minerals equals no AI. It really is that simple.

Everyone loves to talk about the future of tech - AI, semiconductors, data centers, the whole show - but none of it works without mining. If the world wants a faster, cleaner, smarter future, it needs aluminum, copper, lithium, rare earths - and an army of people willing to extract them.

Mining isn't a relic; it's the launchpad for everything modern life runs on. We're not a supporting act to the tech industry - we're the industry that keeps the tech industry alive. So, let's use that truth to bring in the talent we need to meet global demand. Because it is not just about what's beneath us; it is about what's ahead of us. And minerals are now the currency of this digital age.

CODELCO

Máximo Pacheco

Chairman, Codelco

Public-Private Strategic Alliances: Key Drivers of the Future of Minerals

As the entire industry foresees, the demand for critical minerals such as copper and lithium is growing significantly and will continue to do so over the next decade, driven by the global energy transition. This makes them strategic resources in a context of intense international competition.

At Codelco —a company 100% owned by the State of Chile, with 54 years of history and the world's largest copper producer since its beginning— we believe this dynamism faces structural challenges: aging and declining ore grades in current deposits; increasing requirements for sustainability and social legitimacy; the growing importance of safety as a fundamental pillar of business sustainability; lengthy permitting processes; investment projects with long construction horizons that will inevitably face volatility and instability; rising engineering complexity, as well as geopolitical and climate risks.

All these factors create a production gap estimated at between 6 and 8 million tons by 2035, which can only be closed through new projects and strategic alliances. This scenario represents an opportunity for efficient producers and companies like ours, which have world-class mineral reserves and a diversified customer portfolio.

From our perspective, the mining sector faces three key trends. First, managing geopolitical risks is essential in this multipolar world, where international tensions and trade fragmentation affect supply flows, price stability, and strategic investment. Trade disputes and low inventory availability introduce uncertainty and volatility, which is why at Codelco we have strengthened our scenario analysis and risk management capabilities to navigate this changing environment.

Second, sustainable development has become an indispensable requirement to maintain social legitimacy and position us as leaders in the energy transition. We have integrated International Council on Mining and Metals (ICMM) principles into our corporate policy and obtained international certifications such as The Copper Mark and the Global Tailings Management Standard. We are advancing specific goals in carbon footprint reduction, sustainable water management, and territorial development with social value, enabling us to access green financing, attract talent, and strengthen investor and community trust.

The third trend is the need for technological breakthroughs and relevant innovations to address aging and deeper mines and respond to the demand for responsible mining. At Codelco, commitments such as full decarbonization with 100% clean energy, the desalination plant under construction in Tocopilla, and development with social value will allow us to remain competitive.

To tackle these challenges, we have firmly committed to developing public-private strategic alliances in copper and lithium projects. These partnerships allow us to share risks, exchange expertise and best practices, optimize resources, minimize environmental impact, and accelerate investment in new productive capacities. What have we done in terms of partnerships? We partnered with Rio Tinto to explore the Nuevo Cobre project and we are evaluating synergies to define a major project in the Potrerillos-San Antonio district, both in Atacama. With BHP, we combined efforts to explore the Anillo project in Antofagasta. We acquired 10% of Quebrada Blanca and partnered with Teck (currently merging with Anglo American). We agreed on a joint mining plan with Anglo American in the Andina-Los Bronces district (the latter mine is operated by Anglo American Sur, where we are partners with Mitsui). We signed an MoU with Kutch Copper Ltd (KCL), a subsidiary of the Indian giant Adani Enterprises Limited, to explore three copper projects near renowned mining districts such as Sierra Gorda and Diego de Almagro. We announced an MoU with Glencore to build a new smelter for Chile. And finally, we acquired a minority stake in I-Pulse, a U.S. company leading in high-power pulsed technology development, aiming to accelerate research and implementation of disruptive solutions to increase mining production.

Meanwhile, as part of the Chilean National Lithium Strategy, we established an alliance with SQM for lithium exploitation in the Salar de Atacama. In Australia, we acquired Lithium Power International, a company with mining concessions and environmental permits in the Salar de Maricunga, where we will add those provided by SQM after signing our partnership, to develop another world-class lithium project with Rio Tinto.

In summary, the industry's major challenges are clear. It is also evident that, to materialize world-class projects, ensure supply and operational continuity, and respond to the sector's global strategic and environmental challenges, we must further strengthen public-private collaboration. At Codelco this enables us to advance our purpose of being a pillar of sustainable development for Chile and the world.

AngloAmerican

Duncan Wanblad

Chief Executive Officer, Anglo American

The world needs so much more copper, which means more processing infrastructure

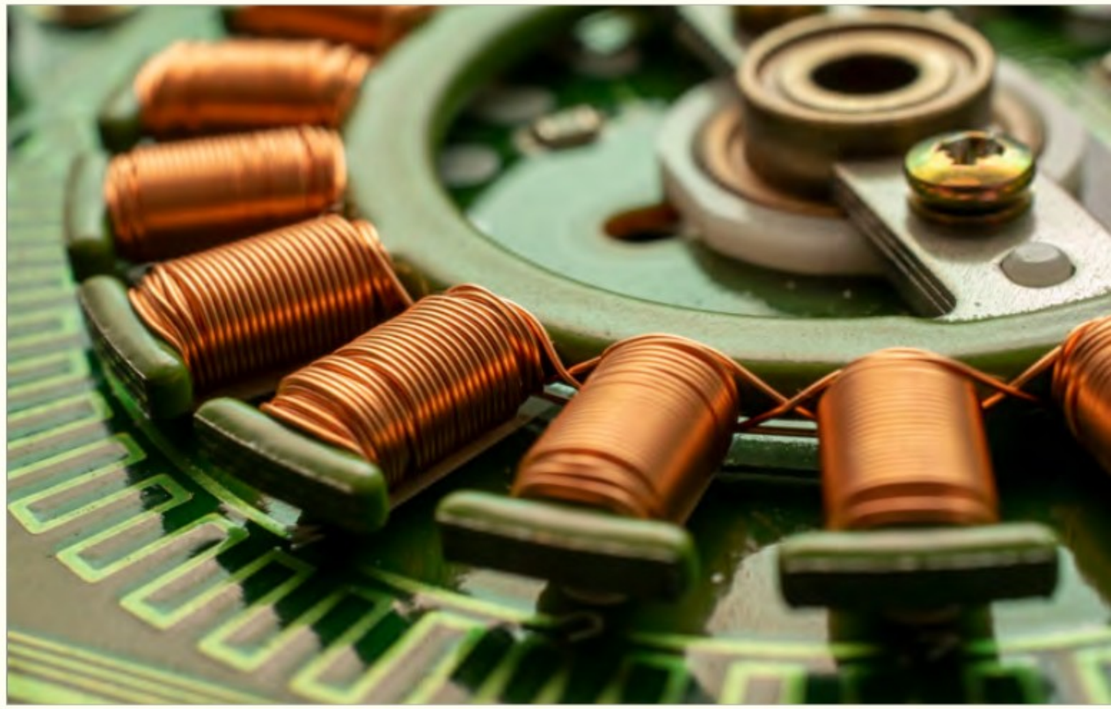
As the world races to decarbonise, including electrifying energy and transport systems, and as many countries progress along their development pathways and others upgrade aging infrastructure, copper is flashing red as one of the world's most critical industrial metals. Global demand for copper is almost universally projected to grow rapidly and the fact is that supply growth isn't keeping pace. Our newest copper mine – Quellaveco in Peru – started up in 2022 and is set to deliver around 300,000 tonnes per annum of copper on average during the first ten years of operation. But to meet growing demand, which industry analysts Woodmac estimate will grow by 75%, to 56 million tonnes per annum by 2050, and to offset the effects of aging, depleting mines that currently supply the world's demand for copper, as an industry we will need to bring ~60 new mines like Quellaveco online over the next decade alone. We just cannot see that happening.

Anglo American has an important role to play – as do others. We currently produce around 3% of the world's copper supply and have around 6% of the world's known copper reserves and resources. As we progress bringing those reserves and resources online, we will go some way to meeting growing global demand. As our industry pedals as fast as it can to bring new supply online – which in itself is far from straightforward, so we will need additional metal processing capacity to avoid a bottleneck in supply.

The world must therefore also invest in more smelters and refineries, which is a similarly complex task with a multitude of economic and other market drivers, as well as the environmental imperative for clean processing. What is clear is that we cannot bring more copper to market in a way in which harms the environment or undermines the mining industry's commitment to sustainable development of the world's vital natural resources. That would be a depressing contradiction.

The interconnected nature of copper supply chains – from miners, smelters and refiners all the way to end-product manufacturers – also underscores the importance of collaboration. A healthy and functioning copper market depends on good working relationships along the value chain, with each link bringing its own contribution to form a successful, sustainable flow of responsibly produced copper. Collaboration is more important than ever, and we welcome the opportunity to work towards solutions in international forums like the Future Minerals Forum.

Building out new midstream capacity is not straightforward. But, for countries which have the right capabilities and ambitions, it also presents a considerable opportunity to capitalise on the next wave of metals-intensive global development. Saudi Arabia is well positioned to capitalise. With an abundance of wind and solar energy and expertise in emerging energy technologies such as hydrogen, Saudi Arabia has the potential to develop a global green metals processing hub. Saudi Arabia's natural advantages, coupled with the policy framework set out under Vision 2030, position the Kingdom well to offer a solution to a global problem, while diversifying the domestic economy. We therefore look forward to continuing to explore opportunities with Saudi Arabia and other partners, building on initiatives like the Critical Minerals Framework, as we work towards maximising the sustainable supply of copper and other essential metals and minerals.



IVANHOE MINES

Robert Friedland

Ivanhoe Mines Founder and Executive Co-Chairman

The mining business is famously cyclical, but today's cycle sits atop a much larger structural wave. Electrifying the world's power systems, digitizing every corner of the economy, and the explosive growth of artificial intelligence are converging into a single, metals-intensive future. The truth is simple: you cannot decarbonize, compute, or transmit without mining.

Resource security has evolved from a technical topic to a boardroom and cabinet-level concern. Nations and companies now recognize that supply chains, which stretch across geopolitics, weather, and permitting regimes, are fragile. They seek long-term, transparent access to responsibly produced materials—copper for wiring and motors, nickel, lithium, manganese, and graphite for batteries, platinum group metals for clean fuels and catalysts, and scandium for 6G wireless technologies and specialty alloys. The winners will be those who secure molecules and atoms with the same seriousness they apply to software and finance.

AI and data centers deserve particular attention. Training large models and serving inference at scale demands huge amounts of reliable electricity—and with it, a surge in the metals that make power generation, cooling, and transmission possible. Every server rack whispers "copper"; every substation and transformer shouts it. As data centers cluster near secure, robust power networks, jurisdictions with clean baseload—hydro, nuclear, geothermal—will become digital-industrial hubs, provided they can offer predictable access to the upstream materials and the skilled people to produce them.

At the same time, the electrification of transport and energy grids is rewiring the global economy. EVs require far more copper than internal combustion vehicles; grids need thicker veins and many more of them; storage must scale with a portfolio of chemistries. "No transition without transmission" is not a slogan—it is an engineering constraint. And transmission, like everything else in this story, begins in the ground.

The sector must answer this demand surge while tightening its environmental and social performance. This means deploying best-in-class water stewardship and energy efficiency, powering mines with renewable and low-carbon energy, and embracing new technologies when it comes to mining and mineral processing. It means reducing waste footprints and implementing smarter milling technologies to conserve electricity and maximize recoveries with a lower environmental footprint. It also means re-mining tailings, boosting recycling where it is truly material, and investing in people and communities for generations, not quarters.

Capital has been another constraint. A decade of underinvestment, lengthy permitting timelines, and rising capital costs have left project pipelines thin. If the world is to have secure and ethical supplies, price signals and contracting models must evolve. Offtakes linked to development capital, prepayments from end users, and policies that reward verified low-carbon production can unlock supply where it is most needed. Automakers, tech companies, utilities, and governments must become true partners—sharing risk, reward, and accountability.

We are profoundly optimistic. Geology has not run out of high-quality deposits; human ingenuity has not run out of improvements. What we are building is an energy- and information-based civilization whose lifeblood is metals. The sooner we treat resource security as foundational infrastructure—and collaborate across borders and disciplines—the faster we can deliver abundant, clean power and intelligent machines to everyone. The future will be electrified, computed, and, above all, mined.

VALE

Gustavo Pimenta

Chief Executive Officer, Vale

From challenge to opportunity: climate action and the future of mining

We live in an unequivocally complex world. Although increasingly integrated due to trade and communication flows, paradoxically it is also fragmented. Humanity is facing one of its biggest challenges: climate change and its harmful effects on people and the environment. Changing the course of these events is crucial and requires deliberate and sustained efforts.

Looking at this bold mission, it is essential that society actors act together in formulating effective strategies to fight climate change. I am confident that times of great challenges open room for opportunities and for new innovative solutions to thrive. This is relevant across various industries, including the mining sector.

I cannot imagine the future without mining – at least not one that is sustainable, combining economic development with environmental preservation and social responsibility. Mining is essential to everything. From Artificial Intelligence processing units to electric car batteries, wind turbine towers or even everyday devices such as cell phones; they all require strategic and critical minerals.

This key role of mining will only further increase as we globally advance towards an energy transition agenda. The future of the sector is understanding its imperativeness to decarbonization, which is not only an investment option, but a strategic opportunity.

For Vale, decarbonization is our business. We invest in technologies such as the briquette, which enables our steel customers to reduce CO_2 emissions in steel production by up to 10%. We are committed to being part of the solution, developing viable paths to a low-carbon economy.

To achieve tangible results and meaningful change in this journey, the keyword is collaboration. Vale was the first mining company to publicly disclose Scope 3 goals, driving the development of customized solutions that support our clients in their decarbonization pathway.

However, an analysis of the global momentum indicates that the challenge to ensure competitive prices without compromising sustainability remains. Economic and fiscal pressures in the international scenario affect the demand for low-carbon solutions. Sectors such as steel, cement, and aviation — which are energy-intensive and fundamental to the economy — also face significant technical and economic challenges to their transition.

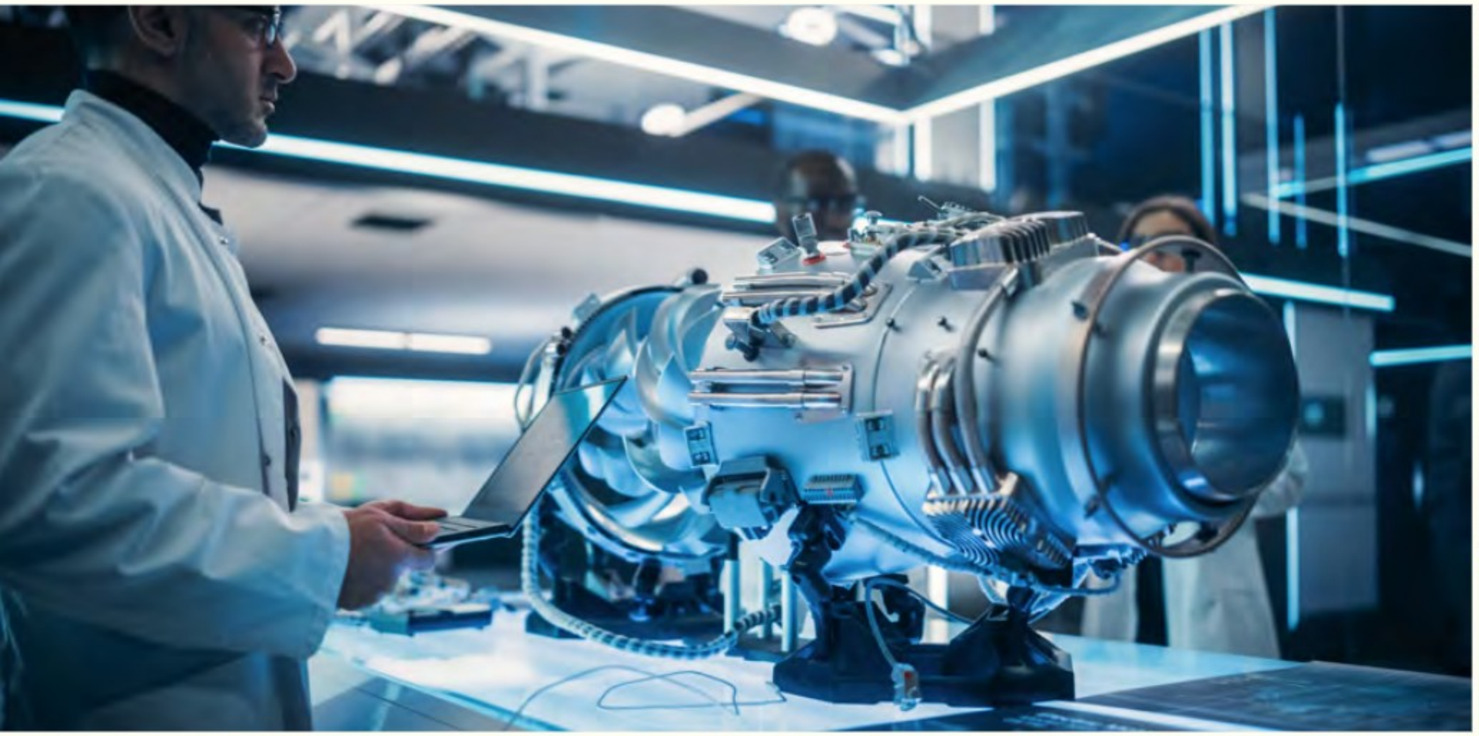
Partnerships and cooperation between international players are essential for the industry to move decarbonization from intent to implementation. On the long term, we believe that green products will become more efficient, and over time, scale will drive competitiveness. Understanding the complexity of the challenge now and investing in solutions that combine economic viability, scale, and environmental impact is pivotal for the success of this transition towards a more sustainable world.

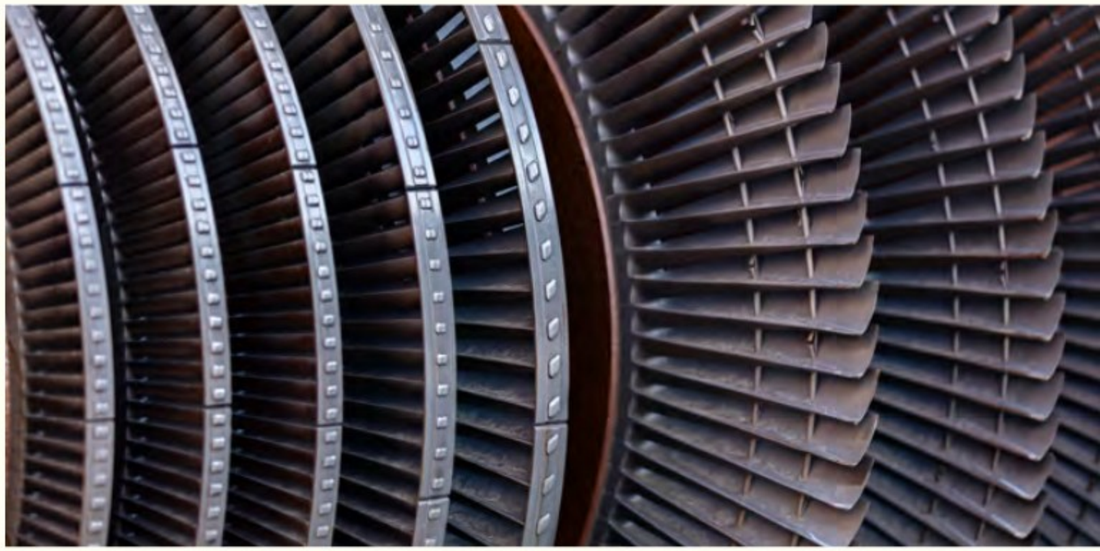
Considering all these factors, I believe the mining sector should remain committed to global decarbonization. As challenging as it is to combine short-term and long-term strategies in the business, we cannot be limited to responding to the current market conditions only, but also make efforts to actively build transformative solutions with a shared vision of the future.

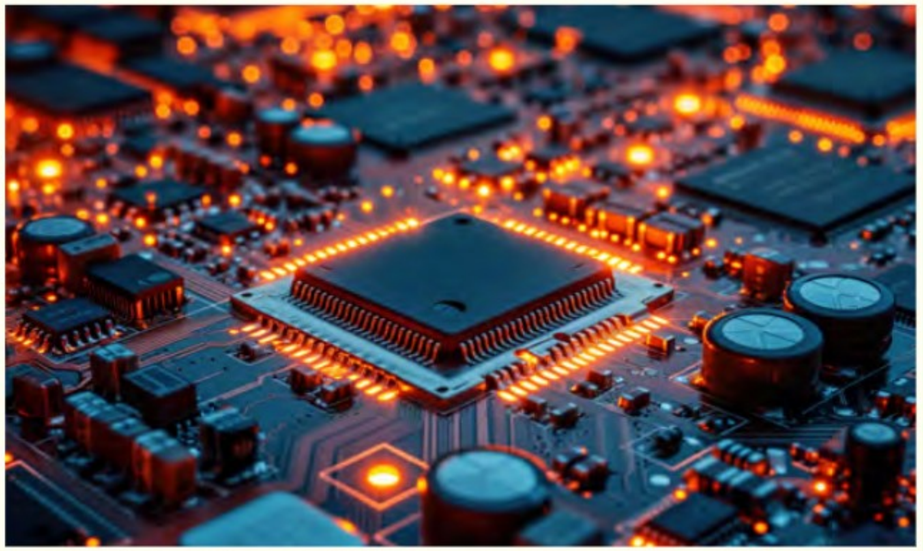
The path towards decarbonization is clear. Nevertheless, to be realistic about global context is crucial to open space for complementary approaches: investments in climate adaptation, community resilience, and new fields of knowledge, such as geoengineering, which are still under development but could be part of the global response. It is a matter of expanding the range of viable solutions without ever losing focus on decarbonization.

As the purpose remains, it is necessary to build a trusting relationship with stakeholders, including investors, ensuring alignment around common goals. Open dialogue between governments, industry and society is pivotal to progress on decarbonization projects while maintaining financial viability, strengthening the technological and economic foundation on which this transformation will take place.

The energy transition is irreversible because climate change remains the greatest challenge of our generation. We will tackle this challenge with ambition and realism, and with the conviction that there is only one path: that of sustainable progress, led by cooperation and dialogue between governments, businesses, and society. Together





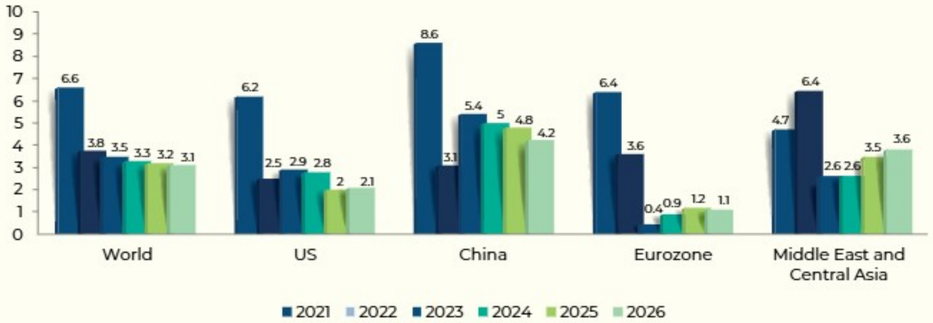


5. State of the Sector: Minerals, the New Global Priority

Authored by:
McKinsey & Company & S&P Global & GlobalAi

5.A. Macro Perspective

GDP outlook, %



The world economy is projected to grow by 3.1% in 2026, down from 4.1% average growth during 2021-2025. The weakening of global growth is largely due to expected slowdown in the United States and China – the two largest economies accounting for more than 40% of the world output. The **US economy** is **expected to grow by 2.1 % in 2026, down from 2.8% in 2024**, while **China's GDP** is expected to **grow by only 4.2% in 2026**, **falling from 5% in 2024**. Growth in the **Eurozone countries** will remain **subdued**, slightly improving from **0.9% in 2024 to 1.1% in 2026** (IMF, October 2025).

The **economies in Sub-Saharan Africa, Middle East and Central Asia** – encompassing the FMF Super Region – are projected to experience **significant improvement in their growth outlook**, with **growth in Middle East and Central Asia** forecasted to **increase from 2.6% in 2024 to 3.8% in 2026**, supported by more than **11.5% projected increases in non-oil commodity prices during 2024-2026** amid rising geopolitical tensions and supply chain disruptions (IMF, October 2025).

Global headline inflation is projected to fall, although inflation expectations in the United States remained elevated at 2.6% for 2026, above the 2% inflation target of the Federal Reserve (Federal Reserve, September 2025). Consumer spending in all major developed economies is expected to moderate in 2026 due to lingering inflationary pressures, tariff related uncertainties, weakening labor market conditions and growing household debt. In the US, consumer spending on durable goods decelerated, while fixed investments – especially in data centers and energy infrastructure – registered double-digit growth during the first half of 2025, pushing up demand for base metals and many critical minerals. Prices of iron ore, aluminum and copper trended upward in 2025, reflecting strong demand for these base metals across various sectors. The value of US dollar fell by nearly 10% in 2025, marking its biggest decline in half a century, contributing to higher commodity prices, as most commodities are priced in US dollars.

The near-term global economic outlook faces lingering uncertainty and significant downside risks. Widely anticipated interest rate cuts by Federal Reserve in 2026 is expected to provide some tailwind to the growth outlook. Lower interest rates and falling sovereign spreads are expected to increase capital flows into, and investments in, the developing regions of the world, including in the countries within the Super Region defined by FMF.

