GLOBAL BUSINESS REPORTS

MACIG

MINING IN AFRICA
COUNTRY INVESTMENT GUIDE

2022

Dear Reader,

We are delighted to present the 2022 edition of our annual Mining in Africa Country Investment Guide (MACIG) publication, a book that spans thousands of km and hundreds of interviews to cover the continent's most prolific mining jurisdictions and their unique value chains. For the 9th edition of MACIG, we profiled 10 countries: Ghana, Burkina Faso, Mali, Nigeria, Niger, Guinea, Ivory Coast, Namibia, South Africa, and the DRC. We grouped these geographically into West Africa and Southern Africa, the first region booming with fresh discoveries, the second already home to the largest and most outstanding discoveries ever made. Finally, we dedicated a separate chapter to the DRC, which deserves a separate spot given its complex mineral and socio-economic context.

The continent's two biggest gold producers, Ghana and South Africa, each with over 100 years of mining history, have been the catalysts to broader-based investment into neighbouring countries, where juniors can get cheaper