5.B. Five major themes are driving the critical minerals sector in 2026

Five major themes are shaping the global critical minerals sector: a move from global to local supply chains; the dual energy & digital transition and defense; the rise of critical raw material (CRM) industries; importance of Chinese investments in conversion capacity; and increased intervention of governments in the critical minerals sector. These themes – particularly the growing demand segments and importance of critical raw materials – reflect the evolving geopolitical, economic, societal, and technological landscape.

1. From global to local supply chains

Context:

Several governments are taking steps towards regionalization and localization, with countries and regions prioritizing local supply chains and reducing reliance on global trade networks. This trend is driven by geopolitical tensions, trade wars, and the need for supply chain resilience in a context of supply concentration in a handful of countries.

Implications for minerals:

- **Supply concentration in a few countries has led to disruptive policies aimed at protecting local industries and reducing dependency on external suppliers.**
- The EU's Critical Raw Materials Act exemplifies this trend, as it seeks to secure critical material supply chains and reduce reliance on external sources. Since 2023, China has restricted the export of certain minerals by imposing export control measures.
- Regionalization may lead to fragmented markets, where countries or blocs prioritize self-sufficiency and alliances over global cooperation.

65%
single-country dependency[4]

4) The goal is to ensure that no more than %65 of the EU›s annual consumption of any single strategic raw material at any stage of processing comes from a single third (non-EU) country by 2030

2. Dual Energy & Digital Transition and Defense

Context:

The global shift toward renewable energy and electrification is a key driver of demand for critical minerals. Technologies such as solar photovoltaics (PV), wind turbines, and electric vehicles (EVs) require significant amounts of materials such as lithium, nickel, and rare earth elements. The digital transition also relies on minerals, for instance, to meet the demands of data centers and their energy consumption. Additionally, defense budgets are rising in some regions, driving demand for certain strategic materials.

Key Drivers:

- **Renewable energy capacity has grown exponentially, with global installed capacity for offshore wind, onshore wind, and solar PV increasing by 75% from 2543 GW in 2019 to 4448 GW in 2024.**
- **Renewable energy costs declined by 70-90% between 2010 and 2021, making clean energy more economically viable.**
- **Data center capacity increased by 254% between 2020 and 2024 from 34.5 GW to 122 GW.**
- **By 2030, the demand for critical minerals is expected to grow by 250%, according to the International Energy Agency's (IEA) Net Zero Emissions (NZE) scenario.**

x1.7
increase renewables capacity

Challenges:

- Although the energy transition is moving forward, there is a shift in technology adoption favoring cost-effective solutions, while "out-of-the money" technologies are being delayed.
- There is a risk that supply will fall short of demand, particularly for minerals essential to the energy transition, especially when considering committed supply project pipelines only.
- Commodity price volatility and insufficient mining investment may hinder ability to meet future demand.

3. The Rise of CRM Industries

Context:

Critical raw materials (CRM) are becoming the focus of materials producers, with a marked increase in portfolio configurations around critical materials. Industries focused on critical raw materials are expanding rapidly to meet the growing demand from growing end-use applications.

Key Developments:

- The production of critical materials such as copper, lithium, nickel, cobalt and graphite grew by as much as 20% between 2023 and 2024, supported by the rise in EV production especially in China, and highlighting an increasing reliance on CRMs.
- The supply of energy transition materials, such as lithium and nickel, is scaling faster than expected, driven by technological innovation and increased investment.

Up to 20%
increase in critical raw materials production in 2024

Uncertainties:

- Technological advances, particularly in battery and magnet materials, are creating uncertainty in demand outlooks, as new technologies may alter the need for certain critical raw materials.

4. Importance of Chinese investments in Conversion Capacity

Context:

China has played a significant role in the global minerals sector, driven by years of strategic investment and development of refining and processing capacity. This has been supported by long-term planning aimed at ensuring access to supply chains critical for its industrialization.

Key Trends:

- Chinese investors have significantly increased ownership in global refining assets – particularly in copper, lithium, cobalt, manganese, graphite, rare earths and nickel – between 2019 and 2024.
- By 2024, China's renewable energy capacity had reached approximately 1.89 TW, accounting for 56% of its total power generation, further driving its demand for CRMs.

>45%
share of global refined production of EV materials in China

Implications:

- China's investments in conversion capacity strengthen its position as a global leader in the minerals value chain but also raise concerns about supply chain concentration and dependency. With the growing demand for CRMs and greater focus on supply chain resilience, there will be more diversification of processing capacity in the coming years. This presents an opportunity for the Critical Minerals Framework to be put to use.

5. Increased Intervention of Governments in the Minerals Sector

Context:

Some governments worldwide are taking a more active role in securing critical mineral supply chains, driven by the strategic importance of these materials to energy security and economic growth.

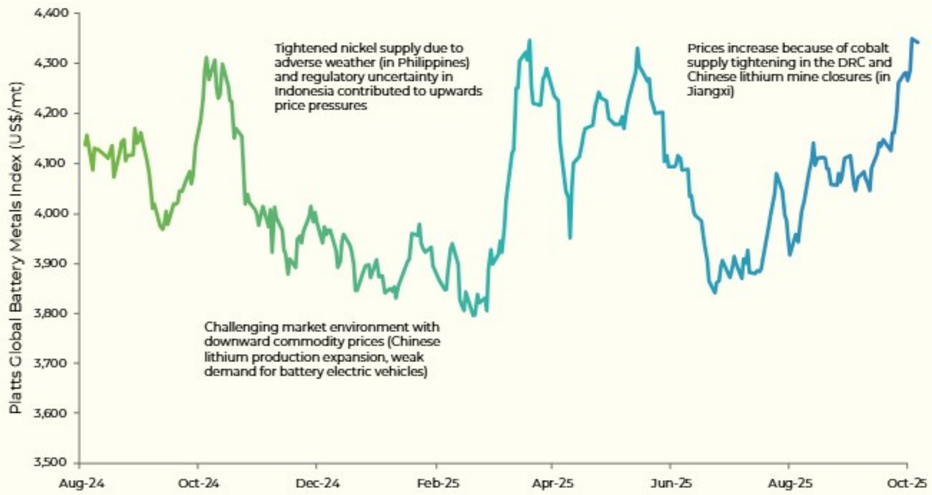
Examples of Intervention:

- The EU's Critical Raw Materials Act is a direct response to the need for secure and sustainable supply chains.
- Japan's 2023 Policy for Securing Stable Supply of Critical Minerals sets specific procurement targets for minerals like lithium, nickel, and graphite for 2030, supporting domestic production of batteries and permanent magnets.
- Specific policies in countries with concentrated supply, aim to protect local industries and ensure resource availability for domestic use or local value addition. Zimbabwe's Base Minerals Export Control Order of January 2023 limits the export of unbeneficiated base minerals like lithium ore, nickel, and manganese, aiming to foster local processing and value addition.

Challenges:

- Government interventions can lead to market distortions, such as trade restrictions or export bans, which may exacerbate supply chain vulnerabilities.
- Balancing national interests with global cooperation remains a significant challenge in the minerals sector.

5.C. Critical mineral index (Platts Global Battery Metals index)



China continues to dominate global electric vehicle growth, accounting for 78.6% of combined top market growth with 1.1 million passenger plug-in electric vehicles (PEV) sold in August 2025, while all major markets achieved record-high penetration rates despite intense price competition among Chinese manufacturers effecting profitability.

In late 2024, battery metals markets experienced significant oversupply conditions. Battery-grade lithium carbonate prices declined to $10,200/mt CIF North Asia in October 2024, marking a 32% decrease from the start of the year. Nickel prices halved versus early 2023 levels, primarily due to increased Indonesian supply. Cobalt prices also declined through mid-2024 as EV demand and battery chemical demand remained below expectations.

Market dynamics shifted due to changes in battery technology preferences. Lithium iron phosphate (LFP) batteries increased their market share from 41% in 2023 to 50% in 2024, while NMC batteries decreased in market share. This transition reduced demand for nickel and cobalt. Additionally, automakers adjusted their EV strategies due to lower sales and reduced subsidies in North America and Europe.

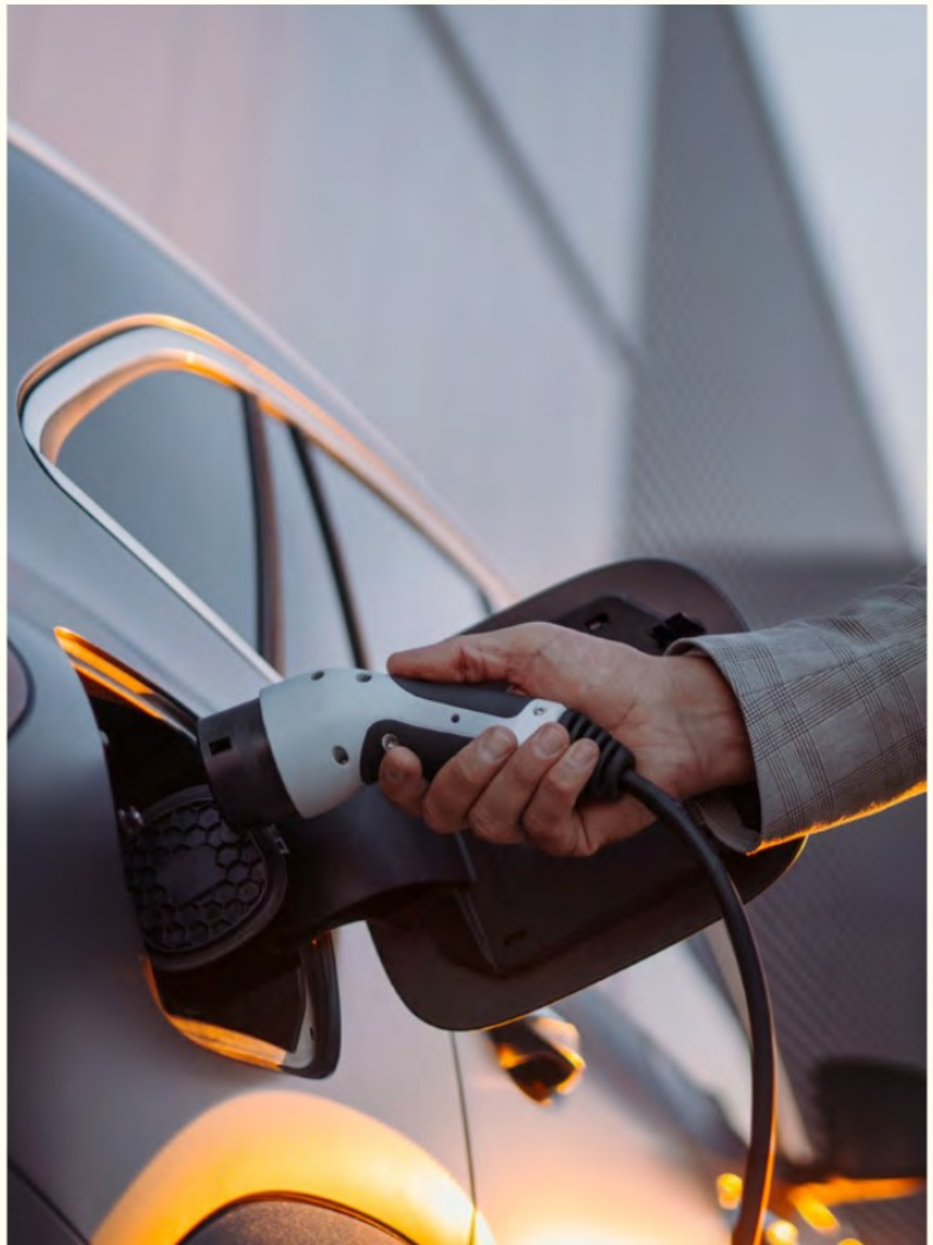
In August 2025, supply disruptions in China, including the closure of CATL's Jianxiawo mine and regulatory changes, caused a temporary increase in lithium prices. Lithium carbonate futures reached an eight-month high in China during this period. Cobalt prices increased in early 2025 due to supply constraints caused by the Democratic Republic of Congo's export ban and quota system. Nickel prices remained stable but low due to Indonesian supply dominance and continued oversupply conditions.

By September 2025, lithium prices decreased as supply issues were expected to resolve. Cobalt prices stabilized at higher levels, particularly in Europe, due to ongoing supply constraints. Nickel prices continued to face downward pressure, with Indonesia accounting for 60% of global supply.

S&P Global Platts Global Battery Metals Index represents a global price of Platts' key physical assessments of battery metals, used in electric vehicle production. The weighting of commodities represents the average NMC811 battery used for commercial electric vehicle manufacturing.

Index methodology:

https://www.spglobal.com/commodity-insights/en/pricing-benchmarks/our-methodology/subscriber-notes/092925-platts-to-launch-global-battery-metals-index-oct-1-2025



5.D. M&A activity eased in 2025 as tariff uncertainty unsettled dealmaking — until the Latin America-focused Anglo-Teck megamerger

Major deals in Latin America and Africa focused on critical minerals: copper, cobalt, lithium and PGMs

M&A Activity
Deal Value ($B), number of transactions labelled

Fuelled by the Anglo American-Teck merger, Latin America- and Africa-focused M&A activity experienced robust growth through the first nine months of 2025, with the two regions' deal value surging past $30 billion, accounting for three-quarters of the global share. Major producers are driven to secure resources for operational continuity and synergies while supply chain risks fuel the expansion of smaller players into new jurisdictions, especially where geology has potential for critical mineral deposits. The result has been a rapid growth of known mineral hubs with vast resources and the creation of new critical mineral hubs; however, this positive trend is driven by a few blockbuster deals masking a **slowing market that is shifting investments to perceived safer jurisdictions, and benefitting Latin America at the expense of Africa.**

$30B
M&A in Q1-3 2025

74%
in Latin America

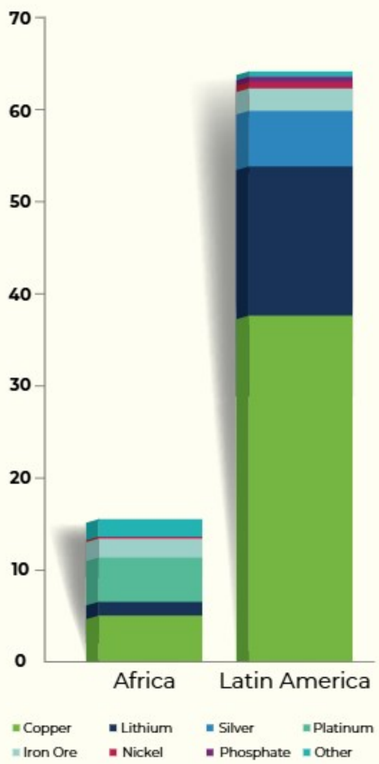
New mining markets

The continued rise in demand for lithium-ion batteries as an enabler for the energy transition set the course for a series of major consolidation deals in Argentina, passing $15 billion over the past six years, and spurring $1.5 billion of deals in lithium projects across Central and West Africa from Chinese players. Southern and East Africa have meanwhile benefited from demand for non-China supply of graphite and rare earth elements, attracting $1.7 billion from international players headquartered outside the rare earth powerhouse.

Unsurprisingly, copper activity was dominated by majors consolidating resources in Chile, totaling $31 billion in 6 years, but the prospect of developing large discoveries in Argentina, supported by an improving investment environment, attracted over $4.7 billion. In Africa, Australia-listed, Chinese-owned miner, MMG, which already had operations in DRC, put Botswana copper on the map in 2023 with a $2.3 billion acquisition. The potential for new copper discoveries has attracted deals for exploration assets in Namibia and Morocco, for example. Major copper hubs DRC and Zambia, the focus of $2.6 billion in deals in 2020–21, have seen a major pullback in transactions since the start of 2024, however, reflecting Chinese buyers that have pared back efforts in recent years — a void that other players have not backfilled amid perceived higher levels of above-ground risk.

The big picture

Africa vs. Latin America Deal Value
US$ Billion



Global M&A deal value has risen nearly 50% since 2021, yet the number of deals has halved, indicating a slowing market dominated by the majors consolidating. There has been a dramatic shift in regional distribution, with Latin America becoming the hotspot, achieving 74% of global announced deal value in 2025 by the end of the September quarter. In the past five years, Latin America deal value grew over 200%, with over 50% associated with three major blockbuster deals in the past two years. This is in stark contrast to deal value in Africa, which fell 79% in the past five years, and the rest of the world, which fell 9%.

Unpacking the reasons behind this direction of deal flow is layered with regional differences, ranging from infrastructure to mining legislation. Fundamentally, however, it is the perceived risks that miners consider when allocating capital. Africa is rich in resources but struggles to compete with the stability available in mineral-rich states of Latin America.

200%
Latin America

-79%
Africa

Deal Value since 2021

The blockbuster deals

The past two years have been defined by three massive transactions considered Latin America-focused, even though they involve resources from around the world.

2025

The Anglo American – Teck merger announced in the September quarter stands out at $24.3 billion (80% of the year's total), centered on Chilean and Peruvian copper assets and infrastructure synergies.

2024

Rio Tinto's $8.15 billion Arcadium Lithium acquisition and BHP's $2.8 billion Filo copper purchase (both in Argentina) together represented 63% of that year's value.

The story of Arcadium Lithium itself tells a tale of consolidation — formed just a year earlier from the $2.9 billion merger of US-based Livent Corp. and Australia's Allkem (which itself was created through a $1.8 billion merger in 2021).

The volatile metal rush

Copper remains king, representing 25% of all global deals over the past five years and over 43% of deal value; within the region of Africa and Latin America, this rises to 33% of deals and 50% deal value. The lithium M&A boom represents 14% of global deal value and 22% within the two regions, peaking in 2024 before collapsing in 2025 as oversupply engulfed the market. Silver deals in Latin America and Africa grew in activity in the past two years, along with iron ore and other ferrous alloys such as chromite and manganese. Meanwhile, smaller critical mineral markets such as tin, rare earths, graphite, niobium, uranium, ilmenite, rutile and zircon have seen few but significant deals. After a two-year lull, activity in Brazil has rebounded in 2025, driven by deals ranging from base metals and phosphate to rare earths and critical minerals.

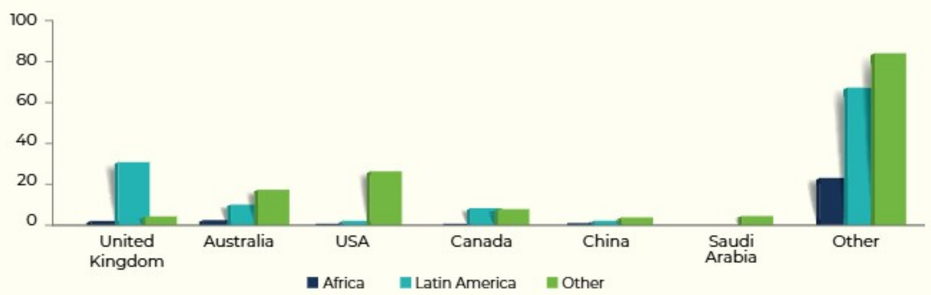
Critical minerals have the potential to drive Africa forward

Companies based in the Organisation for Economic Co-operation and Development (OECD) member states have been active in the past five years, with over two-thirds of the $157 billion global deal value, almost entirely focused on the Americas. South Africa has benefited greatly in recent years and is attracting new investment from Turkey and US, countries that have typically invested locally. In contrast, Africa attracted less than 4% of OECD investment, and primary international buyers — China, UK and Australia — have pulled out in recent years. Local deals funded from South Africa and Zambia have also steeply declined since 2021.

Africa contributed close to one-third of global deal value back in 2021, driven initially by South African PGM deals before weakening markets deterred investment, followed by the short-lived lithium boom, and now the continent accounts for under 5%. There are positive signs, however, as 2025 has seen increased activity from UK companies, and even new international buyers with United Arab Emirates-listed Alpha Mining acquiring tin assets in DRC. The global critical minerals supply race has shifted the dynamic, and Africa is expected to benefit. Already Tanzania has generated major interest from players for its graphite and rare earths resources, as has Malawi for uranium and rare earths, and South Africa for ilmenite and zircon.

The mining M&A landscape tells a story of strategic consolidation, with companies betting big on the minerals that will power our future — and increasingly looking to Latin America to find them. Africa has lost the race in recent years and has an upward struggle to capture interest from a slowing market but still has potential, with vast areas of unexplored land, rich in critical minerals.

M&A Deal - Buyer Country
US$ Billion



5.E. Latin America and Africa accounted for 38% of exploration budget in 2025, with growing activity in Africa

Recent drilling activity in the regions provides a positive outlook for exploration

Exploration Spend (excluding Gold)
US$ Billion

Drilling activity monitor
Number of significant drill results

Exploration spending and drilling activity serve as crucial indicators of the health and outlook for the mining industry. These metrics not only reflect current market confidence but also embody the industry's commitment to future production and growth. High exploration spending typically signals strong commodity prices and positive market sentiment, while increased drilling activity suggests companies are actively pursuing new resources to replace depleting reserves. Together, these indicators help forecast future mineral supply and provide insights into the sector's long-term sustainability.

The global mining exploration sector is showing signs of moderation following a period of robust activity earlier in the year. After reaching peak levels in July 2025, exploration activity has entered a cooling phase, with the S&P Global Market Intelligence Pipeline Activity Index declining in August. This shift suggests a more cautious approach from mining companies as they navigate market uncertainties.

23%
Latin America

27%
Africa

Increase in exploration budgets since 2021

Despite this recent moderation, the sector's fundamentals remain relatively strong. Market capitalization across the mining industry continues to trend upward, and exploration financing remains at historically healthy levels, despite having retreated from recent peaks. The industry has maintained steady drilling activities, although companies appear to be focusing more on enhancing productivity within existing projects than pursuing new ventures.

In Latin America, exploration budgets have risen 23% since 2021, and Brazil remains a bright spot for exploration activity. The success of projects like Altamira Gold's Cajueiro demonstrates the region's ongoing potential for significant discoveries. Exploration budgets targeting Africa have risen more than any other region since 2021, up 27%. West Africa has maintained its position as a key exploration frontier, particularly in Burkina Faso, where recent project developments have shown promising results despite regional challenges.

Looking ahead, the sector appears to be transitioning from the aggressive growth seen in early 2025 to a more measured approach. This strategic shift suggests a maturing market that prioritizes sustainable growth over short-term gains.

5.F. Critical Minerals Demand Perspective

Role of Critical Minerals

Critical minerals have become increasingly vital to global economic and strategic priorities, especially as the world accelerates its shift toward low-carbon energy systems. These minerals – including lithium, cobalt, nickel, copper, high-purity manganese, silicon, and rare earth elements (REEs) – are essential for producing electric vehicles (EVs), renewable energy technologies like wind turbines and solar panels, and advanced battery storage solutions.

As nations strive to achieve climate targets and transition away from carbon-intensive energy sources, demand for these minerals is projected to rise significantly. By 2030, battery electric vehicles and their related infrastructure are expected to represent around 40% of global rare earth element consumption[11]. Additionally, the ongoing digital transformation will further increase material requirements.

The increasing reliance on critical minerals poses several challenges due to the concentration of supply chains in a limited number of countries. This has prompted many nations to localize production and strengthen their supply chains. Such concentration exposes global supply networks to geopolitical risk and price volatility, but also offers opportunities to diversify supply through innovation, recycling, and expanded sourcing strategies.

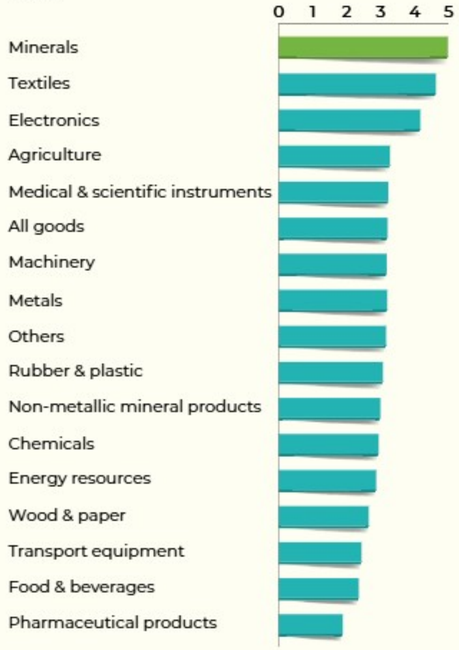
The war in Ukraine has driven shifts in energy strategies aimed at ensuring reliable access and diversifying sources. Countries are prioritizing energy security, as demonstrated by Germany's temporary reactivation of some coal plants to address energy supply shortages and concerns during the energy crisis.

Protectionism and Trade Restrictions

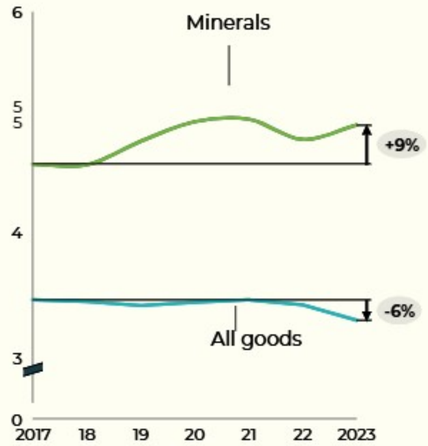
Increasingly, some nations are implementing protectionist measures and trade controls to protect their critical mineral resources. This trend could accelerate global fragmentation, as countries focus on self-sufficiency and strategic alliances rather than broader international cooperation.

An analysis by McKinsey Global Institute suggests that the average "geopolitical distance" of trade in minerals is considerably higher than trade in other sectors. This means that minerals are more likely to be traded between economies – like iron ore from Australia to China, or nickel from Russia to Europe. We now see evidence of some countries investing to manage these dependencies. Announced greenfield Foreign direct investments (FDI) into minerals has increased since the pre-pandemic period, and the geopolitical distance of announced mineral investment is lower than the current mineral trade lanes of today. This means that in some cases some more proximate corridors could be formed. Nonetheless, many of these investments continue to cross wide geopolitical distances – from Chinese investment in Europe and Latin America to Canadian investment in the Democratic Republic of Congo.

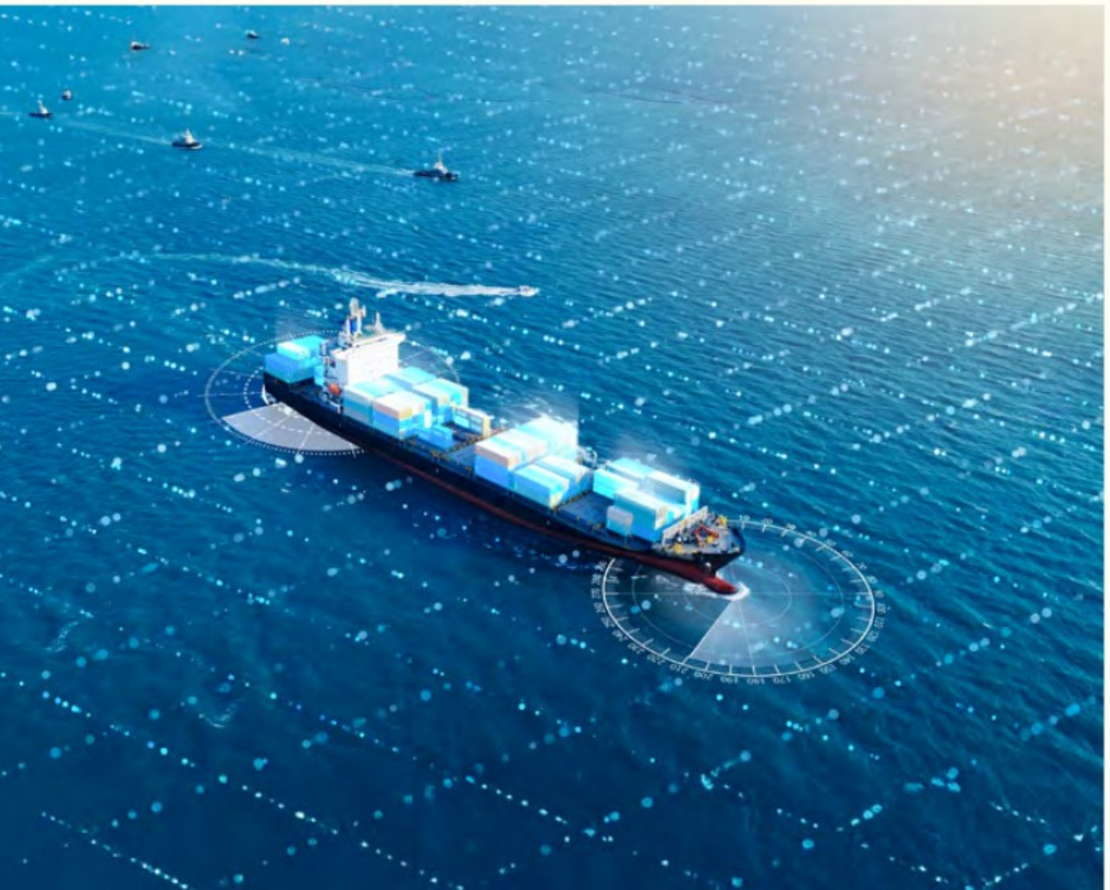
Average geopolitical distance of trade, 0–10 scale



Average geopolitical distance of trade[1], 0–10 scale



Source: UN Comtrade, Voeten (2017) and UN Digital Library; McKinsey Global Institute analysis



Four Drivers of Critical Minerals Demand

As the global economy transitions towards a more electrified, and strategically complex future, four key drivers are set to significantly reshape the demand landscape for critical minerals in the mid- to long-term:

1. Population Growth & Emerging Demand

A growing global population – expected to near 10 billion by 2050 – is fueling demand for housing, transportation, and energy, all reliant on key raw materials

"By 2050, the global population will grow by 25%, reaching 10bn, with the vast majority living in urban centers"

~Mike Henry, CEO BHP

+1.5 billion people between 2024 and 2050

2. Electric Mobility Powering the Future

The rapid adoption of EVs is accelerating demand for battery materials like lithium, cobalt, and nickel, reshaping supply chains and innovation

"The clean-energy transition to arrest global warming is based on increasing the use of critical minerals"

~Neal Froneman, Former CEO

+3.6 million EVs between 2023 and 2024

3. AI, Data & Advanced Technologies

The rise of AI, data centers, and machine learning infrastructure is creating new, mineral-intensive tech ecosystems with unique supply needs

"The world is excited about AI... and all of it... is going to need energy, is going to need copper. We should be investing in our futures"

~Caitlin Jeffs, CEO Red Metal Resources

+153 GW data centers between 2024 and 2030

4. Security & Defense in a Changing World

Geopolitical tensions and rising military investments are increasing the strategic value of critical minerals in defense and aerospace applications

"Critical defense systems rely on refined rare earths, but the U.S. lacks domestic refining. Instead of copying China's model, we must innovate our own to ensure national security"

~Mark Jensen, CEO of ReElement Technologies

+275 billion $ global defense spending between 2023 and 2024

1. A growing population largely located in the Super Region

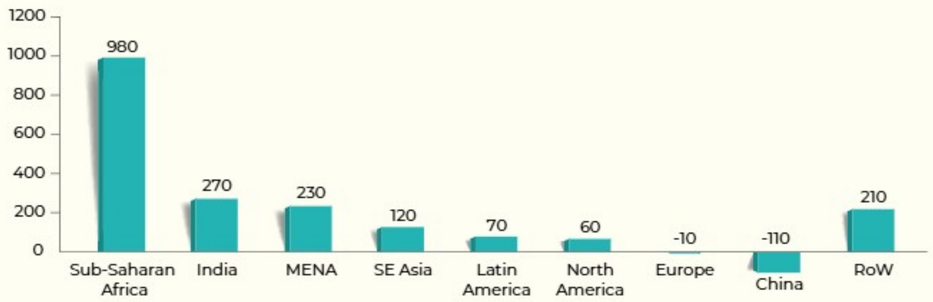
Population Growth and Middle Class

The global population reached 8.2 billion in 2024 and is projected to approach 9.2 billion by early 2040, according to the United Nations.

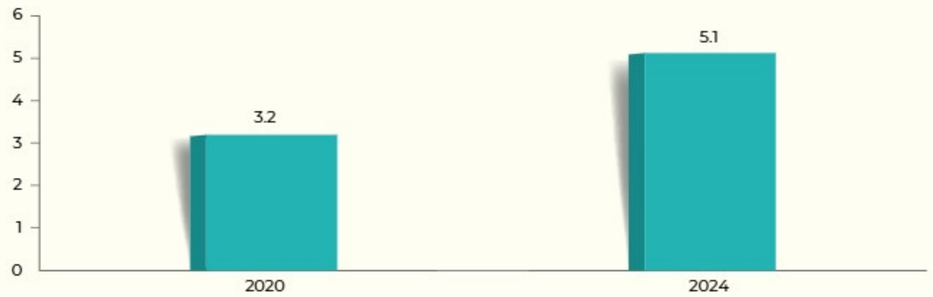
A substantial portion of this growth will occur between 2030-40, predominantly concentrated in the Super Region – notably in Sub-Saharan Africa and Southeast Asia. These regions are expected to see not only population increases but also accelerating rates of urbanization and middle-class expansion.

This demographic shift is set to drive significant demand across multiple sectors – housing, transportation, energy, and consumer goods – all of which are highly dependent on raw materials.

Projected population increase 2020-2050, million people



Projected size of middle class 2020 vs 2040, billion people



Source: IHS Markit

2. Electrification and Digitalization are driving short-term materials demand

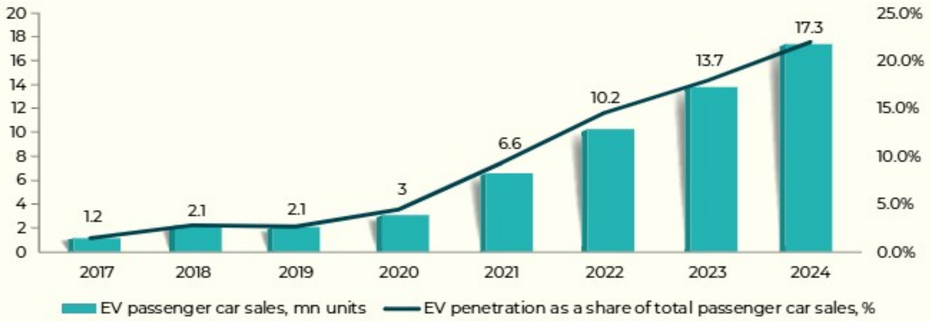
Critical Minerals: Powering the Future of Electric Mobility

Critical minerals such as lithium, cobalt, and nickel are foundational to the rapid growth of the electric vehicle market, serving as indispensable inputs for advanced battery technologies. These materials enable key performance improvements—such as longer ranges, faster charging, and enhanced energy density—that are driving the global adoption of EVs.

With electric vehicles projected to account for over 50% of new vehicle sales by 2030, demand for critical minerals is expected to rise exponentially. This surge is fundamentally reshaping global supply chains, particularly for materials historically consumed in low volumes, such as lithium, high-purity manganese, and rare earth elements. As governments and corporations prioritize securing access to these strategic resources, finding stable supply sources is critical to avoid supply disruptions and price volatility.

To address these challenges, stakeholders are advancing a range of innovative solutions, including scaling recycling capabilities, diversifying sourcing strategies, and investing in next-generation battery chemistries. These efforts are not only essential to ensuring the resilience and sustainability of mineral supply chains, but also pivotal to enabling the continued expansion of the EV market and achieving global decarbonization goals.

EV penetration as a share of total passenger car sales



Source: International Energy Agency (IEA)

3. Digital transition

The rapid proliferation of artificial intelligence (AI), machine learning (ML), and advanced visualization technologies are fundamentally reshaping global demand for critical minerals. As the backbone of this digital transformation, data centers and AI infrastructure are placing pressure on global mineral supply chains due to substantial power requirements and their material-intensive construction.

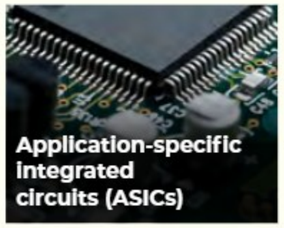
Power transformers and upgraded electricity grids – core components of AI infrastructure – are especially minerals-intensive, with key materials representing the majority of their production costs. The shift toward digitalization is driving up demand for high-performance materials used in power distribution, computing, and cooling systems, such as copper, silicon, aluminum and rare earths.

AI applications, particularly those involving deep-learning, large language models, and real-time data processing, require vast computational power. This demand is met by specialized hardware including:

AI is more than a software revolution – it's a hardware- and resource-driven transformation. Executives must therefore recognize that sustained deployment of AI and digital infrastructure will depend on the long-term availability of secure, diversified, and resilient critical mineral supply chains.

Global data center demand is projected to reach ~219 GW by 2030, growing at ~22% p.a.

Si Silicon 28.085 · Ta Tantalum 180.947 · Ge Germanium 72.63 · Cu Copper 63.55 · Nd Neodymium 144.24



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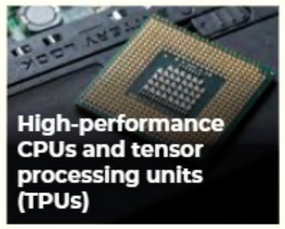
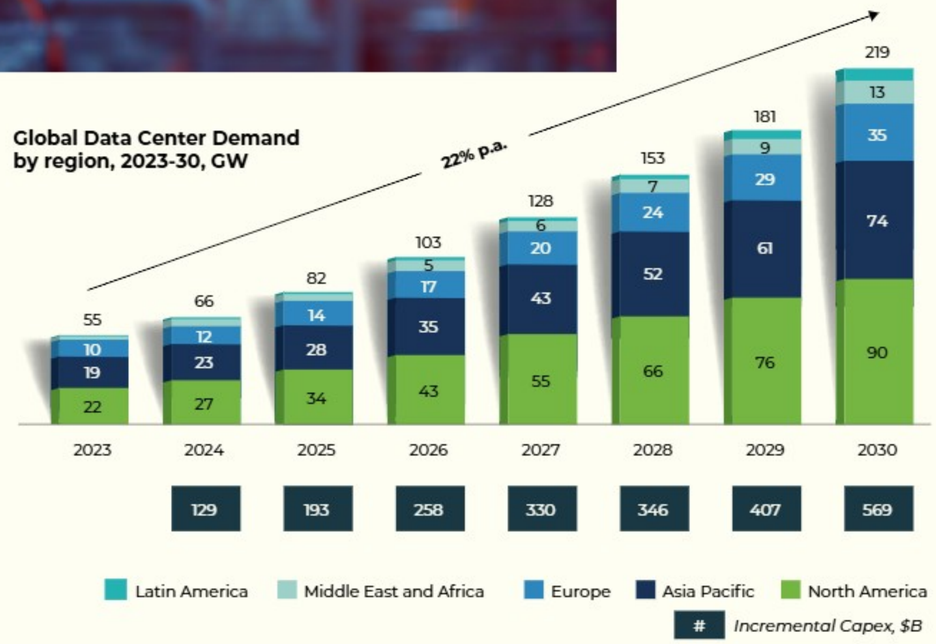


Si Silicon 28.085 · Ta Tantalum 180.947 · Cu Copper 63.55 · Ge Germanium 72.63

Cu Copper 63.55 · Nd Neodymium 144.24 · Ni Nickel 58.693 · Mn Manganese 54.938 · Li Lithium 7.0



Source: IEA, McKinsey Data Center Demand Model, McKinsey Data Center Capex model, Turner & Townsend

4. Regional security becoming increasingly important

Security and Defense: Critical Minerals in a Changing World

Geopolitical dynamics and shifting strategic priorities of the aerospace and defense sectors are reshaping global demand for critical minerals. Events such as the Russia-Ukraine conflict and China's export restrictions on rare earths and graphite have highlighted the risks of highly concentrated supply chains, prompting nations to diversify sourcing strategies.

The aerospace and defense industries rely on minerals such as neodymium, dysprosium, titanium, niobium, and beryllium, which are essential for advanced alloys, sensors, and lightweight structures used in jets, satellites, and defense systems. Notably, NATO has identified a list of critical materials for specific defense applications, further emphasizing the strategic importance of these resources.

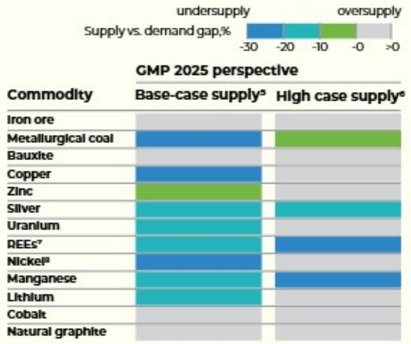
Heightened security concerns and increased defense spending are reinforcing governments' focus on readiness and supply assurance. As a result, critical minerals are increasingly treated as strategic necessities, with procurement decisions often shaped by reliability, traceability, and continuity of supply, not just price.

Addressing these challenges will require a combination of innovative sourcing strategies, advanced recycling technologies, and international collaboration to ensure a stable, sustainable, and secure supply of these essential resources.

According to the Stockholm International Peace Research Institute, defense budgets are expected to increase substantially until 2030, reflecting the higher ambition level set with new NATO-target

The Super Region is poised to play a key role in future mineral supply chains

Despite efforts to increase mineral production, the supply of several key materials could fall short of demand by 2035 or earlier, considering existing committed project pipelines. This is the case with materials such as copper, nickel, high-purity manganese, REEs, lithium, uranium and silver, for example.



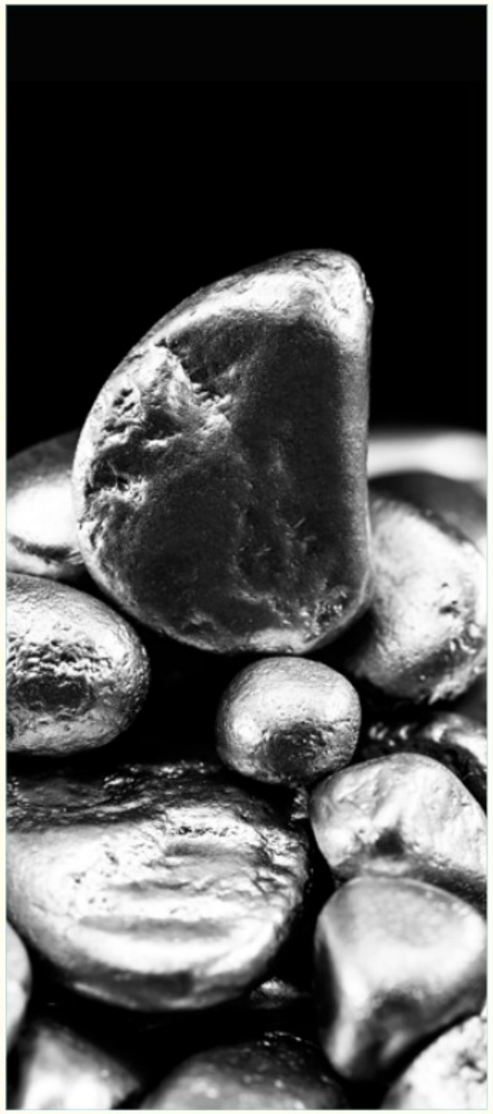
The Strategic Role of the Super Region

The growing demand for critical minerals presents significant opportunities for mineral-rich countries, especially those within the Super Region, to develop and expand their mineral value chains. The Super Region plays a pivotal role in supplying a broad range of essential minerals and metals, making it a key partner in global decarbonization and digitalization efforts.

Collaboration within the Super Region and with international partners is essential to unlock this potential. This strategic development enhances economic diversification, strengthens regional supply security, and positions the Super Region as a cornerstone of the global energy and digital transitions.

By investing in upstream extraction as well as midstream and downstream processing capabilities, countries in the Super Region could not only meet global demand but also build more robust and value-generating industries at home, thereby contributing to wealth creation for their people.

5) Base-case supply includes all announced projects which are deemed certain or probable to come online.
6) High-case supply includes projects of which feasibility is not yet confirmed; announced early-stage projects.
7) Rare earth elements incl. Dysprosium, Neodymium, Praseodymium and Terbium.
8) Forecast based on currently announced projects; undersupply is unlikely, as an oversupply is expected until 2030, with additional projects anticipated thereafter.



6. FMF Critical Minerals Framework: Enabling a new age of development for supplier regions

The Critical Minerals Framework: FMF introduced the Critical Minerals Framework (CMF) at its 2025 Ministerial Roundtable – a strategic blueprint and structured methodology for establishing sustainable and resilient global mineral value chains.

Authored by:

GlobalAi

The Critical Minerals Framework (CMF) provides a structured approach to developing cross-regional and resilient mineral value chains

FMF's Critical Mineral Framework has been produced over the past three year by FMF at the request of the Ministerial Roundtable, with input from international governmental and industry experts. It supports the development of cross-regional mineral value chains, from exploration to circular waste management.

The Critical Mineral Framework is centered around the development of enablers to support critical minerals value chain, with the initiatives on centers of excellence and sustainability being integral to turning the framework into reality.

Vision

Creating sustainable, resilient global mineral value chains by enabling metals, industrial hubs, and multi-stakeholder collaboration for regional growth and innovation

Mission

Super Region to supply its share of minerals and metals to the world for the energy transition, while enabling economic development and job creation for contributing countries

Objective

Maximize regional mineral value chains, drive collaborative global integration and create an attractive investment ecosystem, while minimizing the environmental impact of these value chains on the region

Value Chain

- Exploration
- Logistics
- Manufacturing
- Mining
- Processing
- Circular waste management

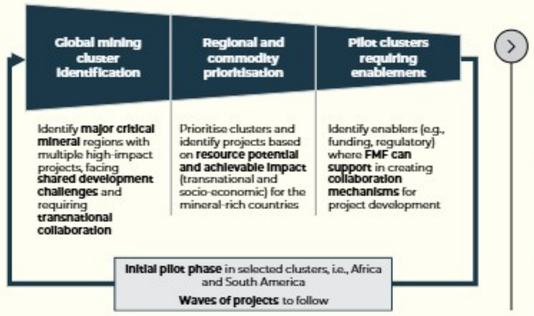
Enablers

- Funding
- Technology
- Infrastructure development
- Talent development
- Sustainability
- Policy
- Geology

Stakeholders

- Government (incl. geological surveys)
- Financiers
- Non- Government Organizations
- Mining companies
- Service providers

FMF followed a three-step approach to develop initial pilot projects



Seven clusters[9] were identified in Africa and South America

Source: MineSpans, SNL metals and mining

The Future Minerals Forum (FMF) followed a three-step approach to prioritizing pilot projects for the CMF. As a result, five clusters were prioritized based on mineral attractiveness, supply potential, and their opportunity for FMF to impact distinct enablers for cluster development.

Africa South America

Enabler in focus		Value chain cluster	Description
1. Energy infrastructure	Co 27	**Copperbelt** power in **DRC and Zambia**	**Build power capacity** to increase copper supply for global energy transition
2. Traceability scheme	Ta 73	Traceable **3T[10]** production in **Great Lakes region[11]**	**Consolidate artisanal mine** production of 3T through processing capacity and make it **marketable through increased traceability**
3. Processing capacity	C 6	Integrated **natural graphite value chain** in **East Africa**	**Develop natural graphite mining** through **offtakes** from an **integrated processing hub in the region**
6. Water infrastructure	Li 3	**Lithium** production in **Chile, Argentina and Bolivia** Triangle	Build a **water pipeline** from Chile and establish a **desalination plant** to **unlock production in the Lithium Triangle**
7. Processing technology partnerships	Nd 60	**REEs** production in **Brazil**	Unlock REE production in Brazil **through processing technology partnerships**

9) Projects focused on critical minerals, concentrated within 3-1 regions/ countries and have potential opportunities within infrastructure and processing.

10) Tin, Tungsten and Tantalum.

11) Many countries in the region are linked to armed groups and conflict financing.

6.A. Critical Minerals Supply Chain Participation in the Super Region

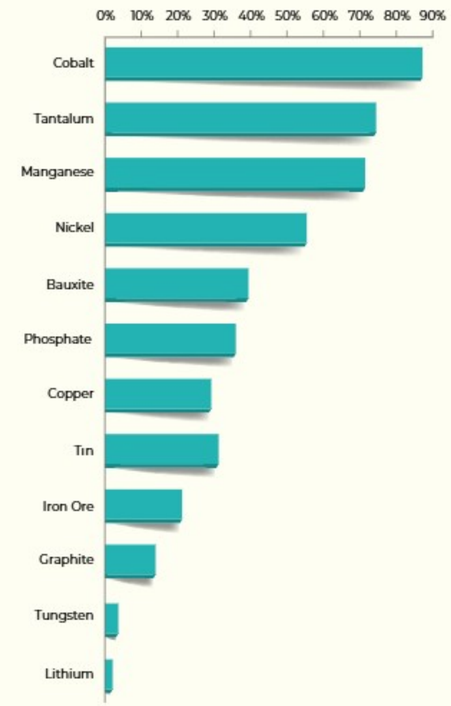
This section provides a quantitative assessment of the state of the "Enablers" - Policy and Regulations, Financing, Infrastructure, Traceability and Sustainability, Talent Development and Technology – supporting and promoting the development of the critical minerals sector in five mining corridors in Sub-Saharan Africa: Copper (Democratic Republic of Congo and Zambia), Graphite (Mozambique and Tanzania), 3T (Burundi, Rwanda and Uganda), Multi-metal (Botswana, Namibia and South Africa) and Iron-bauxite corridor (Côte d'Ivoire, Guinea, Liberia, Mali and Sierra Leone).

The review shows a high degree of heterogeneity in the state and progress of the "Enablers" - and their effectiveness – promoting the development of mining sectors in these five corridors, with some corridor economies registering higher levels of development than others. The multi-minerals corridor economies, for example, score high on energy availability, roads and railway connectivity and port facilities and talent development, while the economies in the iron-bauxite corridor score high on policy and regulatory performance, leading to rapid development of the mining sector and higher export and GDP growth. With the exception of the multi-mineral corridor countries, energy shortages and under-developed road and railway connectivity remain a key constraint for further development of the mining sector in these economies.

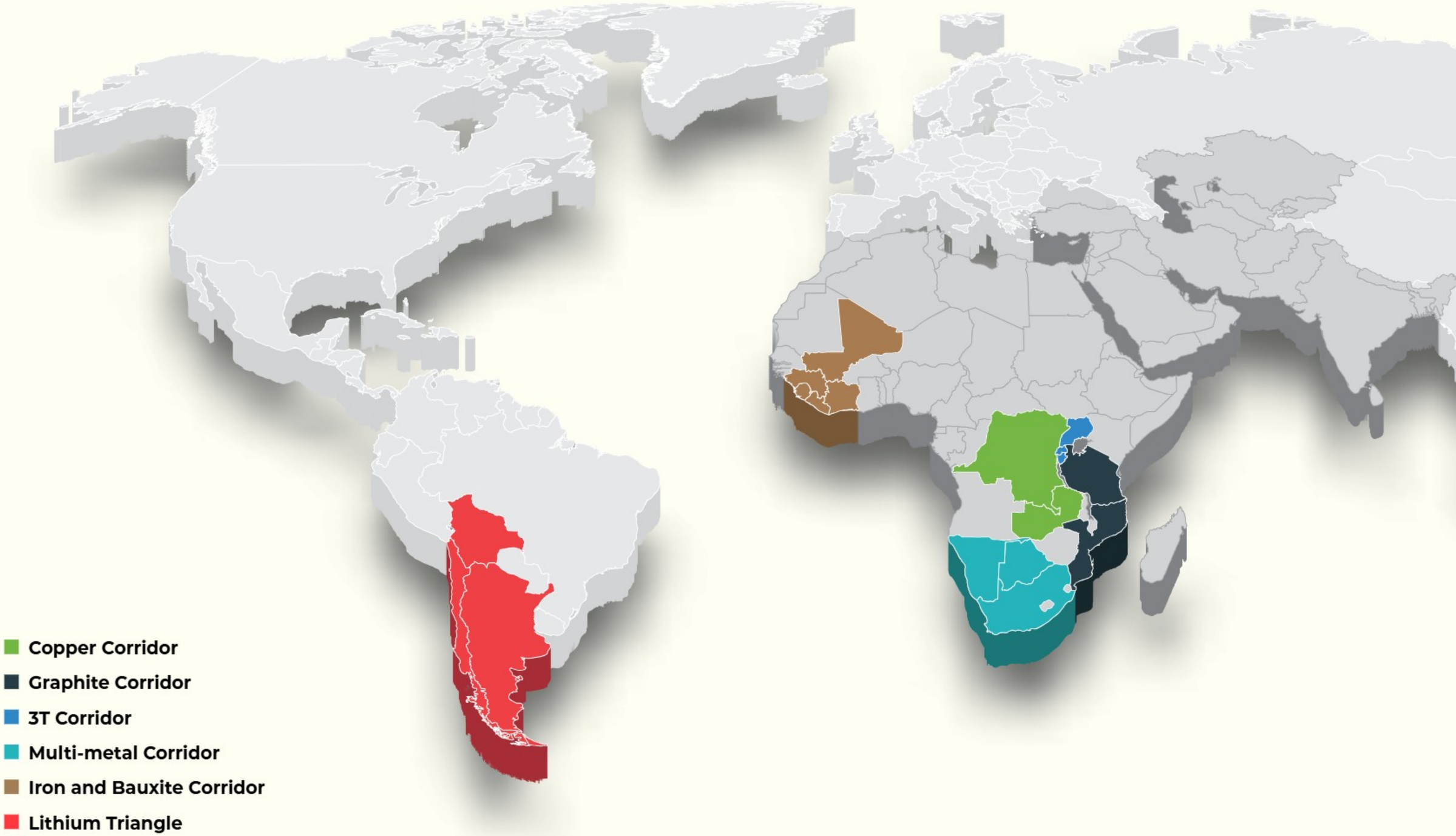
The varied progress on the enablers across these corridor economies presents an opportunity for them to learn from each other, strengthen collaboration, strengthen the effectiveness of the enablers and co-develop their mining sector to develop resilient critical minerals supply chains in the Super Region.

Metals and minerals ore exports are the key drivers of economic growth in the Super Region. In nearly a third of its countries, critical minerals and metals exports accounted for 40% of total exports. Mining and minerals exports exceeded 75% of total exports from: Guinea (87.2%), Mali (85.4%), Burkina Faso (84.1%), Zambia (78.7%) Democratic Republic of Congo (77%). Mining is the lifeblood of these economies. The share of metals and mining exports in total exports are increasing in more than half the countries. Countries in the Super Region accounted for more than
50% of the global production of cobalt, tantalum, manganese and nickel – the critical minerals needed for the energy and digitization transitions.

Energy Transition Metals and Minerals
The FMF Super Region's Share (%) in Global Production, 2024



FMF Critical Minerals Priority Corridors at Glance



Copper Corridor

Area:
3,010,440 sq. km

Population:
124.3 million

GDP:
US$ 97.3 billion

Key Minerals:
Copper and Cobalt

Graphite Corridor

Area:
1,672,180 sq. km

Population:
100.1 million

GDP:
USD$ 102 billion

Key Minerals:
Graphite

3T Corridor[12]

Area:
2,641,127 sq. km

Population:
187.6 million

GDP:
US$ 142.2 billion

Key Minerals:
Tantalum, Tin, and Tungsten

12) In all future analysis in this section, DRC will be considered only under the Copper Corridor to avoid duplication of figures

Multi-metal Corridor

Area:
2,603,110 sq. km

Population:
68.9 million

GDP:
US$ 432.9 billion

Key Minerals:
Copper, Nickel, and Tantalum

Iron and Bauxite Corridor

Area:
1,952,410 sq. km

Population:
86 million

GDP:
US$ 148 billion

Key Minerals:
Iron and Bauxite

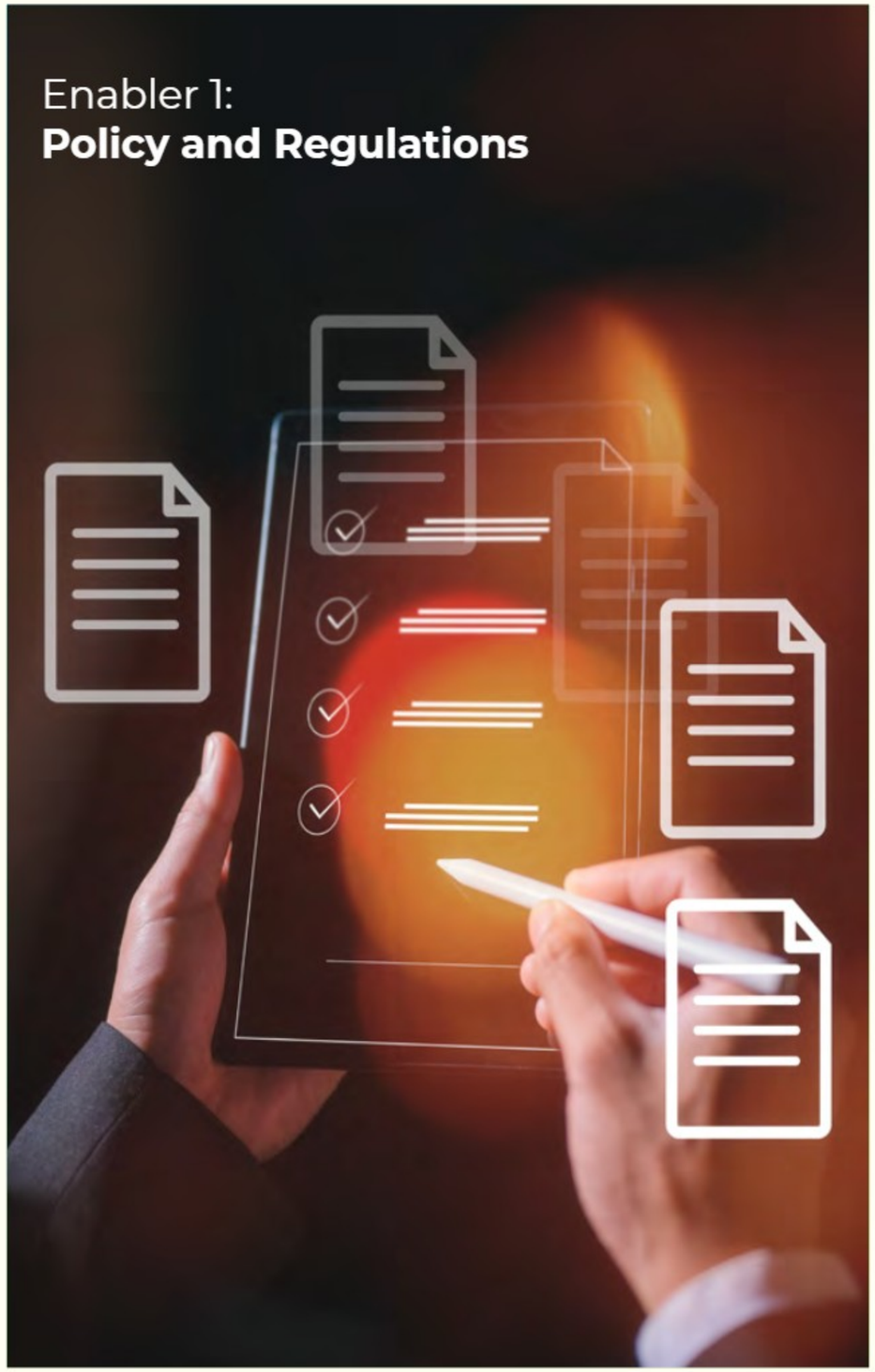
Lithium Triangle

Area:
4,563,522 sq. km

Population:
79.5 million

GDP:
US$ 1.01 trillion

Key Minerals:
Lithium



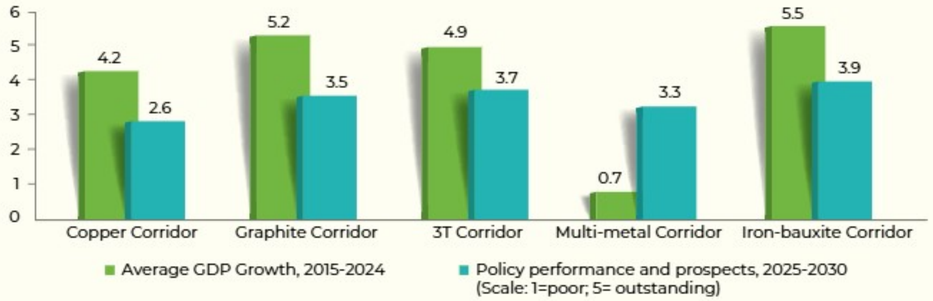
Past Performance, Economic Policy and Future Prospects

The FMF policy-performance index represents the weighted average of:

- The level of economic development, measured in terms of GDP per capita in 2024.
- The quality of economic management in the areas of:
  a. Monetary and Exchange Rate Policies
  b. Fiscal Policy
  c. Debt Policy and Management
- A score of 5 represents high quality of economic management, while 1 represents low quality economic management.
- GDP growth forecasts for 2025-2030.

The overall score is presented in a scale of 1 to 5, with 5 representing high performance and economic prospects

Policy Performance Index



Insights:

- A number of countries in the critical mineral corridors experienced high average growth rates during 2016-2024 – Rwanda (6.7%), Guinea (6.3%), Cote d'Ivoire (5.9%), Tanzania (5.8%), exceeding the 3% average growth registered by SSA countries during the same period.
- Metal and minerals' share in total exports from these corridors reached 60% of their total exports in 2024 compared to the 24% average for the FMF countries in the Super Region.
- Structural bottlenecks – high unemployment and inflation – undermined growth in the multi-metal corridor countries in Southern Africa.
- The FMF corridor economies, except for the multi-metal corridor economies in Southern Africa, are forecasted to grow by more than 6% a year during the next five years, outperforming their peers in Sub-Saharan Africa (3.6%-3.8%), supported by accommodative fiscal, monetary, exchange rate and debt policies playing a key role in bolstering economic growth.
- The countries in the iron-bauxite corridor are projected to register a GDP growth rate of 6.7% during the next five years.

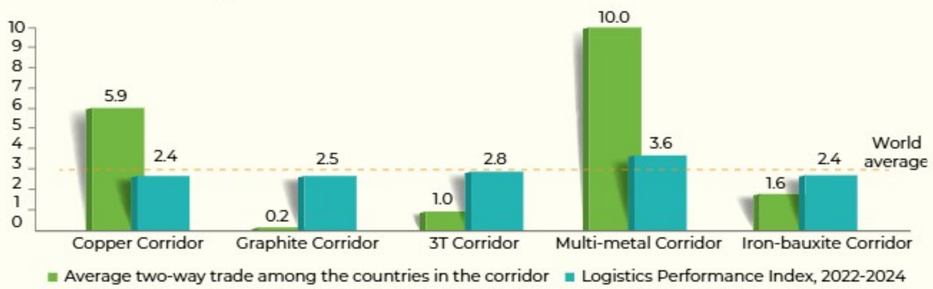
Trade and Economic Integration

- Trade and economic integration will remain critical for building resilient supply chains in the corridor countries.
- Developing integrated supply chains in these mineral corridors will require investments in infrastructure and connectivity and simplified logistics processes.

Insights:

- The multi-metal corridor, encompassing Botswana, Namibia and South Africa, is the most economically integrated critical minerals corridor, measured in terms of bilateral (two-way) exports as % of total exports, among the countries in the corridor while the graphite corridor encompassing Mozambique and Tanzania is the least integrated.
- Two-way trade between Mozambique and Tanzania, for example, averaged less than 1% of their total exports worldwide, while two-way trade among Botswana, Namibia and South Africa in the multi-metal corridor averaged over 10% of their total trade.
- The corridor countries produce, and compete in, similar products including similar metals and minerals, limiting scopes for building value-chains within the corridor. DRC and Zambia, for example, are both major exporters of copper, competing for increasing their share of copper exports in the total export of coppers. Similarly, Guinea and Liberia are competing in the iron ore exports.
- Customs clearing and processing remain cumbersome in most corridor countries. For example, it takes 28.6 days to clear customs for imported goods in the Democratic Republic of Congo and 20.3 days in Sierra Leone against the world average of 9.9 days to clear customs (the World Bank).
- **Barring the countries in the multi-mineral corridor, most countries rank low in terms of the logistics performance index, which measures: efficiency of customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively** priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time.

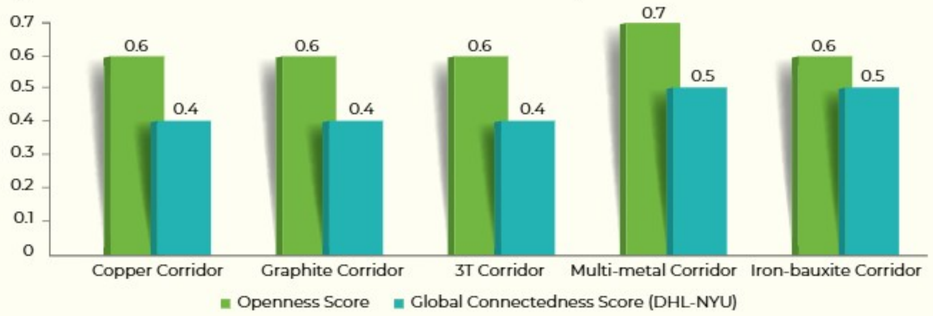
Trade and Economic Integration



Openness and Connectedness to the Rest of the World Economies

- The Openness Score (0-100) measures a country's level of openness in terms of policies affecting economic, social and cultural openness across 30 variables.
- The NYU-DHL Connectedness Score (0-100) measures a country's level of connectedness to the rest of the world in terms of trade, capital flows, information sharing and scientific collaboration and the flow of people.
- Both the measures of openness and connectedness are critical drivers of foreign direct investments in countries, especially in developing and frontier economies in Sub-Saharan Africa.

Openness and Connectedness to the Rest of the World Economies, 2024



Insights:

- Countries in the multi-metal corridor are both most open to, and most connected with, the rest of the world economies.
- The Iron corridor economies (Cote d'Ivoire, Sierra Leone) are least open, as measured in the World Openness Index (2024), which measures a country's policies regarding capital control, exchange rate controls and FDI, underscoring the need for structural and policy reforms. Botswana, Uganda and South Africa are most open among countries in the critical minerals corridors.

The Copper corridor countries are least connected to the rest of the world economy, given under-developed physical infrastructure and limited access to port and shipping facilities. Democratic Republic of Congo's score on the DHL Liner Connectivity Index is 5.1 compared to the score of 41.2 for South Africa or 15.6 for Tanzania.

Six out of 15 countries in the FMF's 5 critical minerals corridors are land-locked, which poses a structural challenge to their participation international trade.

Enabler 2: **Financing**

FDI Inflows and Greenfield Investments

- Mining exploration, development and processing activities are capital intensive.
- Foreign direct investments (FDI) not only help countries meet the financing requirements to find and develop new mines, but also facilitates the transfer and diffusion of cutting-edge mining technologies.
- FDI is a critical enabler for the development of the mining sector in the FMF critical minerals corridors.

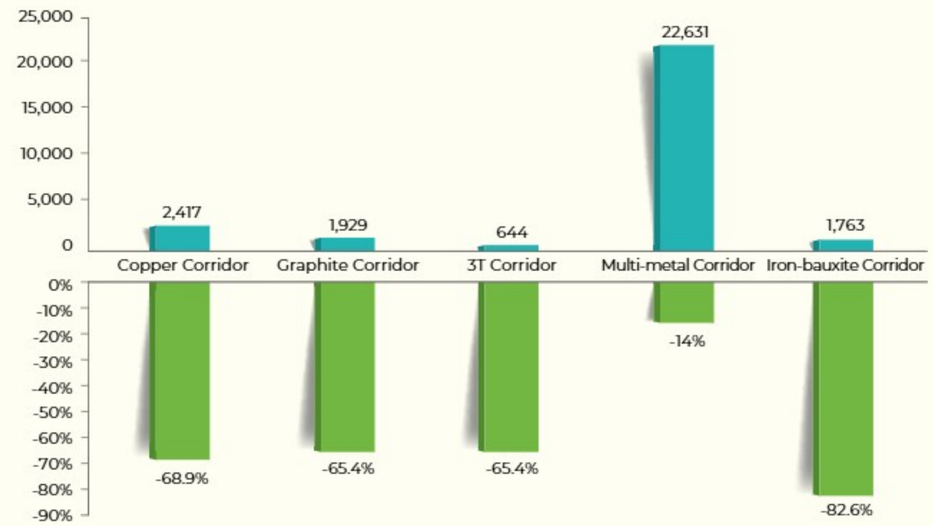
Insights:

- In 2024, FDI inflows declined by 11% worldwide against the backdrop of slowing economic growth, high interest rates, geopolitical uncertainties and sharp increases in investments in AI infrastructure and data centers, especially in the US and China.
- While total FDI inflows into Africa increased, greenfield investments in the critical minerals sector declined by 63% between 2023 and 2024.
- The FMF aims to bolster greenfield investments in the corridor economies in the coming years.

Greenfield FDI investments in the FMF critical minerals corridors declined by 43% in 2024.

Rising geopolitical risks, policy uncertainties and high interest rates impeded investments in the critical minerals sector in 2024.

Greenfield FDI in 2024, USD million



Growth% in greenfield investments in 2023-2024

Electricity Generation

- The mining and minerals sector development requires reliable energy sources.
- Renewable energy resources – hydro, solar and wind energy – can play an important role in increasing energy supply and greening the mining economies.
- The corridor countries have vast, but untapped, renewable energy resources, particularly hydroelectricity in the copper corridor and solar energy in the iron-bauxite corridor.

Electricity Generation (kw/h) per Person, 2024

Insights:

The corridor countries face significant shortfalls in electricity generation and supply, impeding the rapid development of their mining and minerals sector.

- With the exception of the countries in the multi-metal corridor, electricity generation averages less than 10% of the global average – presents a significant hurdle to the development of the mining and mineral sector.
- Annual electricity generation in the 3T corridor countries averaged only 98 Twh compared to an average of 3,638 Twh in the multi-metal corridor countries.

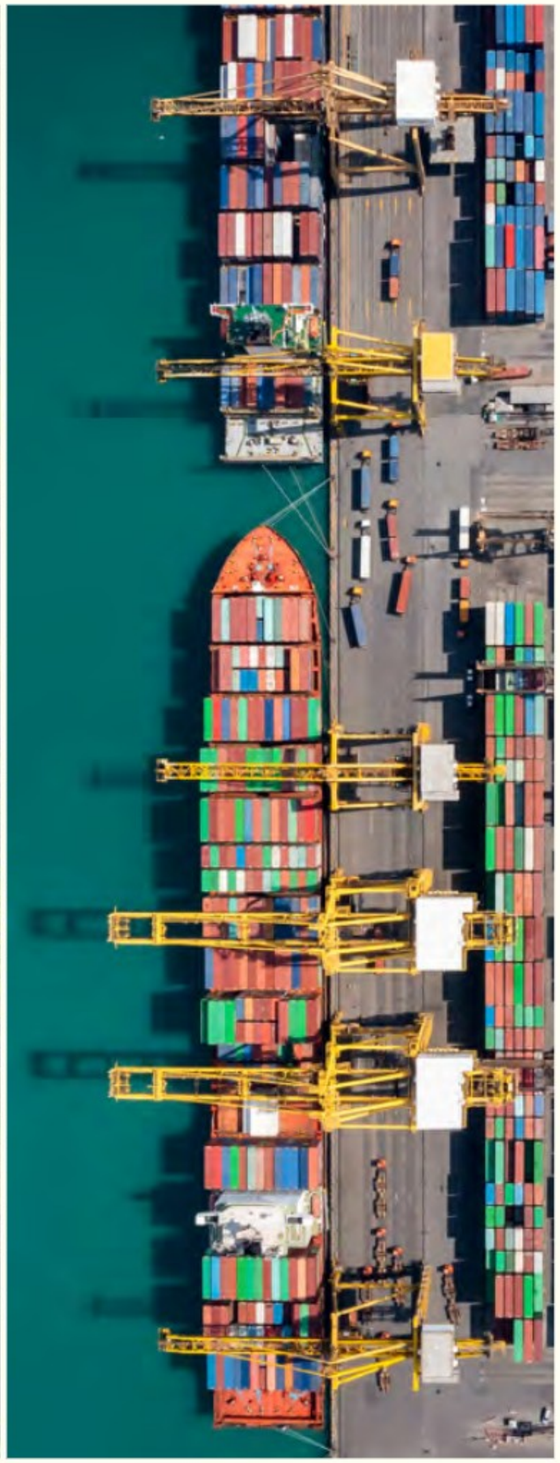
- Expanding energy generation is a priority in these economies
  - Inga III hydropower project is expected to add 11,000 MW to the national grid in the DRC.
  - The Hydro-Link project will build a $1.5 billion a 720-mile (1,160-kilometer) transmission line to deliver 1,200 megawatts of electricity to key copper and cobalt mines from hydropower sites in neighboring Angola.
  - Julius Nyerere hydropower project in Tanzania and Mphanda Nkuwa hydropower project in Mozambique are expected to add 3,400 MW and 1,500 MW of electricity
  - Sanankoroba Solar project in Mali will add 200 MW of electricity supply.
  - Kusile Coal Power Plant completion (4,800 MW) in South Africa
  - Karuma Hydropower (600 MW) project in Uganda is expected to commission in 2026.

State of Infrastructure: Road, Railways and Seaports

- Physical infrastructure – roads, railways and seaports - is essential for the development of the mining sector.
- Connectivity between mining sites and ports are critical to building efficient and resilient supply chains.
- The FMF is prioritizing infrastructure investments to accelerate development of the critical minerals in the corridor countries.

Insights:

- The multi-metal corridor and the 3T corridor have the most extensive road and railway networks, even though Burundi and Rwanda are yet to have any railway lines.
- While the graphite corridor countries have large numbers of seaports, road and railway network remain under-developed. Tanzania is implementing an ambitious 1,219 km standard gauge railway (SGR) network connecting Rwanda, Burundi and the Democratic Republic of Congo. The China-Africa Development Fund is funding the modernization of the railway connectivity between Dar-as-Salam and Kapiri Mposhi in Zambia's central province.
- The construction of the 900 km railway lines from the border between Angola and the Democratic Republic of the Congo connecting the border town of Dilolo to Kolweziand on to Lubumbashi, and then on to Sakania on the border with Zambia - projected to complete in 2027 – will significantly improve transport logistics in the Copper corridor, which currently has access to only four seaports.
- The second phase will connect the capital Kinshasa with the Congo Central region and the coast and the new deep-sea port in Banana. A third corridor will connect the Central Congo to the east of the country, including the Kassai region.



Enabler 4: **Sustainability and Traceability**

The countries in the critical minerals corridor are undertaking bold and concrete measures to improve environmental, social and governance standards (ESG) to attract FDI, including in the mining and minerals sector.

The quality of institutions and policies for improving environmental sustainability, however, remains weak in the corridor countries, especially in the graphite and the iron-bauxite corridors. The weighted average institutional rating (compiled by the World Bank) for the graphite corridor countries is 3.15 relative to 3.64 for the 3T corridor countries.

During 2023-2024, a majority of countries in the critical minerals corridors adopted a number of rules, regulations and administrative measures to improve ESG compliances, with the Iron-Bauxite corridor countries adopting 13 new ESG related measures.

New ESG related measures during 2023-2024

Copper Corridor

Democratic Republic of the Congo (DRC)

- Establishes a high-level IGM inspectorate to:
  - fight against mining frauds and smuggling in all their forms.
  - Prevent investigate and record infringement of mining legislation and regulations.
  - protect the mining environment and
  - support the Center of Expertise and Evaluation and Certification (CEEC) of precious and semi-precious mineral substances.
- Prime Ministerial Decree no. 23/08, which came into force on 22 February 2023, introduced new procedures to:
  - ensure that disposals of mining assets are carried out in a transparent and consistent manner, protecting the interests of the State and the state-owned companies.
  - prevent the sale of the assets at a price lower than their real value.

Zambia

- Creates Minerals Regulation Commission (MRC) with a mandate to:
  - grant, suspend, and revoke mining and non-mining rights.
  - approve transfers and encumbrances of mining rights and changes of control in mining right holders.
  - audit environmental performance in collaboration with the Zambia Environmental Management Agency ("ZEMA").
  - Regulate mineral marketing and valuation.
  - Requires mining project to submit 5% of the total mine site rehabilitation cost, as estimated by the mining developer, to the Environmental Protection Fund.

Graphite Corridor

Tanzania

- Reinforces compliances with environmental standards.
- Imposes fines up to TZS 1 billion (~USD 407,000) for illegal imports or venting.

3T Corridor

Rwanda

- Strengthened oversights and enforcement mechanisms to eliminate child labor in artisanal mining, implementing a new ministerial order and child labor case management framework in 2023.
- Requires environmental rehabilitation guarantee for mining projects.
- Suspends licenses for undeclared exports.
- Adopts new strategy for gender mainstreaming in the mining sector (Rwanda Mining, Petroleum and Gas Board).

Burundi

- Creates an OBM Traceability & Ethics Directorate.
- Introduces new regulations for artisanal & semi-mechanized mines.
- Requires a rehabilitation bond ≥ USD 10,000 per site.
- Imposes stringent child-labour sanctions.
- Tightens ESG reporting requirements without adding new fees.

Uganda

- Requires Environmental and Social Impact Assessment and Environment Risk Assessment for mining projects, raising the non-compliance fine amount to UGX 1 billion for individuals or fifteen years in prison or both; and UGX 6 billion for corporate bodies.
- Requires mining license holders «to obtain a financial guarantee in accordance with the National Environment Act.
- Requires bag-and-tag with unique IDs for 3T minerals under the ICGLR RCM.
- Requires minimum 99.85% Tin export purity.

Multi-metal Corridor

South Africa

- Transitioning towards mandatory ESG reporting, building on JSE sustainability guidelines (in effect since 2022), with Companies and Intellectual Property Commission (CIPC) requiring mandatory Environmental, Social, and Governance (ESG) reporting in 2025, initially targeting public and state-owned companies

Iron-Bauxite Corridor

Liberia

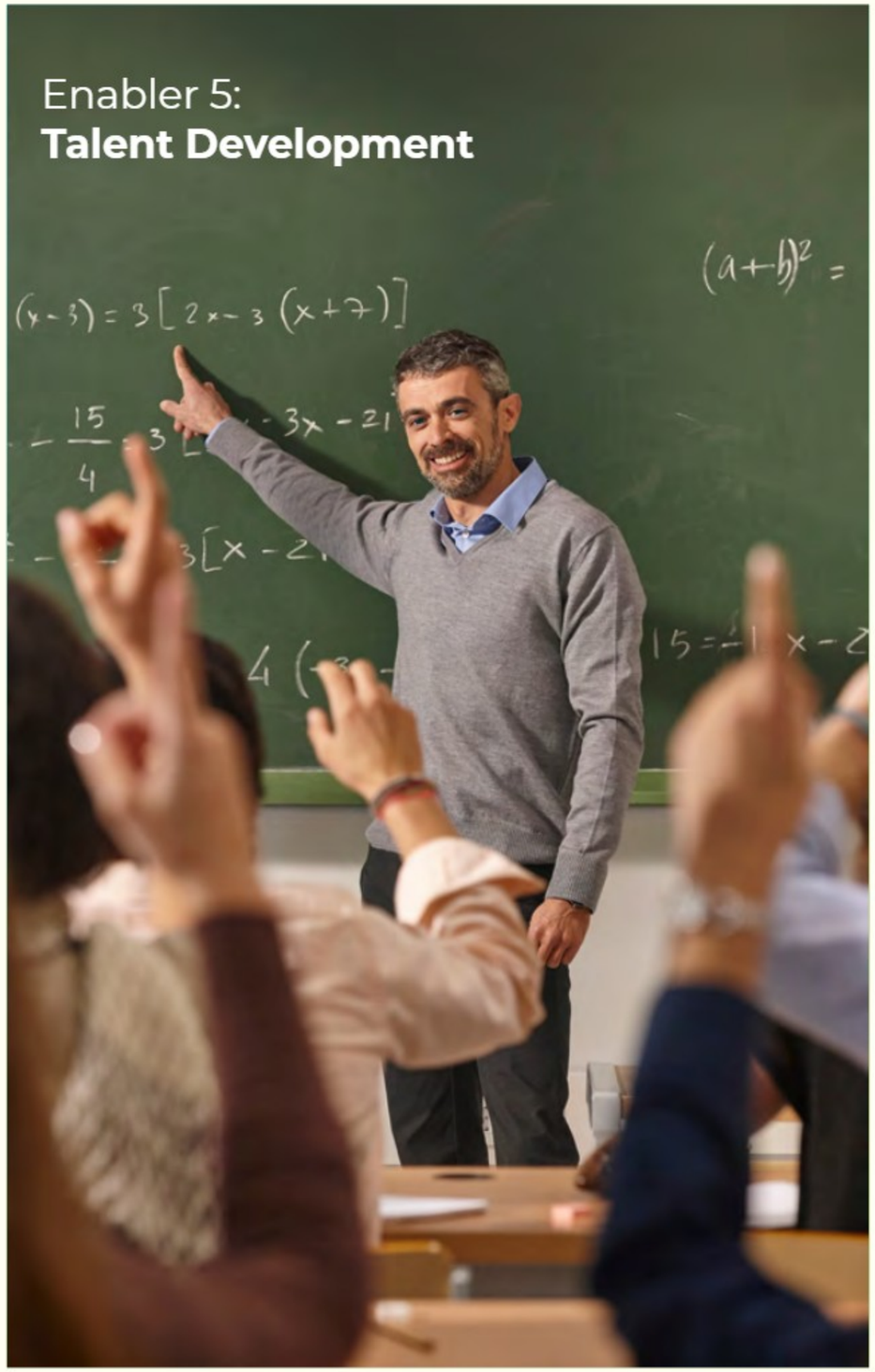
- Requires local employment in senior roles and community development funding.
- Requires mining firms to respect landowner rights to ensure revenues benefit national development.
- Introduces measures to crackdown on illegal mining and dredging, seeking stronger protection of watercourses and ecosystems.
- Establishes county Mines Offices established in all 15 counties for local oversight and enforcement, promoting decentralized monitoring to protect investors and communities.
- Reforms target conflicts of interest, opaque ownership, and illicit financial flows.
- Aligns governance with international transparency standards.

Mali

- The revised Mining Code of August 2023 allows the government to hold up to 10% equity in new projects, with the option to buy an additional 20% during the first two years of operation. A 5% stake can be ceded to locals, taking state and private Malian interests in new projects to 35%, up from 20%. This confirms increased local participation in mining activities.
- Requires EIA before any exploration or mining project.
- Requires mining companies to develop a site rehabilitation plan after mining activities.
- Requires mining companies to partner with local entities or support the training of the Malian workforce.
- Requires investors to fund community projects, such as building infrastructure or supporting education and healthcare

Sierra Leone

- Introduces EIA requirements for all mining projects, covering social, health, and safety impacts.
- Guarantees landowner rights, compensation, and fair rent distribution.
- Strengthens community protections and grievance mechanisms.
- Mandates human rights and social responsibility commitments in licenses.

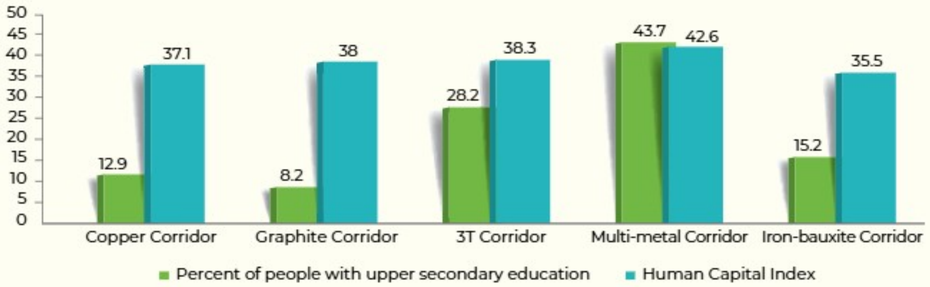


Enabler 5:
Talent Development

Higher Secondary Education and Human Capital Index

- Human capital and availability of skilled worked force are key factors in attracting foreign investments in the mining and mineral sectors.
- The percentage of people with higher secondary education can measure a country's readiness to participate in midstream and downstream supply chain activities which typically require more skills than in upstream activities.
- Human capital index of the World Bank measures how much human capital – skills, knowledge and ability – a child born today can expect to attain by age 18, given current health and education conditions. A score of 100 will indicate that the child has attained his or her full potential human capital.

Percent of People with Higher Secondary Education and Human Capital Index

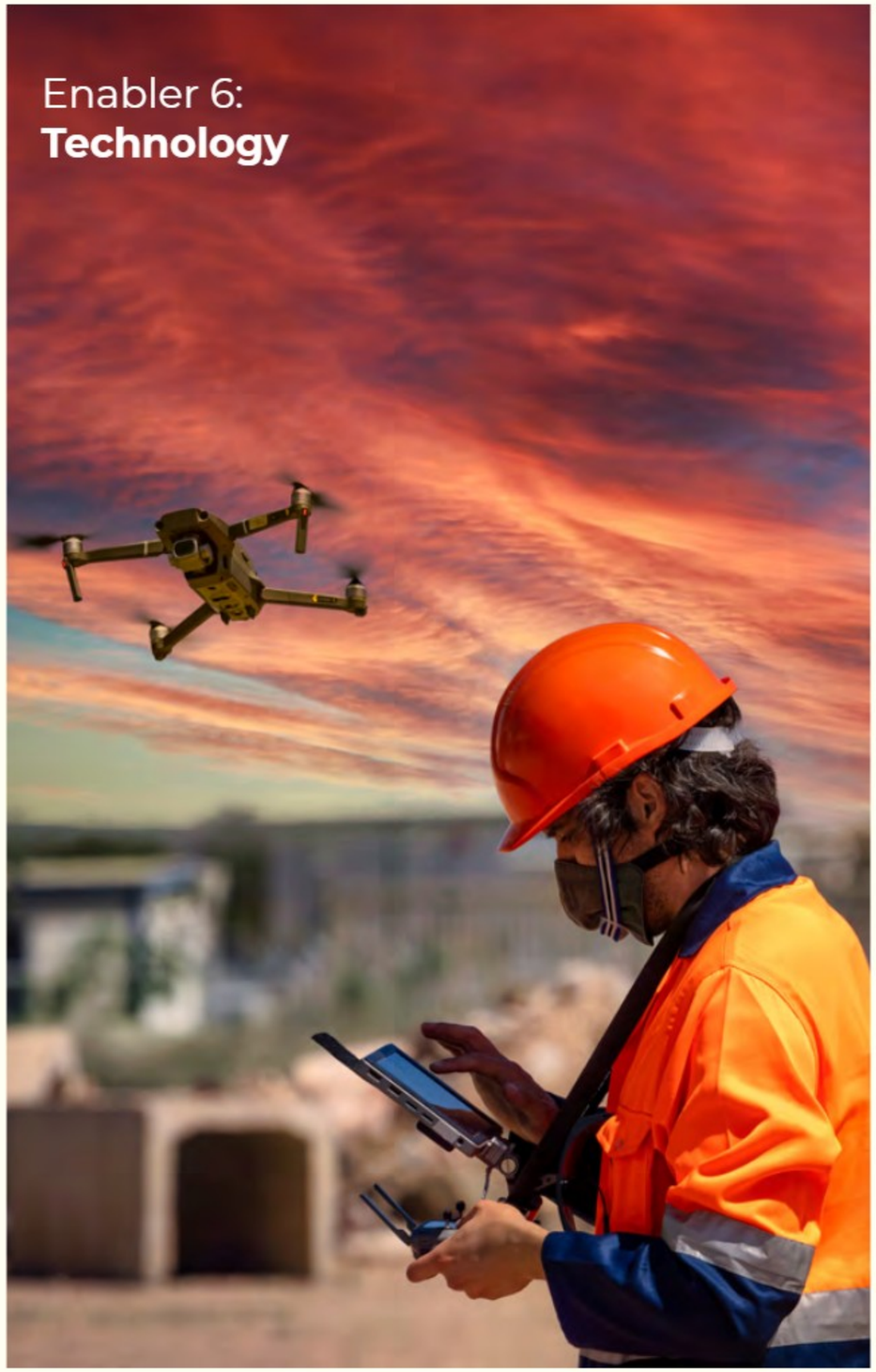


Insights:

- Most countries in the FMF critical minerals corridors face shortfalls in skilled workers to increase local value-added in mining processing and participate in global value chains. Only 8.3% of adults in the graphite corridor and 12.9% of adult population in the copper corridor attained upper secondary level education, compared to 43.8% in the multi-metal corridor and 28.2% in 3T countries.
- The countries in the multi-metal corridor and the 3T corridor have more educated and skilled workforces relative to the countries in other mineral corridors. In the multi-metal corridor, 43.8% of the adult population had upper-secondary level education, compared to only 8.3% of adult population with upper secondary level education in the Graphite corridor countries.

The human capital index in the corridor countries averaged 40, compared to the world average of 56 – a significant gap that continues to persist in these countries.

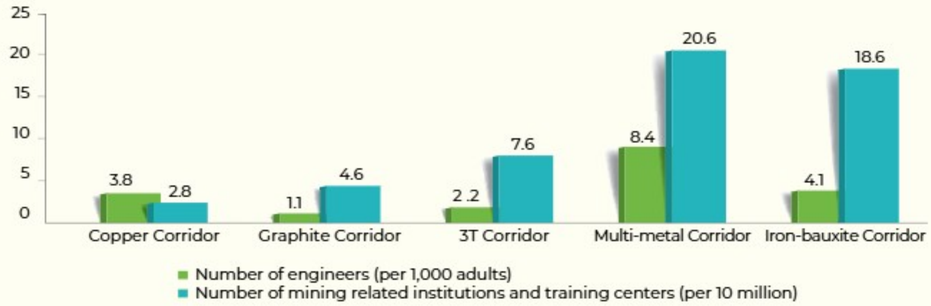
FMF is prioritizing the development of human capital and local talents in the corridor economies to enhance their participation in the global value chains of critical minerals.



Number of Engineers and Mining Schools

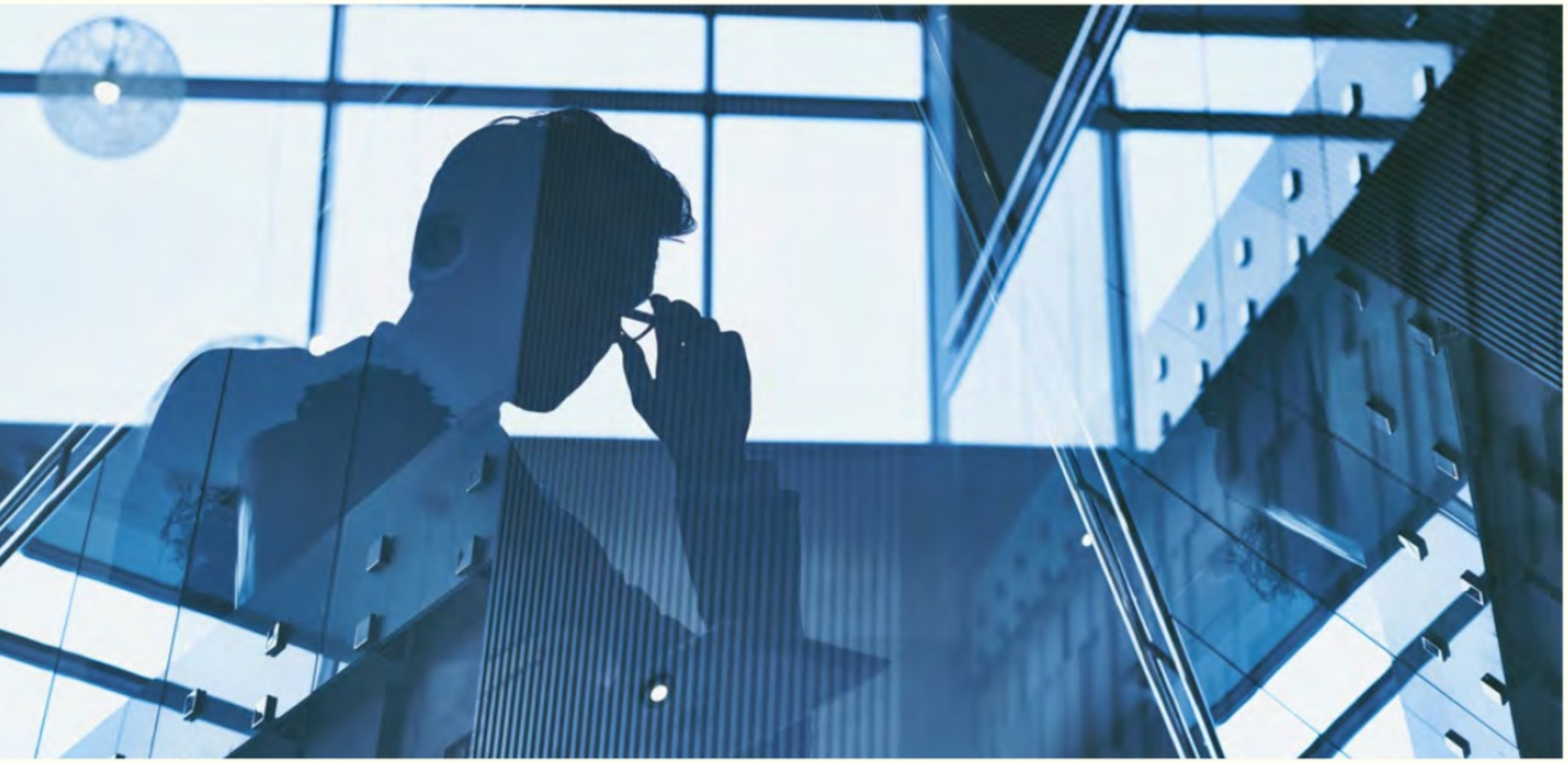
- Midstream processing of metals and minerals requires advanced technology and a highly skilled workforce.
- Mining schools are often the facilitators of technology transfers and incubators for developing new technology for the mining sector
- Engineers – especially in metallurgy, chemical, civil, mechanical and electrical fields – are part of the highly skilled workforce that play a critical role in adopting and deploying new technology to develop a robust mining and mineral sector.
- Mining institutions – including vocational training on mining best practices – need to serve as centers of excellence, driving innovation and attracting foreign investments.

Number of Engineers and Mining Training and Research Institutions



Insights:

- The countries in the FMF critical minerals corridors are prioritizing local skills development.
- Both the multi-metal corridor and the Iron-bauxite corridor have established world class institutions, focused on mining- and minerals- related education and research.
- The School of Mining Engineering at the University of the Witwatersrand (Wits) in South Africa, the Higher Institute of Mines and Geology of Boké (ISMGB) in Guinea, the Department of Geology, University of Lubumbashi in the Democratic Republic of Congo, or the African Center of Excellence in Mining and the Mining Environment (CEA-MEM) in Cote D'Ivoire are centers of excellence that are developing local and regional expertise in mining and mineral research.
- The FMF is prioritizing building centers of excellence in the super-region.



7. Barometer: Stakeholder Consultation

Authored by:

GlobeScan

Introduction

As an aid to decision-making, FMF aims to develop a State of the Sector Survey that will reveal changes over time in stakeholder confidence levels in the factors enabling critical minerals value chain development, as outlined in the CMF. The annual survey of private and public sector leaders across critical minerals mining clusters will provide a comprehensive understanding of the current state and future prospects of the mineral value chain in key supplier countries. The survey will be developed in 2026 and shared in the next FMF Barometer Report.

As a first step to the creation of the State of the Sector Survey, FMF commissioned in-depth stakeholder consultations to better understand the current landscape and the perceived preparedness of critical minerals value chains according to the six key enablers identified by the FMF (policy, financing, infrastructure, sustainability, talent development, and technology). While the previous section (6A) of the Barometer Report shares factual data about the current state of the sector, this section reveals the perceptions and priorities among key stakeholders.

Experts were sourced from within and outside supplier regions, with backgrounds ranging from private sector (mining, finance, technology), to government, industry associations and standards, academia and thought leaders.

These results of these interviews will help inform the creation of the State of the Sector Survey to be launched in 2026.

Methodology

41

In-depth interviews with experts

16
Corporate leaders in mining, finance, and technology

12
Government representatives across industry, mineral resources, energy, finance, logistics, and environment

9
Thought leaders and academics

4
Industry associations and standards organizations

19

Countries including 12 in the Super Region

Consultation period: **August to October 2025**

7.A. Priority Areas to Unlock Mineral Value Chains

Summary of findings from stakeholder interviews

The following summarizes stakeholders' high-level perspectives on the six enablers of critical mineral value chains, which they see as highly interconnected. Each enabler is examined in greater depth on subsequent pages, with an overview of key supports required and collaboration opportunities to further unlock supply and meet global demand.

Financing is seen as a key component to unlocking progress, but investment is negatively affected by perceptions of a high-risk environment with slow returns. The alignment of mining plans with broader national or regional development goals and regional funding mechanisms would help expand investment opportunities.

Stakeholders are looking for patient capital, flexible funding models, and ways of de-risking the environment through cost competitiveness levers, long-term guarantees and other incentives to increase investor confidence.

Policy and regulation are seen as the backbone to strengthening the value chain. Most stakeholders feel that enough policies exist, but geopolitical instability, corruption, conflicting and competitive regulatory landscapes, and inconsistent adherence and enforcement undermine progress. Consideration of local value creation is also important to avoid exploitative relationships.

Stakeholders call for harmonized, easy to understand, long-term policy and standards across the region, backed by good governance and upheld by law. These need to be reflective of local realities and capabilities to ensure their application.

Significant investment in core **Infrastructure** (e.g., transport, energy, connectivity, etc.) and **Technology** (especially for exploration, sustainability, mineral utilization and processing) is needed to support the future demands of critical mineral value chains. Many feel that while the right technologies exist, their adoption is limited due to high costs, lack of skilled operators and inadequate supporting infrastructure. Stakeholders emphasize the need for diverse investment, policy support, risk management in infrastructure planning, workforce upskilling, and regional collaboration—particularly through shared infrastructure models and multi-actor technology partnerships—to unlock value and ensure long-term resilience.

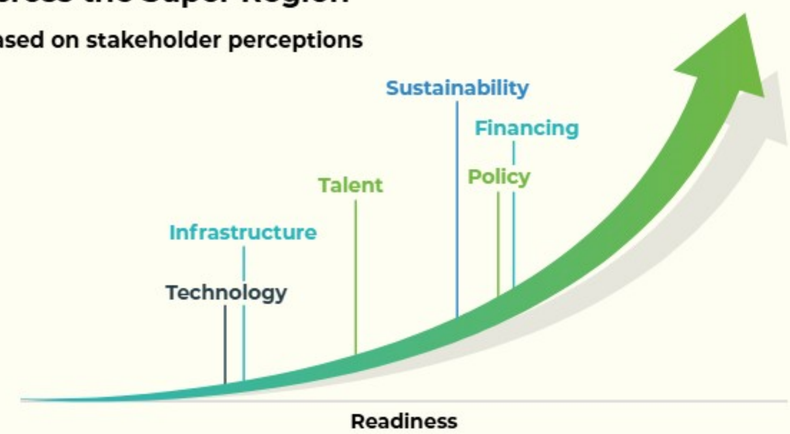
Stakeholders see a major global Talent gap in the critical minerals sector, worsened by the industry's poor image and inconsistent local capacity building.

Key priorities for **Talent Development** include upskilling, promoting STEM and sustainability education, and improving the sector's appeal to younger, more diverse talent. Support is needed through investment in education, policy reforms for mobility, and international learning opportunities. Collaboration between governments, academia, and industry is seen as essential to build talent pipelines, share expertise, and establish global hubs for mining education and innovation.

Sustainability is increasingly prioritized, but unevenly implemented due to inconsistent standards, governance, measurement and reporting, and technology adoption. Key priorities include stronger commitment and leadership from industry and government, practical and inclusive standards, and robust governance to ensure accountability. Focus areas are responsible resource use, community safety and engagement, legacy and post-mine issues, and traceability and transparency. Stakeholders point out the need for mindset shifts, supported by locally-relevant policies, best practice guidelines and roadmaps, and technology investments. Collaboration through regional standard-setting, public-private partnerships, and engagement with international sustainability bodies can help localize and align standards and drive consistent, responsible practices across the value chain.

Perceived "readiness" of each enabler across the Super Region

Based on stakeholder perceptions



7.B. Enabler 1: Policy and Regulations

Stakeholder perceptions and insights

Readiness: Varies across the supplier countries, influenced by mining sector maturity and political stability. Growing demand for critical minerals has boosted policy presence but complex regulatory landscape and inconsistent enforcement and adherence undermine progress.

General policy priorities:

- Long-term applicability and lack of abrupt disruptions, with stability during political cycles and consistent enforcement
- Easy to understand and comply with
- Harmonized across governments and regions
- Grounded in local realities and capacities to ensure feasibility and relevance
- Balanced and favourable conditions for all involved, with mutual benefits over the long term
- Consideration of local value creation to avoid exploitation of mineral rich countries
- Clear investment guidelines – e.g. creation of a financial body to oversee / ensure transparency, ensure stable monetary flows, tax stability agreements, royalties etc.
- Encouraging cooperation / avoiding regional competition

"Mining companies often have to redo everything for each government, which is exhausting. For countries - especially in Latin America and Africa - creating a stable, predictable policy environment is critical. If you want companies to invest for 30 to 50 years, you need to offer certainty and guardrails that help de-risk political instability."

Thought leader/ academic stakeholder

Specific priorities:

- **Streamlining the permitting and licensing** process to reduce delays and provide operational certainty – this is seen as key to encouraging investment and de-risking the environment
- **Incorporating local value creation into planning**, aligned with national capacity and development goals (e.g., education, infrastructure, talent development)
- **Facilitating cross-border mineral flow and regional value chain integration**
- **Fostering more sustainable practices** – environmental protection/restoration; safety; labor stability; human rights; inclusion of local/indigenous communities in decision-making; circularity / value extraction from raw materials and waste

Policy debate: Beneficiation

- Beneficiation is a key debate between government and private sector
- Governments have a strong desire for policies that encourage and enable value-add within their countries e.g. through mid- and downstream operations
  - Want to receive maximum benefits from commodities and be positioned strategically
- Private sector and industry experts raise concerns about mid- and downstream viability within mineral rich countries due to high cost, lengthy timeframes, and infrastructure and expertise limitations. They point out that not all locations are suited to this, especially if outputs are required in the short term
  - Suggest policies and frameworks that ensure monetary benefits are received in alternative ways in the short term, with opportunities to build capacity in the long term e.g. mid/downstream customers offering payments to supplier countries or investing back into source country
- Both sides in agreement that policies must ensure equity and respect for their relative interests

Support needed:

- **Policy reform and modernization** to reflect current realities, practices and priorities, as well as investor expectations
- Up-to-date **policy-relevant data** to inform decision-making (ideally open-source)
- **Enhanced expertise among policy makers** to ensure policies are based on accurate understanding of the sector
- Cross-border collaboration to ensure **regional policy alignment**, with reference to international best practice standards (e.g. ISO)
- **Stakeholder engagement** to ensure feasibility of policies on the ground
- **Strong governance** to ensure policies consistently applied and enforced over the long term – requires stable governments, legally binding agreements, accountability under the rule of law

Collaboration opportunities:

- **Domestic inter-ministerial coordination** to harmonize mining-related policies and avoid conflicting regulations
- **Regional benchmarking and harmonization** across supplier countries to reduce competing interests and foster mutual benefits
- Multilateral **partnerships between supplier and customer** countries to balance trade and local development and value creation
- **Public-private dialogue** to co-design investor-friendly policies that simultaneously reflect sector needs

"Mining companies are expected to adopt best practices, but governments rarely collaborate to create consistent, modern frameworks. Instead, they layer regulations on top of each other, making things more complex. What would be incredibly beneficial is if regulators could get together across a region and agree on a more appropriate and streamlined framework."

Industry Association stakeholder

7.B. Enabler 2: Financing

Stakeholder perceptions and insights

Readiness: Financing is widely recognized as key to critical mineral value chains development – a necessary component to subsidise all other enablers. Funding availability varies by investor type and investment target but is often held back due to perceptions of a high-risk environment and slow returns. While some stakeholders note increased funding due to rising interest and supportive policies, others report a slowdown based on risk. All feel a shortfall gap exists, with current investment unable to meet the demand for growth.

"At the moment, financing does not work well. Financing issues are complex and difficult. There is a lack of means to conduct in-depth research to estimate reserves and resources, to value them, and to secure concrete investments. The state does not have sufficient resources to invest, yet investors want guarantees to reduce risk."

Government stakeholder, Super Region

General financing priorities:

- De-risking of the investment landscape (political, logistical, social, etc.) and demonstration of the value of investment in critical mineral projects (a view expressed by private sector specifically)
- Examining levers to improve cost competitiveness in regions with higher investment costs (e.g. operational efficiencies, production volumes, investments in tech, etc.)
- Aligning contributions to mining operations with broader national/regional development needs in order to expand future investment opportunities in the region

Specific priorities:

- Investment is required **across the whole critical minerals value chain**, from upstream operations (exploration, development, extraction) through to processing, as well as underlying infrastructure support.
  - **Exploration:** critical as sector is dependent on discovery, but considered extremely high risk due to potential lack of returns
  - **Processing:** governments in supplier regions have a noted preference for increased mid- and downstream capabilities within their country, but stakeholders outside of supplier countries are unclear how to make this approach cost effective, preferring a "critical minerals without borders" approach. Some encourage **regional approaches with built-in compensation mechanisms** so that supplier countries can also benefit from post-extraction returns
  - **Infrastructure:** fundamental to unlocking value within critical mineral value chains but requires large up-front costs that impact investor ROI

Support needed:

Types of financing:

- **Patient capital** from long-term investors comfortable with delayed returns and commodity volatility
  - E.g. private investors, state funding (e.g. across Gulf Region), seed funding, venture capital, Foreign Direct Investment, investment from development banks or global financing bodies e.g. IFC, World Bank
  - Some supplier countries may require investors to offer soft loans or predictable interest rates due to economic conditions / pace of growth
- **Flexible funding models** to attract external investment
  - E.g. Build-Operate-Transfer (BOT) arrangements between private entities and the public sector; private contracts with usage fees
- **Equity Capital Markets (ECM)** to raise funds through the selling of shares e.g. IPOs

Guardrails for financing:

- **Legal and fiscal stability and certainty** with long-term transparent policies and governance e.g. oversight of where and when funding is being spent, **anti-corruption measures**
- **Incentives and guarantees** to encourage investment by building confidence among investors around ROI
- **Collaboration across the region** to enhance market appeal
- Improved understanding among investors around investing in the critical minerals sector, **removing inaccurate perceptions** e.g. of risk levels
- **Access to data and pre-feasibility studies** to provide more precision around ROI timelines, mineral reserves, likelihood of progression
- **Frameworks defining investor involvement** to balance control vs. operational autonomy

Suggested incentives and guarantees:

- reduced ROI timings
- guaranteed floor prices
- tax rebates, tax credits
- reduced planning timelines
- accelerated depreciation schedule
- incentives for exploration (like offered in Canada, Saudi Arabia)
- strong and reliable exchange (for local investors)
- government loan guarantees

Collaboration opportunities:

- **Co-investment models and resource pooling** to spread risk and amplify impact – e.g.:
  - Governments, multilateral development agencies, and private sector partnerships
  - Public-private investment partnerships and frameworks e.g. Junior Mining Exploration Fund in South Africa
  - Multi-government (central and regional), cross-border funding, resulting in shared benefits e.g. investments in infrastructure
  - Trade partnerships with customer countries (e.g. Europe, USA)
  - Investment from downstream customers (e.g. utilities, tech, automotive companies), ensuring future supply for their needs and responsible operations
- **Investor engagement through forums and events** (e.g. FMF) to strengthen financing ecosystems

"You need to have coalitions forming around certain assets. Not least from the perspective of the asset owners / operators, so they›re hedging their bets. Who knows which way the political balls are going to bounce in the next 20 or 30 years over the life of a typical mine. I think that leadership, starting from government relationships, should connect these projects to the capital providers in the jurisdictions either from whence the capital comes, like the Middle East, and/or from whence the metal will go, like Japan or Korea."

Private sector stakeholder

7.B. Enabler 3: Infrastructure

Stakeholder perceptions and insights

Readiness: Infrastructure across many supplier regions not adequately equipped to support the future demands of critical mineral value chains. Mineral deposits are often located in remote areas with minimal infrastructure and challenging environmental conditions. Readiness varies significantly by country and mineral type. Proactively addressing these gaps can unlock substantial investment opportunities.

General infrastructure priorities:

- Risk management in infrastructure planning, especially for supply reliability, market shifts, tariff changes, disruptions (e.g. wars/conflict)
- Connecting infrastructure developments to wider community needs to ensure local benefits
- Prioritizing core infrastructure improvements that are relevant to many players across the value chain

> *"You can unlock investors if infrastructure is built... so infrastructure here is really important. Minerals without logistics are stranded assets."*
>
> ***Government stakeholder, Super Region***

Specific priorities:

- **Power:** Reliable access to electricity/energy (generation and transmission)
- **Transport:** roads/trucks, railways/trains (especially in remote areas, landlocked countries), ports/shipping fleets, air
- **Connectivity:** Internet connectivity (for communications, use of technology), digital infrastructure, telecommunications
- **Water**
- **Security**
- **Midstream infrastructure** (to boost processing capabilities in the Super Region)
- **Scientific and technical facilities**

Infrastructure as an opportunity:

- Stakeholders agree developing infrastructure is crucial but remain pragmatic that investments need to make economic sense. Money invested should result in good returns and allow for proper ongoing maintenance of infrastructure.
- If not possible to achieve this through the primary users, an opportunity presents itself to rent out or provide access to infrastructure to third parties for a fee.
- Capital gained can be re-invested into the business

Support needed:

- **Diverse investment and funding** e.g. public funds, mining companies, logistics companies, multilateral development agencies, etc.
- **Policy/strategy** developments:
  - **Political stability and regulations for anti-corruption** and effective use of funds
  - Creation and implementation of policy to **bring infrastructure up to basic standard**
  - **Align national infrastructure strategies with mining goals** and other national goals
  - Assurance of **policy implementation** on the ground
- **Risk mitigation strategies** to address supply chain disruptions and market volatility
- **Privatization of utilities** (or encouragement of other local competition) to foster flexible and responsive infrastructure development, attract investment and improve practices

Collaboration opportunities:

- **Strategic investment partnerships** to pool resources and reduce risk (with strong governance, backed by policy and regulation). Recommended models include:
  - Public-private partnerships, multilateral governmental agreements (e.g. joint infrastructure funds), involvement of multilateral development banks (to help independently manage cross-government investments), multi-sector collaboration and pre-competitive private partnerships (e.g. between mining companies, utility companies etc.)
- **Shared infrastructure models** across neighbouring countries to reduce costs and improve efficiency:
  - Example: Creating agreements to share processing/refinery infrastructure across a region to avoid additional funds and time required to build new infrastructure
  - Benefit: Offers solutions to regions with similar challenges and physical environments in a cost-effective way
  - Challenge: limited success so far due to geopolitics and competing views from nations on how to manage and maintain operations across countries
  - Opportunity: member organisations could create best practice guidelines for mining infrastructure collaboration and facilitate practical application; Mineral-specific collaborations may be considered
- **Engagement with and participation from communities** to ensure infrastructure needs meet local requirements and avoid opposition on the ground

" Private-Public Partnerships in terms of infrastructure. In Botswana, for instance, we are a small country, so we don't have a lot of airports. But two of them were built by the diamond mines, but then they are regulated and managed by the State because the diamond mines build them to move the product, but they don't fly every day. So, while they are not flying, they can be used by anybody else. They got two airports by saying, look, as part of the deal, you build them, we will look after them and regulate them from there and after then they become assets for everyone else."

Private sector stakeholder, Super Region

7.B. Enabler 4: Sustainability and Traceability

Stakeholder perceptions and insights

Readiness: Difficult to assess objectively due to lack of consistent measurement and reporting. Maturity perceived to vary greatly according to governance, infrastructure and technology adoption. Stakeholders feel sustainability performance is improving and increasingly prioritized but progress is often localised and there is consensus that more needs to be done to ensure responsible practices are well understood, integrated and adhered to.

General sustainability priorities:

- Leadership and commitment from industry and governments to prioritise sustainability
- Creation of pragmatic sustainability standards
- Approaches that enable participation from players of all sizes and maturity levels
- Robust governance (monitoring, evaluation, reporting) to track progress and ensure compliance and accountability
- Market incentives (e.g. premiums) for sustainably produced minerals
- Addressing sector's poor reputation around environmental and social impacts

Specific priorities:

- **Resource use** – water, energy, re-use/circularity, etc.
- **Community:**
  - **Participation** – meeting community expectations and needs, involvement in decision making
  - **Safety** – H&S in the workplace, avoidance of crime, violence, sexual harassment etc. especially for women and children
- **Social license to operate**
  - Demonstrating development impacts and value of sustainability
  - Appropriately balancing local job creation and use of new technologies (e.g. AI, automation, robotics, etc.)
  - Ensuring prosperity beyond the life of the mine
- **Legacy issues** accountability and remediation
- Post-mine land reclamation/**rehabilitation**
- Protection of **biodiversity**
- Improving standards among **artisanal miners** e.g. in the DRC
- **Transparency and traceability** in sourcing, supply chain, price, investments

Support needed:

- **Mindset change** to show sustainability as continuous commitment through education and integration into operations
- **Policy creation and implementation** for environmental and social topics
- **Monitoring and good governance** to ensure accountability and responsible practices
- **Best practice guidelines** for responsible approaches that are **locally relevant** to supplier regions
- **Expertise and resource** to tackle sustainability topics – especially for smaller organizations
- **Investment in technologies** that support sustainable practices (e.g. decarbonization tech, traceability) and monitor/ensure compliance (e.g. drones, satellite imaging and AI) in a cost-effective way
- **Customer demand** to encourage sustainable practices

"Sustainability is a process. It's not an on and off thing that you decide to do today, and after one month you will complete. It's a continuous process and you have to change the culture and the thinking of people, make it one of your daily work."

Government stakeholder, Super Region

For sustainability standards:

- **Alignment** on which standards to use/prioritize – streamlining or consolidating
- **Adaptability** of standards to reflect local needs and capacity realities
- **Inclusion of smaller players** in standard setting dialogues to ensure realistic goals
- **Roadmaps and practical guidance** to help implement and achieve standards
- **Governance** and assurance that standards will be followed

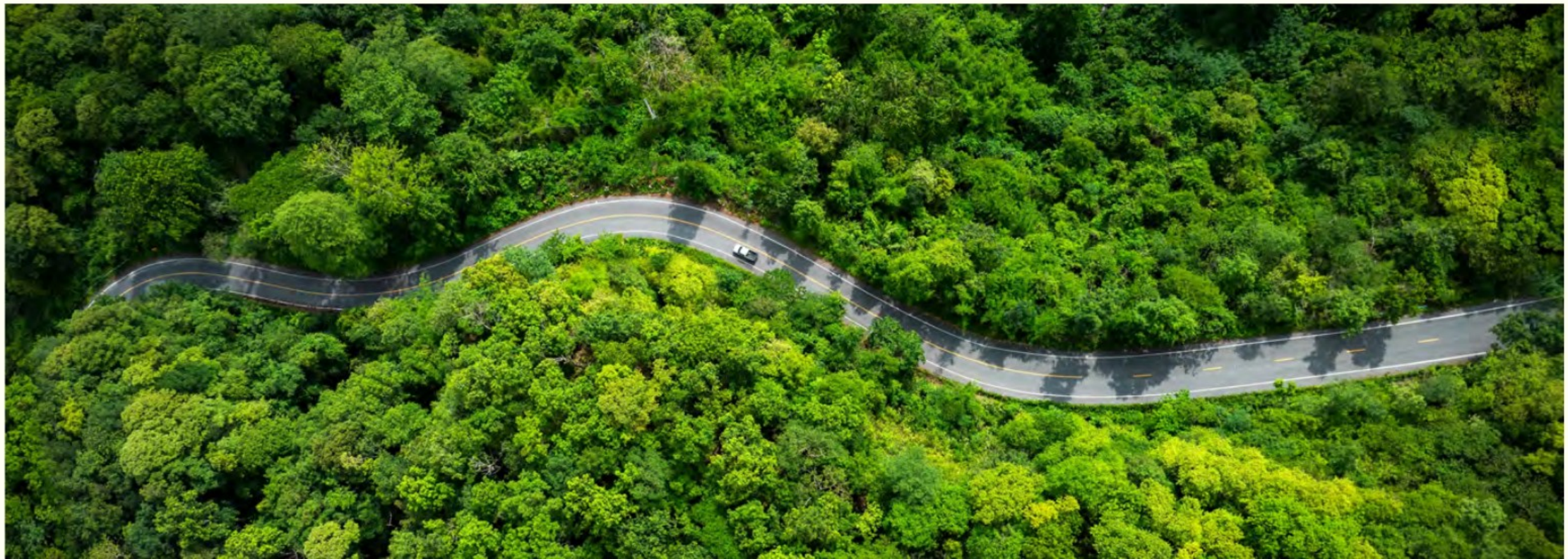
Collaboration opportunities:

- Foster **public-private-community dialogue** to create/maintain social license to operate, ensure shared value
- **Collaborate with technology providers** to implement monitoring solutions and enhance transparency
- **Co-develop sustainability standards with regional stakeholders** to ensure relevance and feasibility
- **Harmonize standards** across the Super Region to reduce complexity and improve compliance
- Form **industry-led coalitions to set realistic and actionable sustainability benchmarks.**
- Form public-**private partnerships to ensure accountability** and responsibility
- **Engage customer regions** to align expectations and promote sustainable sourcing

Encourage active participation in international sustainability-focused organizations e.g. ICMM, EITI or create new, regional ones that are aligned but more localized – such as the FMF-SASO-ISO led development of an international traceability standard for copper

"The proliferation of [sustainability] standards is a real problem - my members talk about auditors in their offices every week. Each customer wants a different kind of standard, and it's just a pain. It's great to have standards, but they need to be respected, not just set up for the sake of it. Third-party verifiable assessments are really important, but maybe we need a little consolidation."

Private sector stakeholder, Super Region



7.B. Enabler 5: Talent Development

Stakeholder perceptions and insights

Readiness: Consensus that a significant global talent gap exists. While expertise is available, current levels are considered insufficient to meet future needs and the industry's negative image makes it difficult to attract younger generations. In supplier regions, local capacity building is inconsistent, requiring tailored solutions. Many see enormous potential in multi-stakeholder partnerships in this space.

Talent development Priorities:

- Continuous learning/upskilling of existing/future workforce aligned with industry advancements
- Diversity of voices and expertise in education to attract wider talent pool
- Broad-based capacity-building across related stakeholder groups e.g. government, operators, suppliers, communities, civil society
- Improving the reputation of mining and the working environment to attract best talent

Specific priorities:

- Sustainable mining approaches, the importance and business value of ESG
- New technologies e.g. AI, automation, robotics, digital, data science, etc.
- Mid- and downstream expertise (esp. processing) in countries that have traditionally focussed on upstream activities but have economic development plans that aspire for more value creation
- Interdisciplinary knowledge to diversify skills e.g. management of projects and people

Support needed:

Talent Development:

- **Investment** in education infrastructure, educators, scholarships and job guarantees
- **STEM education** at graduate/higher level e.g. geologists, engineers, as well as primary education/ school age
- Availability of **more relevant courses** in the supplier regions' higher education system or access to pre-existing courses available internationally e.g. via student exchange or study abroad programmes, online learning
- Policy that enables **student and labour mobility**, harmonised across the supplier regions
- Accessing/leveraging **expertise from other sectors** (e.g. oil and gas), regions and institutions
- Collaboration via **international partnerships** (which requires the removal of bureaucratic barriers and competitive environment)

Talent Attraction:

- **Rebranding of the sector** to alter negative, outdated perceptions (e.g., highlighting mining's future-focused roles in the energy transition, technology, and innovation)
- Sharing pathways for growth, mobility, and skill-building to **demonstrate personal benefits** of working in the sector
- **Inclusive and attractive work environments** to diversify applicants and workforce
- **Partnerships with global institutions** to offer international exposure and career mobility

> *"What motivates [young people] most in choosing their career path is feeling like it's an opportunity to make a difference in the world. There›s a wonderful story to tell there and it›s not being told very well and certainly hasn't reached the full public perception."*
>
> ***Thought leader/ academic stakeholder***

Collaboration opportunities:

- **Government-private-academic partnerships** are viewed as having enormous potential
  - Can **leverage existing academic networks** for active collaboration e.g. the Society of Mining Professors.
- **All players have something to offer** – sharing knowledge/expertise/resources/labor, providing funding or pooling of financial resources, co-developing talent pipelines (e.g., university-mining company collaborations)
  - **Ensure well-defined roles and responsibilities** for all involved with accountability mechanisms
- **Knowledge sharing may occur at multiple levels** – e.g. via Centers of Excellence, academic institutions, industry events, formal/informal expert networks, talent exchanges (educator or student)
- **Global/regional hubs** could be created via strategic international partnerships with well-equipped universities
  - Anchor around a key criterion to ensure focus e.g. a particular commodity, region, skill, etc.
  - Promote and encourage their use once set up

"For all of us, it behoves us to try to and build a collective environment in which we can develop and expose the right young talent... how can we really be thinking about this as a collective, not an individual. You see talent development so locked within [specific companies]. We miss the connectivity. Something from the oil and gas sector that I've always really valued that mining doesn't do very well is that we don't collaborate with each other very openly."

Private sector stakeholder

7.B. Enabler 6: Technology

Stakeholder perceptions and insights

Readiness: While the right technologies largely exist, their availability, accessibility and implementation are limited across supplier regions, particularly in Africa. Technology is seen as critical for sector growth, enhancing efficiency, speed, sustainability, safety and job attractiveness. However, high investment costs and limited availability of knowledgeable operators can hinder adoption.

Technology priorities:

- Optimization and efficiencies in operations across the value chain utilizing AI and automation
- Alignment with national economic development strategies with a focus on prioritised challenges
- Responsible balancing of new technologies and job creation/protection
- Timely adoption and implementation, focusing on a more proactive approach vs. slower paced and reactive

"AI and robotic process automation are becoming major competitive factors. Mining companies need to internalize AI to optimize operations like grinding and processing. In exploration, AI will also be key - improving drilling, geometallurgy, and geomechanical models. It's going to be a critical determinant, and we need to train talent to work in these areas."

Private sector stakeholder, Super Region

Specific priorities:

- **Exploration** – surveying, accelerating discovery timelines and improving safety, speed, efficiency, and quantification (helping to de-risk investment)
- **Sustainability** – supporting decarbonization, water and energy efficiency, 'smart' mining practices, renewable energy, traceability, etc. Important for compliance, positive impact and investment attractiveness
- **Mineral utilization** – maximizing value from mined materials and encouraging circularity e.g. critical minerals from tailings, sorting, recovery of low-grade minerals and secondary materials (e.g. scrap, waste).
- **Processing** – enhancing midstream capabilities to support desire for regional beneficiation. Cost competitiveness is key.

Support needed:

- **Upskilling** of local workforce to use technologies
- **Fostering creative environments** for innovation and ideas to flow and be shared within the workplace/sector
- **Raised awareness** of available technologies and plausible solutions
- **Adaptation** of relevant technologies from other sectors (e.g. oil and gas, space exploration)
- **Integration** of scalable effective technologies across the value chain, avoiding a fragmented tech landscape
- **Improving accessibility** by addressing **cost** (expensive if owned by third-party), **ownership** (pre-competitive environment needed), and **geopolitical** barriers
- **Ensuring stable infrastructure** (energy/internet) to support tech operations
- **Regional collaboration** on R&D, innovation, tech access and infrastructure
- **Greater investment** in tech, innovation and R&D, and **de-risking investment opportunities** to acquire the tech needed

Open access technology case study:

Saudi Arabia's National Geographic Database (NGD)

- Open-source geoscience data for the kingdom of Saudi Arabia
- Includes geological and topographic maps, mineral occurrences (MODS), surface samples data, geochemistry data, etc.
- Provides clear information to stakeholders needed for discovery and exploration in a pre-competitive environment

Collaboration opportunities:

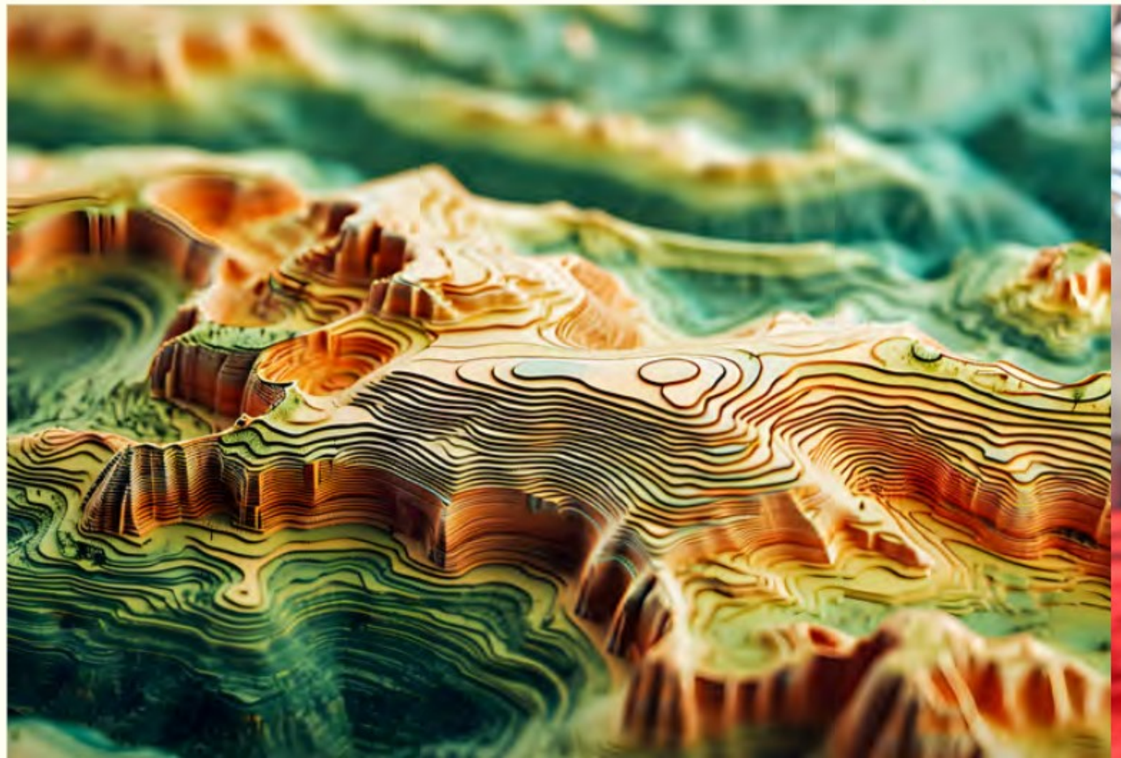
- **Leverage pre-existing technical partnerships and forums** e.g. FMF, Mining Indaba, and PDAC.
- Form **multi-actor partnerships** involving governments, investors, tech firms (established and start-ups) and mining industry e.g. Newlab x KSA Mining Innovation Studio
- **Engage with other sectors** to gain awareness of and access to existing tech solutions not yet utilized for mining

"We need innovative, multi-sector business models and stronger collaboration between governments and companies. Mining is not a good collaborator, and it's slow to adopt new technologies."

Thought leader/ academic stakeholder

Despite a strong appetite for collaboration and a recognition of the mutual benefits, uptake is limited. To enable successful collaboration and maximize technological application across the region requires:

- **Proof points:** Showcase successful collaborations to build confidence and demonstrate value – outline challenges, solutions, value, impact and mutual benefits
- **Cross-border alignment:** Agree best practice across the region to reduce competition and duplication
- **Value chain alignment:** Avoid siloed use of tech by collaborating across the value chain through integrated workflows
- **Non-competitive environment:** Promote open-source sharing to improve accessibility and cost-efficiencies; highlight mutual benefits to encourage participation from mining companies



8. FMF Dashboard: Tracking developments in the Critical Mineral Framework

Authored by:
FUTURE MINERALS FORUM

2025 Priorities

At its 2025 meeting, the FMF prioritized eight projects for further development during the year. Progress in these projects will be tracked in the FMF Barometer Dashboard.

3 **Coordination** Groups created

42 **Nominees from** governments and international organizations

131 **Experts** involved in prioritized projects

Progress Tracker

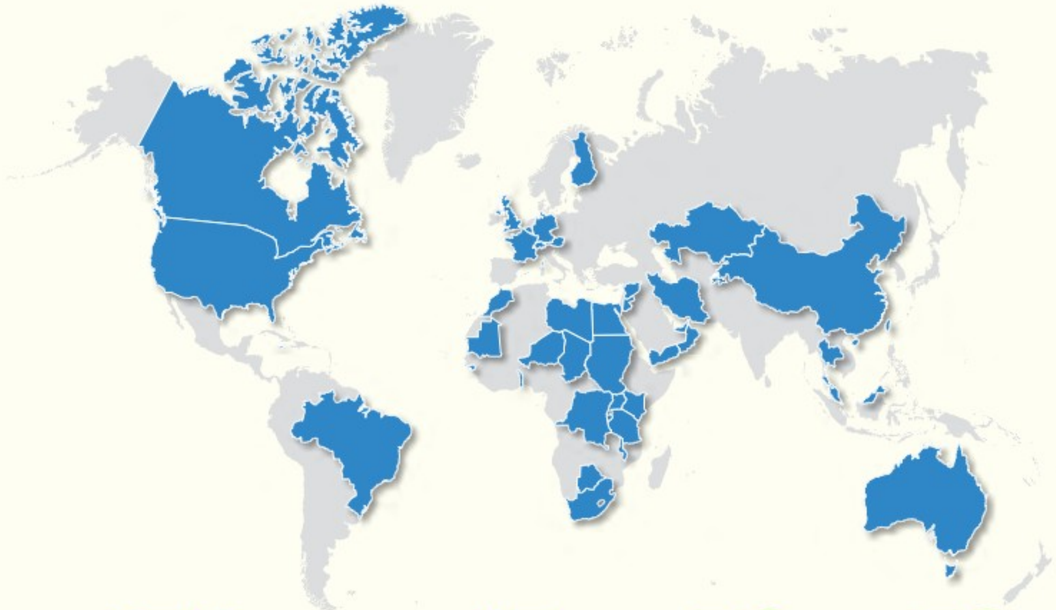
Prioritized projects	Description	Progress to date
Financing	Developing a financing mechanism in high-risk, high-return regions	
CoE: Innovation	Developing Centers of Excellence on innovation	
CoE: Policy	Developing Centers of Excellence on policy	
CoE: Talent and R&D	Developing Centers of Excellence on people and talent	
CoE: Geology	Developing Centers of Excellence on geology	
CoE: Sustainability	Developing centers of excellence for sustainability	
Traceability Principles	Developing traceability principles for supplier regions	
Future Minerals Framework	Agreement on collective actions related to CMF enablers	

Sustainability

Centers of Excellence

Future Minerals Framework

8.A. FMF is driving multistakeholder collaboration



131 Total participants across three coordination groups

47 Critical Minerals Framework

32 Sustainability

52 Centres of Excellence

22 **Multilateral organizations, NGOs and companies**

Multilateral

IGF, ISO, OECD, United Nations, UNEP, UNIDO, The World Bank

NGOs

CMRA, IHRB, IRMA, ICMM, Development Partner Institute

Companies

AngloAmerican, CMOC, Glencore, KAZ Minerals, Manara Minerals, RioTinto, Trafigura, TÜV, Vale

8.B. Future Minerals Framework: Towards a grand minerals agreement

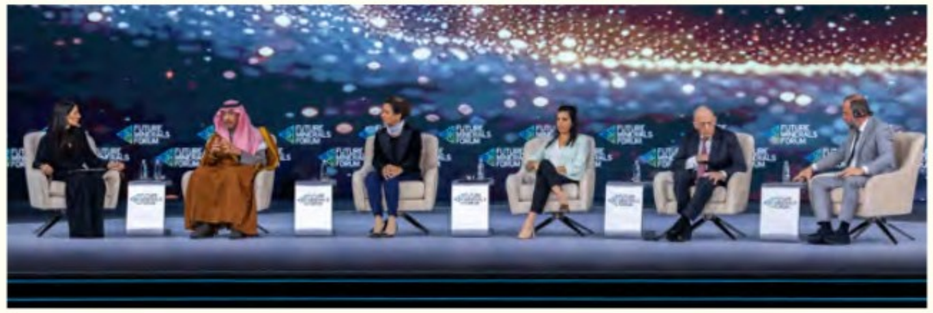
The Future Minerals Framework

The demand for minerals and metals, driven by renewable energy, digitalization, and security needs, is set to rise sharply in the coming years. This will lead nations to secure critical mineral supplies, host countries to seek fair resource benefits, and mining companies to explore new regions. Meeting this demand requires discovering new sources and collective global efforts, as resources often span borders and demand fluctuates with technological changes.

With more than 18,000 people in attendance in 2025, the Future Minerals Forum is now the leading platform for shaping the future of minerals. It brings together governments, industry leaders, and stakeholders to address supply challenges and foster collaboration. FMF's Critical Minerals Framework promotes supplier-customer partnerships, regional perspectives, and local development.

The Future Minerals Framework sets out a process for collective action, including the "Future Minerals Framework," outlines collective actions, including infrastructure funding, capacity building, and transparency through traceability and global standards.

This Framework aims to serve as a model for regional and global mineral supply initiatives.



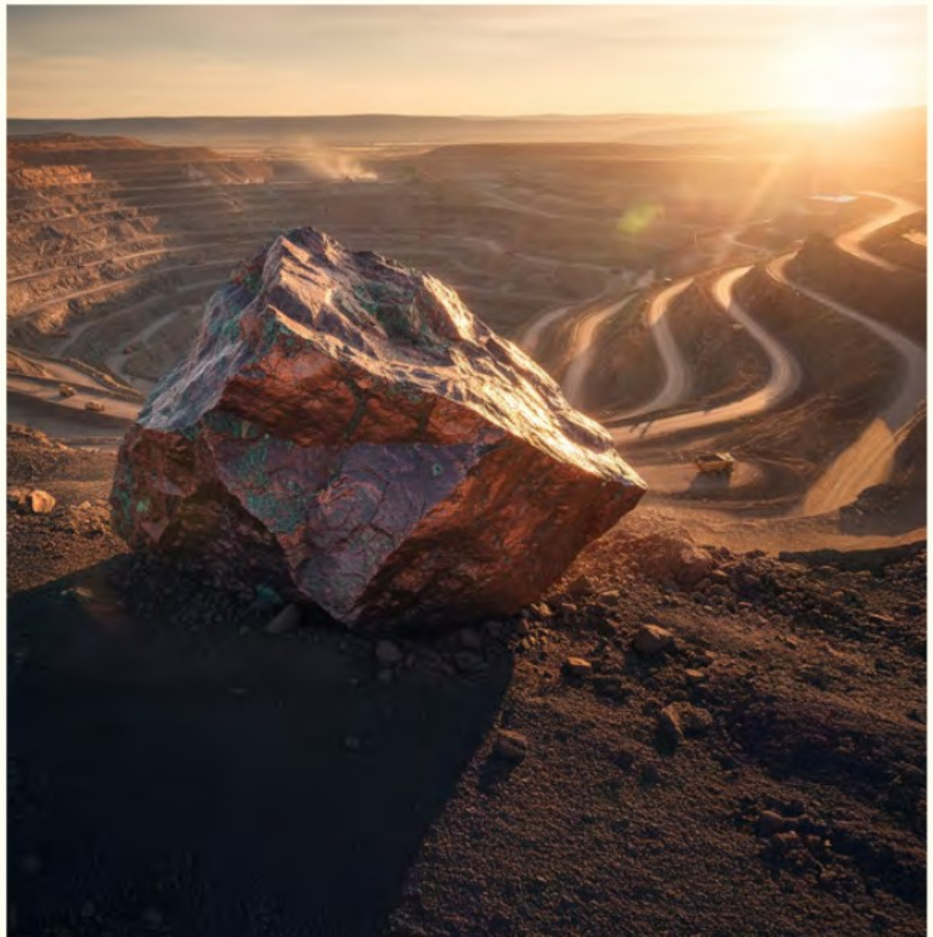
8.C. Financing

Funding Mechanism

The **World Bank** was tasked by Ministers at the 2025 FMF Ministerial Roundtable to recommend options for increasing infrastructure funding for mineral value chains and to set out partnership models for delivery. Building on this mandate, the World Bank has developed a concept note and a broader minerals strategy – the first in decades – that considers FMF priorities, initiatives and funding of mineral infrastructure across the priority corridors. These corridors, initially focused on the African Copperbelt (DRC and Zambia) and the Lithium Triangle (Chile, Argentina and Bolivia), have been identified as pilots for new partnership and funding models that can then be replicated more widely.

The objective is for the World Bank to "house" this infrastructure funding work, significantly scale up financial resources for mineral development, and invite supplier countries to enter investment "compacts" for infrastructure financing, linked to their mineral-sector strategies.

FMF and the World Bank will continue working together to engage interested countries, ensuring that infrastructure investments are aligned with national development priorities and FMF's Critical Minerals Framework.

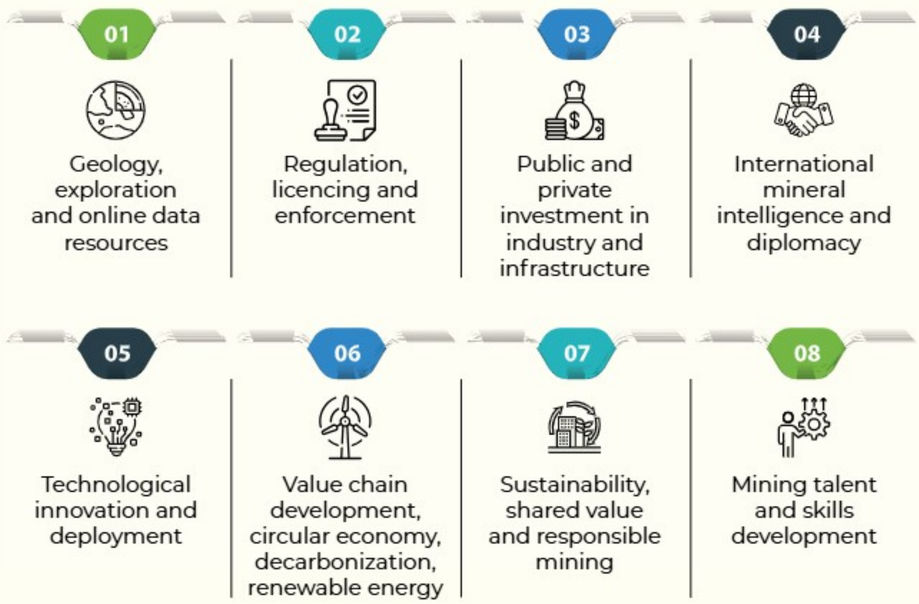


8.D. Centers of Excellence

Centers of Excellence – Value Proposition

The Centers of Excellence network serves as the foundation for developing and deploying new capabilities at scale across the supplier regions. It will build research and innovation capacity that the region does not yet possess.

Centers of Excellence offer benefits of economies of scale, access to large markets, collaborative spaces, resources and new technologies. They support commercialization of new processes and technology areas. FMF's Centers of Excellence aim to cover the following areas:



The beneficiaries of these Centers of Excellence will be governments, industry, investors, academia, geological surveys, technology companies, training providers, sustainability experts and other stakeholders.

Centers of Excellence – Status

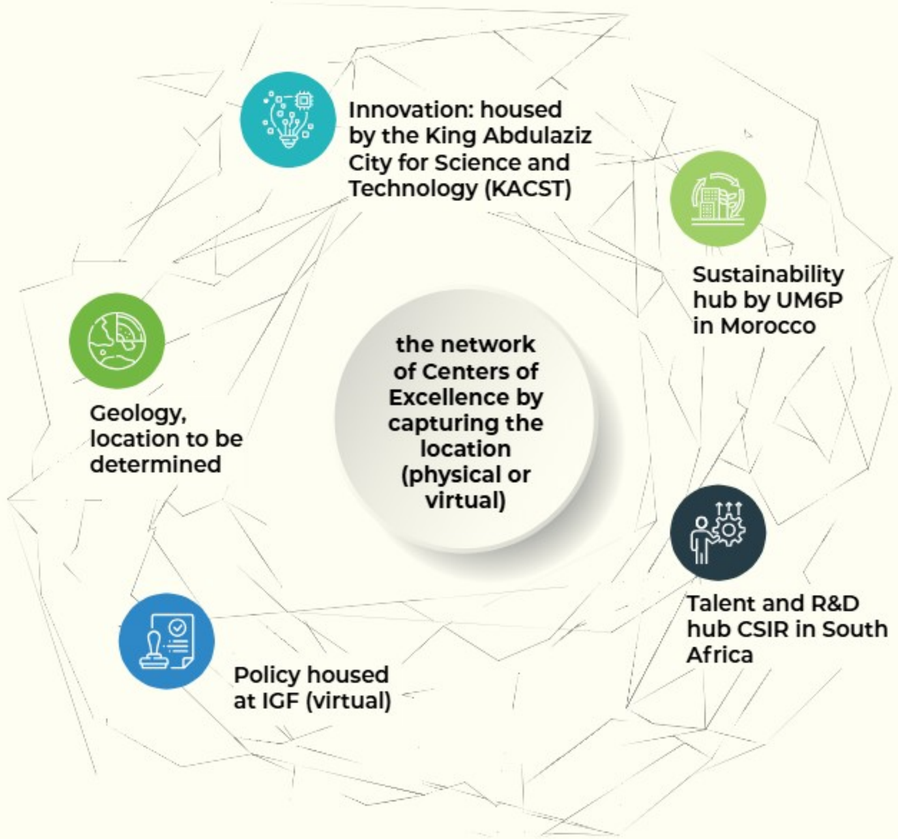
The Mineral Innovation and Acceleration Park (MIAP) is set to be the first phase in the creation of a network of centers of excellence in the Super Region, designed to foster cutting-edge research, technology transfer, and responsible mining practices. It will play a leading role in the energy transition and the responsible development of mineral and metals products, furthering the objectives of the Paris Agreement.

Five Centers of Excellence are under development: innovation, sustainability, talent and R&D, policy, and geology.

King Abdulaziz City for Science and Technology **(KACST)** is developing a proposal to house MIAP and pick up the FMF centers of excellence initiatives work. The proposal will enable partnerships to create a network of centers of excellence starting with four hubs:

1. Sustainability hub, being created in Morocco by UM6P
2. Technology hub, being created at KACST
3. Talent, research, and development hub, being created in South Africa at CSIR
4. Policy hub, being created in partnership with the Intergovernmental Forum (IGF) that will help build institutional capacity in least developed countries. The centers will be supported by the World Bank.

All 4 hubs are planned to be implemented in 2026



8.E. Sustainability

Pillars of Responsible Supply – From Rule Takers to Rule Shapers

The FMF sees opportunity for supplier countries to transition from rule takers to rule shapers by ensuring regional realities are reflected in global responsible mineral supply standards. Together with international experts, the FMF has lead development of a sustainability framework based on four pillars of responsible supply that reflect supplier country priorities.

Development

Streamlining sustainability requirements.

Promoting responsible extraction to advances economic development and prosperity.

Collaboration

Convening regional multistakeholder dialogues that build on current conversations.

Enabling partnering between governments, standards organizations and civil society to harmonize standards.

Capacity

Creating cross regional systems, defining processes, developing a skilled workforce and deploying finance.

Performance

Building societal trust through transparency, traceability, certification.

Towards an international traceability standard

Supply chain transparency of minerals coming from the Copperbelt has come under much scrutiny in recent years, largely due to the presence of artisanal and illegal mining in the region. However, the burden of complex reporting, coupled with difficult local realities makes it challenging for local players to ensure their voices are heard.

Making the mining and processing of minerals more transparent will act as a catalyst for improving the sustainability performance of local/regional organizations. It will provide governments, customers, investors and host communities with more and better information, thereby enabling decision making and strengthening investor confidence to deliver jobs, prosperity and development.

The project aims to provide the supplier region with a voice in the global conversation on sustainability, by ensuring supplier country priorities and local realities are reflected in the design of the scheme.

FMF and SASO have submitted a projects to the ISO for the development of an international traceability standard for copper to serve as a model for tracing the supply of other minerals. The outline of these Traceability Principles has been submitted to the International Standards Organization (ISO) for assessment and 'housing'.

The project is a technical specification in the DRC-Zambia Copperbelt that aims to ensure supply chain transparency, verify ethical sourcing, combat illegal mining, support due diligence, promote sustainable development, enable market access, and reduce fraud. The project aims to consolidate and simplify diverse standards.

The project advances the FMF pillars of Development, Collaboration, Capacity, and Performance, and introduces a maturity model for organizational development.

Its core principles – including transparency, integrity, continuity, verification, accountability, and adaptability – will serve as a blueprint for traceability principles in other mineral value chains and regions.

The new voluntary standard will take approximately two years to develop and will, when finished, help least developed countries design legal, policy and regulatory frameworks that enhance supply chain transparency and, ultimately, investor confidence.

8.F. Dashboard of related developments within the Super Region

Commentary

The challenges of developing critical mineral value chains are receiving increasing attention and driving the relevant stakeholders to find solutions that expedite developments and mitigate risks. The approaches taken by industry participants are noteworthy and align with FMF's Critical Minerals Framework.

FMF is collaborating with the World Economic Forum's Securing Minerals for the Energy Transition (SMET) initiative, which aims to support the development of mineral value chains needed to meet the needs of the energy transition.

In its August 2025 report on Financing Mineral Supply Chains, in collaboration with the Development Bank of Southern Africa, the World Economic Forum presented a playbook of solutions to unlock mineral value chain development in Southern Africa. These solutions align with the FMF's CMF.

Authored by:

McKinsey & Company

Tracking developments in the Critical Mineral Framework

Funding: Rawbank financing Kamoa Kakula projects

Solution

Rawbank has been a key financial partner in the development and expansion of the Kamoa-Kakula Copper Project in the Democratic Republic of Congo (DRC). The bank contributed significantly through two major financing arrangements. In 2024, Rawbank, in collaboration with FirstBank DRC SA and Absa Bank, arranged a 200$ million loan to support the third phase of the mine's expansion. This funding was directed toward increasing the mine's annual copper production to 600,000 tonnes and developing an additional 178 megawatts of hydroelectric power, which would also supply energy to the national grid. This expansion is expected to position Kamoa-Kakula as the world's third-largest copper mine, with one of the lowest greenhouse gas emissions per unit of metal produced.

In 2025, Rawbank further supported the project by securing a 400$ million syndicated loan in partnership with Absa, Africa Finance Corporation (AFC), and First Bank DRC. This financing adhered to international standards and incorporated environmental, social, and governance (ESG) requirements, reflecting a strong commitment to sustainable mining practices. The loan also included provisions to ensure local economic benefits, such as the repatriation of %60 of revenues to the DRC, which is expected to significantly boost the local economy.

Enablers in focus

Financing
Infrastructure

Funding: Lobito Corridor financing partnership

Solution

Multistakeholder Financing and Offtake Agreements in the Lobito Corridor

The multistakeholder financing of the Lobito Corridor is a transformative initiative aimed at improving the transportation of critical minerals, such as copper and cobalt, from the Democratic Republic of Congo (DRC) and Zambia to global markets via Angola's Lobito port. This project is significant for enhancing mineral supply chains, boosting regional economic integration, and supporting global sustainability goals. By reducing transport times from over 30 days to approximately 5 days, the corridor increases export efficiency, strengthens the global supply of critical minerals, and promotes clean energy solutions.

The financing structure of the Lobito Corridor involves contributions from governments, international organizations, private companies, and development banks. Key highlights include:

- **Trafigura-led Consortium:** The Lobito Atlantic Railway (LAR), led by Trafigura with partners Mota-Engil and Vecturis SA, has invested 555$ million in ongoing upgrades and plans to finalize a 533$ million loan with the U.S. Development Finance Corporation (DFC) by the end of 2025.
- **Africa Finance Corporation (AFC):** AFC is securing 320$ million in financing from Italy and has raised over 1$ billion in 2025 alone to support the corridor.
- **G7 and EU Contributions:** The total funding for the Lobito Corridor is estimated at 4$ billion, including 2.1$ billion from the G7 partnership and 500$ million from EU and U.S. private players. Additional U.S. funding of 560$ million aims to generate over 200$ million in private sector capital.
- **Special Purpose Vehicle (SPV):** A dedicated SPV has been established to manage the Lobito Atlantic Railway, ensuring efficient resource allocation and oversight.

Offtake agreements are a critical component of the Lobito Corridor's financing strategy, providing financial stability and reducing investment risks.

Key Offtake Agreements

- **Ivanhoe Mines:** Ivanhoe Mines has signed a reserve capacity agreement with the Trafigura-led consortium to ship up to 240,000 tonnes of copper products annually starting in 2024. This includes high-purity copper anodes (%99.7) from its smelter, ensuring consistent use of the corridor.
- **Kobold Metals:** Kobold Metals has signed an MOU with AFC to transport over 300,000 tonnes of copper per year from its Mingomba mine in Zambia via the Lobito Corridor.
- **Additional commitments:** AFC has secured MOUs totaling 170,000 tonnes of freight commitments from other Zambian mining projects, including Kobaloni Energy and First Quantum Minerals.

The Lobito Corridor is expected to double cargo volumes to 40,000 tons per month by 2026 and transport 1.5 million tons annually within the decade. This will significantly boost trade and economic integration between Angola, Zambia, and the DRC, creating jobs and improving infrastructure in the region. Additionally, the project supports global sustainability goals by facilitating the export of critical minerals essential for renewable energy technologies and electric vehicles.

Enablers in focus

Financing
Infrastructure

Funding: Los Azules copper in Argentina

Solution

Los Azules is progressing under a blended delivery model that combines stable policy, strategic partners, and development-finance momentum:

Policy stability: The project has been admitted to Argentina's Large Investment Incentive Regime (RIGI), giving long-term stability on taxes, currency, and imports for an ~2.7$ billion build. Environmental approvals for construction and operations were granted in late 2024.

IFC involvement: Collaboration with the International Finance Corporation (IFC) to align with IFC Performance Standards and pave the way for potential debt/equity financing, improving bankability and attracting additional capital.

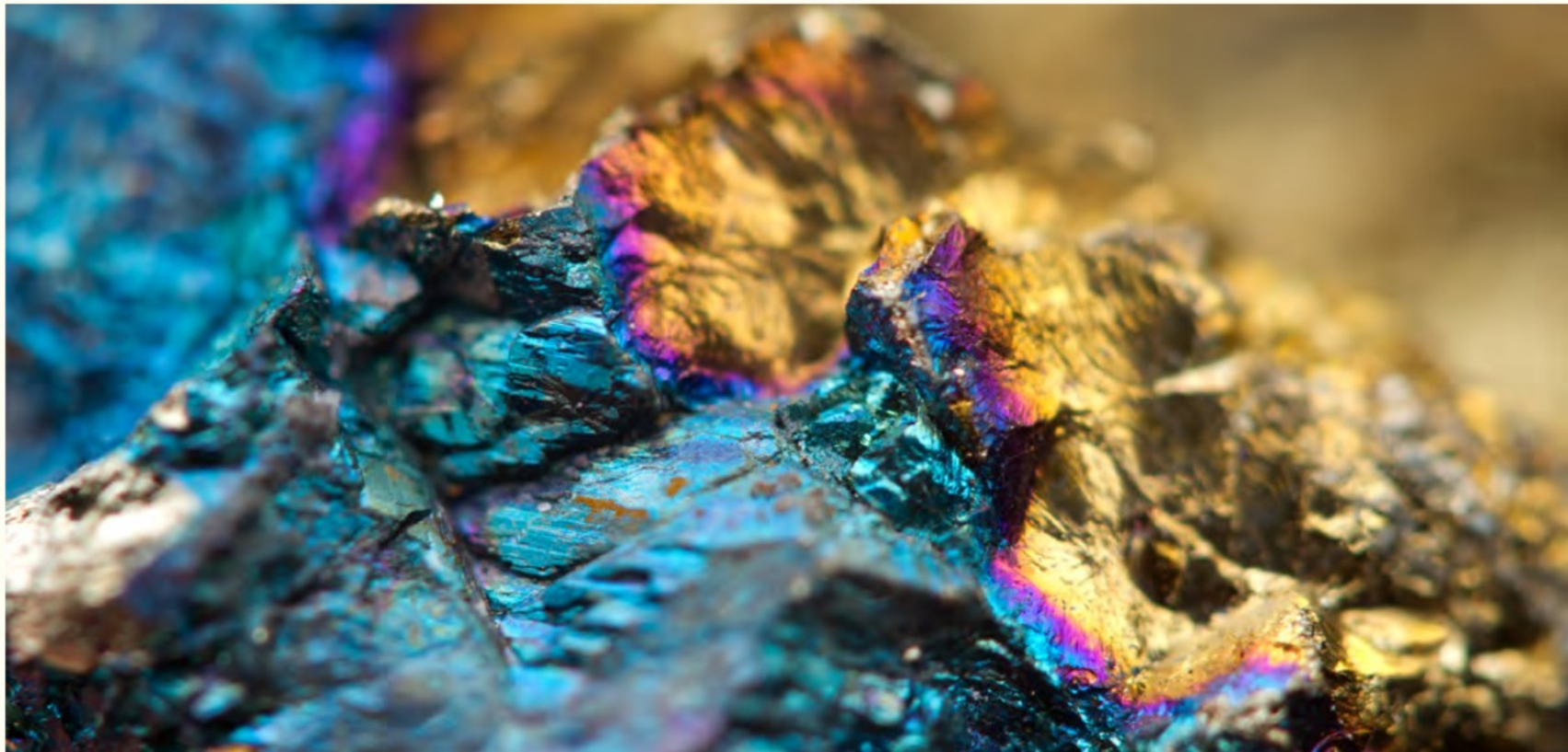
Strategic capital & offtake: Stellantis invested **US155$ million** and secured purchase rights (including a minimum of ~10 kt per year), anchoring future sales. **Rio Tinto's Nuton** added **US35$ million** and is helping deploy lower-impact leaching to make **high-purity copper** on site.

Project readiness: A 2025 feasibility study indicates a long-life, competitive cost profile. The base plan targets construction from 2026 and first production around 2029-2030.

Enablers in focus

Financing
Policy

9. Next Steps



Where Do We Go Next?

Multistakeholder collaboration can unlock the development of critical mineral value chains within the Super Region, to supply local and global needs, while addressing concerns related to transparency, responsible practices and engagement with local communities.

Investments in the Critical Minerals Framework's enablers will be key to future developments. FMF aims to bring international stakeholders to commit to a grand agreement around the Framework.

In practice, the Barometer and stakeholder consultation each point to a clear message: unlocking supply is less about finding 'one' constraint and more about **packaging confidence** in the form of: policy credibility, investable infrastructure, bankable financing structures, deliverable sustainability and traceability, and a workforce that can operate modern mines and processing facilities. Stakeholders consistently highlight de-risking finance through patient capital and guarantees, harmonized, enforceable policy and standards, major investment in infrastructure and technology alongside upskilling, pragmatic sustainability standards with robust governance, and rebuilding the sector's talent pipeline by addressing mining's image.

In effect, commitment to the grand agreement would involve:

1. **Continuing to invest in exploration, power, and processing facilities to meet growing demand for materials.**
   - Expanding pre-competitive geoscience and open-access data models that shorten discovery timelines and improve investability.
   - Prioritizing 'anchor' corridor infrastructure (power and transportation) that unlocks multiple mining and refining assets, and strengthens cost competitiveness across the value chain.
2. **Enhancing regulatory frameworks and reducing bureaucratic hurdles to streamline project approvals.**
   - Focusing on clarity and predictability: long-term rules, consistent enforcement, and governance that reduces perceived risk premiums.
   - Pursuing cross-border alignment where value chains and infrastructure span borders, reducing duplication and conflicting requirements.
3. **Expanding skill-building programs and technology transfer initiatives to support the critical minerals value chain.**
   - Treating talent as a binding constraint: upskilling, STEM and sustainability education, mobility-enabling policy, and international learning opportunities.
   - Resetting the sector narrative to attract younger, more diverse talent, positioning mining as future-focused (energy transition, technology, and innovation), and making career pathways visible.
   - Moving from 'technology exists' to 'technology adopted': lower barriers through proof points, cross-border alignment, integrated workflows across the value chain, and open-source sharing where appropriate to improve accessibility and cost-efficiency.
4. **Strengthening international collaboration and partnerships to share resources, expertise, and best practices.**
   - Using partnership structures that pool resources and reduce risk (public-private partnerships, multilateral agreements, multilateral development bank participation, and pre-competitive collaborations) and codifying best-practice guidance to speed replication.
   - Advancing the Critical Minerals Framework as the vehicle for collective action explicitly covering infrastructure funding, capacity building, and transparency through traceability and global standards.
5. **Promoting sustainable and responsible mining practices to address environmental and social concerns.**
   - Setting pragmatic sustainability standards paired with monitoring, evaluation, reporting, and accountability mechanisms; enable participation across different maturity levels and consider market incentives for sustainably produced minerals and metals.
   - Treating community participation as a design input for projects and infrastructure, reducing opposition risk and strengthening social legitimacy.

Dawn of a Global Cause

The 2026 edition of the Future Minerals Forum aims to continue driving action to impact by:

- Developing the Riyadh innovation hub
- Strengthening global collaboration through regional forums
- Expanding the Centers of Excellence network while strengthening existing ones
- Campaigning to generate a new narrative on minerals and addressing the poor industry reputation

The Ministerial Roundtable will focus on leadership, action and new voices, with "Minerals for a new era of development" as its central theme.

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References

1. Afriwise / Chibesakunda & Co. (2025). Zambia's new mining law: Key insights and practical recommendations for investors under the Minerals Regulation Commission Act, 2024.
2. ARE (Autorité de Régulation de l'Électricité, RDC). (2022). Rapport annuel 2022.
3. ARE (Autorité de Régulation de l'Électricité, RDC). (2023). Rapport annuel 2023.
4. Assemblée Nationale du Burundi / Ministère de l'Énergie et des Mines. (2021). Décret no. 086 du 19 octobre 2020 portant missions, organisation et fonctionnement du Ministère de l'Hydraulique, de l'Énergie et des Mines.
5. Assemblée Nationale du Burundi / Office Burundais des Mines. (2023). Ordonnance ministérielle conjointe N°760/540/1443.
6. Assemblée Nationale du Burundi / Présidence du Burundi. (2022). Décret no. 100-022 du 3 mars 2022 portant révocation du permis d'exploitation du nickel et minerais associés – Musongati.
7. Assemblée Nationale du Burundi / Présidence du Burundi. (2023). Loi no. 1-19 du 4 août 2023 modifiant la loi no. 1-21 du 15 octobre 2013 portant Code Minier du Burundi.
8. Assemblée Nationale du Burundi / Présidence du Burundi. (2024). Décret no. 100-030 du 16 février 2024 portant modification du décret no. 100-086 du 19 octobre 2020.
9. Assemblée Nationale du Burundi / Présidence du Burundi. (2024). Décret relatif au Ministère de l'Énergie et des Mines (2024).
10. Biden White House Archive / PGII Initiative. (2024). Fact sheet: Partnership for Global Infrastructure and Investment – Lobito Trans-Africa Corridor.
11. BNamericas. (n.d.). Spotlight: Highlights of Chile's US$54 bn portfolio of rail investments.
12. Botswana Government – Ministry of Minerals & Energy. (n.d.). Minerals permit information.
13. Botswana Government – Ministry of Minerals & Energy. (n.d.). Mining licence application information.
14. Botswana Ministry of Mineral Resources, Green Technology and Energy Security. (n.d.). Minerals permit information.
15. BridgeWeb. (2024). Guinea: Final T-beam completes rail line's 21 bridges.
16. Business & Human Rights Resource Centre. (2023). Rwanda: Gov. agency cancel mining licences over breach of mining laws incl. safety, environmental and labour standards.
17. CAF (Development Bank of Latin America). (n.d.). CAF approves USD 700 million to modernize and expand Chile's railway network.
18. Cami (Cadastre Minier, DRC). (2024). Arrêté ministériel no. 00086 portant octroi du PR-15809 – Kamolo Mining Resources SARL.
19. CapMad. (n.d.). Rail service resumes in Madagascar.
20. CGTN Africa. (2023). Long-delayed work begins on key rail line in West Africa.
21. Chambers and Partners. (2023). Chambers Global Practice Guides – Mining 2023 (comparative jurisdictional analysis).
22. Comtrade Plus (United Nations Statistics Division). (n.d.). Comtrade Plus data portal.
23. Congo Mines (DRC). (2018). Code Minier – Loi no. 18-001 du 9 mars 2018.
24. Côte d'Ivoire – Ministry of Mines, Petroleum and Energy. (2015). Nouveau code minier de la Côte d'Ivoire.
25. Daily News Tanzania. (n.d.). CADFund announces plan to upgrade TAZARA.
26. Datamar News. (n.d.). Argentina's Belgrano Cargas undergoes major revamp with help from China.
27. DHL Group. (2024). DHL Global Connectedness Report 2024.
28. DroitAfrique. (2021). Code de l'environnement du Burundi (2021).
29. DroitCongolais.info. (2019). Arrêté du 22 février 2019 – Taxes du Ministère des Mines.
30. DroitCongolais.info. (2023a). Arrêté interministériel du 4 août 2023 portant réglementation de la commercialisation des produits miniers.
31. DroitCongolais.info. (2023b). Arrêté ministériel portant réglementation des activités des entités de traitement.
32. DroitCongolais.info. (2023c). Décret du 9 juin 2023 – Inspection générale des mines (IGM).
33. Ecofin Agency. (2025, August 31). Sustainable mining finance: DRC's Rawbank held up as an example by the World Economic Forum.
34. EHSAfrica Logistics. (2024). New mega railway project: Trans-Kalahari Railway set to kick off in 2025.
35. Energy Regulation Board of Zambia. (2021). Energy Sector Report 2021.
36. Energy Regulation Board of Zambia. (2022). Energy Sector Report 2022.
37. Energy Regulation Board of Zambia. (2023). Board decision on ZESCO's application to adjust electricity tariffs for 2023–2027.
38. Energy Regulation Board of Zambia. (2024). Annual report 2024.
39. Energy Regulation Board of Zambia. (n.d.). Approved ZESCO multi-year tariffs 2024–2027.
40. Energy, Environment and Natural Resources Research Institute (IWEP), Chinese Academy of Social Sciences. (2024). World Openness Report 2024.
41. Environmental Management Agency of Zambia – ZEMA. (2013). Environmental Management (Licensing) Regulations, 2013.
42. European Commission – Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. (2024). Critical Raw Materials Act.
43. FAOLEX / FAO Legal Office. (2023). Décret n° 23/08 du 22 février 2023 portant manuel des procédures relatives aux transactions sur les actifs miniers des entreprises publiques.
44. FAOLEX / FAO Legal Office. (n.d.). DRC legal documents – mineral sector taxation.

45. FAOLEX / FAO Legal Office. (n.d.). Environmental management regulations – United Republic of Tanzania.

46. Global Construction Review. (2023). Work starts on US$1.7 bn iron-ore rail and port scheme in Guinea.

47. Government of Burundi / OBM (Office Burundais des Mines). (2022). Politique minière du Burundi.

48. Government of Burundi / OBM (Office Burundais des Mines). (2023). Décret N°100-224 relatif aux opérations minières.

49. Government of Burundi / OBM (Office Burundais des Mines). (2023). Ordonnance ministérielle conjointe N°760/540/1443.

50. Government of Burundi – Ministère de l'Environnement. (2023). Code de l'environnement du Burundi (2021 consolidated edition).

51. Government of Burundi – Ministère de l'Hydraulique, de l'Énergie et des Mines. (2024). Décret portant modification du décret N°100-086 du 19 octobre 2020.

52. Government of Burundi – Présidence de la République. (2023). Code minier du Burundi (2023 edition).

53. Government of Guinea – Direction Générale des Douanes. (2024). Code minier RG-213.

54. Government of Liberia – Environmental Protection Agency. (2022). Updated Nationally Determined Contribution (NDC), 2022.

55. Government of Liberia – Liberia Land Authority. (n.d.). Policies, laws, and regulations repository.

56. Government of Liberia – Liberia Revenue Authority. (2022). Module 13: Natural resource taxation.

57. Government of Madagascar – Ministry of Environment. (2023). Legal framework for environmental and social impact assessment in the mining sector.

58. Government of Namibia – Ministry of Mines and Energy. (2019). Minerals Policy of Namibia.

59. Government of Namibia – National Planning Commission. (2021). Updated Nationally Determined Contribution (NDC), July 2021.

60. Government of Rwanda – Ministry of Environment. (2021a). Ministerial Order No. 001/2021 establishing environmental requirements.

61. Government of Rwanda – Ministry of Environment. (2021b). Ministerial Order No. 002/2021 relating to environmental protection and management.

62. Government of Rwanda – Official Gazette. (2023). Government Gazette No. 49 of 11 December 2023.

63. Government of Rwanda – Official Gazette. (2024). Special Gazette of 24 July 2024.

64. Government of Rwanda – Rwanda Mines, Petroleum & Gas Board. (2022). Gender Strategy for Rwanda's mining sector.

65. Government of Rwanda – Rwanda Mines, Petroleum & Gas Board. (2024). Mining sector regulatory document No. 101823.

66. Government of Rwanda – Rwanda Mines, Petroleum & Gas Board. (2024). Mining sector regulatory document No. 67534.

67. Government of Rwanda – Rwanda Parliament. (2018). Law No. 48/2018 of 21 September 2018 – Environment law.

68. Government of South Africa – Department of Mineral Resources and Energy. (2014). White Paper on Minerals and Mining Policy.

69. Government of South Africa – Department of Mineral Resources. (1998). Minerals and Mining Policy of South Africa (Green Paper).

70. Government of the Republic of Guinea – Ministry of Mines. (2024). Code Minier de la République de Guinée (2024 edition).

71. Government of the Republic of Liberia – Liberia Land Authority. (n.d.). Policies, laws, and regulations repository.

72. Government of the Republic of Namibia – Ministry of Mines and Energy. (2019). Mining sector policy framework.

73. Government of the Republic of South Africa. (n.d.). Mining licensing portal.

74. Government of the Republic of Zimbabwe – Ministry of Finance. (2022). Finance Act 2022.

75. Guinea Ministry of Mines. (2024). Code Minier RG 213.

76. InfoAmazonia. (n.d.). Ferrogrão railway line impacts on indigenous lands and conservation units.

77. Institute of World Economics and Politics, Chinese Academy of Social Sciences. (2024). World Openness Report publications and releases.

78. International Energy Agency. (n.d.). Countries and regions.

79. International Finance Corporation. (2025). IFC supports McEwen Copper on sustainable financing for Los Azules.

80. International Monetary Fund. (2024). Article IV consultation – Democratic Republic of Congo.

81. International Monetary Fund. (2024). Article IV consultation – Guinea.

82. International Monetary Fund. (2024). Article IV consultation – Sierra Leone.

83. International Monetary Fund. (2025). World Economic Outlook database, April 2025.

84. International Renewable Energy Agency (IRENA). (2025). Renewable capacity statistics 2025.

85. International Tin Association. (2023). Uganda clarifies minimum tin export grade.

86. Ivanhoe Mines Ltd. (2023). Ivanhoe Mines exports commence from Kamoa-Kakula Copper Complex along Lobito Atlantic rail corridor.

87. Ivanhoe Mines Ltd. (2024). Ivanhoe Mines exports commence from Kamoa-Kakula Copper Complex along Lobito Atlantic rail corridor.

88. IWEp – Chinese Academy of Social Sciences. (2024). World Openness Report 2024.

89. Leganet (DRC Official Gazette Portal). (2019). Taxes du Ministère des Mines — Arrêté du 22 février 2019.

90. Leganet (DRC Official Gazette Portal). (2020). Journal Officiel – 1 May 2020 edition.

91. Leganet (DRC Official Gazette Portal). (n.d.). Legislation archive – economic law: Code Minier (2018).

92. Lloyds Bank. (n.d.). Lloyds Bank Trade portal.

93. Lobito Atlantic Railway. (n.d.). Lobito Atlantic Railway – corporate site.

94. Madagascar Analyst Liberia Online. (n.d.). Where is HPX–Ivanhoe's $5 billion Liberty Corridor project?

95. Madagascar – Ministry of Environment. (2022). ESIA legal framework for the mining sector.

96. Mayer Brown LLP. (2015). Côte d'Ivoire: New Mining Code – Overview.

97. McEwen Mining Corporation. (2023). McEwen Copper closes ARS 42 billion investment by Stellantis.

98. McEwen Mining Corporation. (2024). McEwen Copper secures environmental permit for construction and operation of Los Azules.

99. McEwen Mining Corporation. (2025). Los Azules feasibility study confirms economically robust copper project with leading ESG performance.

100. McKinsey & Company – MineSpans

101. McKinsey & Company. (2025). Global Materials Perspective 2025.

102. McKinsey Global Institute. (2025, January 27). Geopolitics and the geometry of global trade: 2025 update.

103. Mining Zimbabwe. (2023, May 9). Simplified: The new Base Minerals Export Control Act.

104. Ministry of Mines & Minerals Development, Zambia. (2022). National Mineral Resources Development Policy (2022).

105. Ministry of Mines & Minerals Development, Zambia. (2025). Geological Minerals Development Act (Act No. 2 of 2025).

106. Ministry of Mines & Minerals Development, Zambia. (2024). Mineral Regulation Commission Act (Act No. 14 of 2024).

107. Ministry of Mines and Energy, Namibia. (2019). Minerals policy white paper.

108. Ministère de l'Économie, République de Côte d'Ivoire. (2015). Code minier ivoirien.

109. Namibia & Botswana Railway Project (FurtherAfrica). (2023). Namibia and Botswana's Trans-Kalahari Railway construction set for 2025.

110. Namibia Ministry of Mines and Energy. (2019). Minerals Policy of Namibia (2019).

111. National Assembly of Zambia / Parliament of Zambia. (2019). The Mines and Minerals Act, 2022 (Act No. 29).

112. National Assembly of Zambia / Parliament of Zambia. (2024). Committee Report on Statutory Instruments 2023.

113. National Assembly of Zambia / Parliament of Zambia. (n.d.). National Assembly item – SI No. 2021-42.

114. National Environment Management Authority (NEMA), Uganda. (2023). NEMA to implement express penalty scheme for environmental breaches.

115. North Atlantic Treaty Organization (NATO). (2024, December 11). NATO releases list of 12 defence-critical raw materials.

116. Nuton. (2023). McEwen Copper announces an additional US$35 million investment by Nuton, a Rio Tinto venture.

117. Organisation for Economic Co-operation and Development. (n.d.). FDI flows – OECD indicators.

118. Parliament of Uganda. (2019). Act 5 of 2019 – National Environment Act.

119. Parliament of Uganda. (2020a). Statutory Instrument No. 47 of 2020 – National Environment (Audit) Regulations.

120. Parliament of Uganda. (2020b). Statutory Instrument No. 49 of 2020 – National Environment (Waste Management) Regulations.

121. Parliament of Uganda. (2020c). Statutory Instrument No. 145 of 2020 – National Environment (Environmental and Social Assessment) Regulations.

122. Parliament of Uganda. (2022). The Mining and Minerals Act, 2022 (Returned by H.E. the President).

123. Parliament of Uganda. (2023). Statutory Instrument No. 72 of 2023 – Mining and Minerals Licensing Regulations.

124. Parliament of Uganda. (2023). The Mining and Minerals Act, 2022.

125. Parliament of Uganda. (2024). Statutory Instrument No. 22 of 2024 – National Environment (Air Quality Standards) Regulations.

126. Parliament of Zambia / Government Printer. (2024). Government Gazette, No. 7671, 15 November 2024.

127. Polity / Creamer Media. (2024, February 14). Norton Rose Fulbright advises on US$200M financing for Kamoa mine expansion.

128. Rail Journal. (2023). Mozambique to complete track doubling of Ressano Garcia line.

129. RailMarket. (n.d.). Trenes Argentinos Cargas boosts rail freight capacity with infrastructure works and PPP agreement.

130. Railvolution. (2020). TRAXX Africa fleet completes 10 million km in service.

131. Railway Gazette International. (2023). Contract signed to build first railway to Burundi.

132. Railway Gazette International. (2024). Brazil National Railway Plan will reset project agenda.

133. Railway News. (2023). Chile: Contract awarded for new Santiago–Batuco rail line.

134. RailwayPro. (2023a). Tanzania to announce tender for Rwanda and Congo SGR connection.

135. RailwayPro. (2023b). Chinese firms to build Tanzania–Burundi SGR.

136. RailwayPro. (2023c). China invests USD 1.4 billion in Tanzania–Zambia railway.

137. Republic of Botswana – Ministry of Finance. (2023). Botswana Sustainable Financing Strategy (BSFS 2023).

138. Republic of Botswana – Ministry of Minerals & Energy. (n.d.). Mining licence application information.

139. Republic of Uganda – Government Printer. (2024). Government Gazette GN 2024-2917.

140. Reuters. (2023, October 4). Germany approves bringing coal-fired power plants back online this winter.

141. Reuters. (2025a, June 5). Africa Finance Corp, Italy sign $320 million deal to bolster Lobito funding.

142. Reuters. (2025b, August 20). Trafigura-led consortium aims to finalise US loan deal by end-2025.

143. Reuters. (2025c, September 26). Argentina approves McEwen's $2.7 billion copper project for tax break program.

144. Reuters. (2025d, April 24). China restricts exports of rare earths and other minerals. How does the system work?

145. RFI Afrique. (2021). Le pouvoir burundais suspend les activités minières pour renégocier tous les contrats.

146. Scribd User Submission. (2023). Travail Final.

147. Seneca ESG. (2023). South Africa prepares for mandatory ESG and carbon-neutral strategy reporting.

148. SG-Mines RDC. (2024a). Arrêté no. R-00020-0001 (2024) – Ministère des Mines.

149. SG-Mines RDC. (2024b). Arrêté no. R-00052-0002 (2024) – Ministère des Mines.

150. SG-Mines RDC. (2024c). Arrêté no. R-00071-0001 (2024) – Ministère des Mines.

151. Sierra Leone Legal Information Institute. (2023). Act No. 16 of 2023 – Mines and Minerals Development Act.

152. Sierra Leone Telegraph. (2024). Sierra Leone railway: The stolen national treasure.

153. South Centre. (2025). SV287: Mining sector policy and global governance.

154. State Council of the People's Republic of China / Xinhua. (2025, January 28). Renewable energy accounts for 56 pct of China's total installed capacity.

155. Statista. (n.d.). Mining industry in Africa – statistics and facts.

156. Stellantis N.V. (2023). Stellantis announces strategic copper investment in Argentina, reinforcing commitment to carbon neutrality by 2038.

157. Stockholm International Peace Research Institute (SIPRI). (2025, April 28). Unprecedented rise in global military expenditure as European and Middle East spending surges.

158. Tanzania Legal Information Institute. (2010). GN No. 403 of 2010 – Mining Safety, Occupational Health and Environmental Protection Regulations.

159. Tanzania Legal Information Institute. (2018). GN No. 3 of 2018 – Mining legislation amendment.

160. Tanzania Legal Information Institute. (2022). GN No. 581 of 2022 – Environmental management regulations.

161. The White House. (2024, December 3). Fact sheet: Partnership for Global Infrastructure and Investment in the Lobito Trans-Africa Corridor.

162. Trafigura Group Pte. Ltd. (2023). Concession for railway services transferred to Lobito Atlantic Railway in Angola.

163. Trafigura Group Pte. Ltd. (2024). Trafigura and Kamoa-Kakula sign agreements to become first customers of the Lobito Atlantic Railway.

164. U.S. Department of State. (2024). Investment Climate Statement: Guinea (2024).

165. U.S. International Development Finance Corporation. (2023). DFC announces investments supporting development along the Lobito Corridor.

166. Uganda Gazette / UPPC. (2019). Mining Licensing Regulations, 2019.

167. United Nations Conference on Trade and Development – Investment Policy Monitor. (2024). Adopts new mining code and implementing decree.

168. United Nations Conference on Trade and Development. (2025). State of Commodity Dependence 2025.

169. United Nations Conference on Trade and Development. (n.d.). World Investment Report.

170. United Nations Department of Economic and Social Affairs – Population Division. (n.d.). UN Data Portal – population database.

171. United Nations Framework Convention on Climate Change. (2022a). Republic of Namibia: Updated Nationally Determined Contribution (NDC).

172. United Nations Framework Convention on Climate Change. (2022b). Republic of Liberia: Updated Nationally Determined Contribution (NDC).

173. United Nations Statistics Division. (n.d.). UN Comtrade Plus.

174. University of Bristol – Legal Research Blog. (2025). Combatting human rights impacts in mining in Sierra Leone.

175. White House. (2024, December 3). Fact sheet: Partnership for Global Infrastructure and Investment in the Lobito Trans-Africa Corridor.

176. World Bank. (2023).

177. World Bank. (2025). World Development Indicators.

178. World Population Review. (n.d.). Foreign direct investment (FDI) by country.

179. Zambia Legal Information Institute. (1995). The Mines and Minerals Act, 1995 (Act No. 31 of 1995).

180. Zambia Legal Information Institute. (2022). Act No. 29 – The Mines and Minerals Act, 2022.

181. Zambia Legal Information Institute. (2023). Act No. 8 – Mines and Minerals (Amendment) Act, 2023.

182. Zambia Legal Information Institute. (2023). Statutory Instrument No. 41 of 2023.

183. Zambia Legal Information Institute. (2024). Act No. 14 – Mineral Regulation Commission Act, 2024.

184. Zambia Legal Information Institute. (2025). Statutory Instrument No. 42 of 2025.

185. Zawya. (2024). Uganda's railway eyes revival with new investment plan.

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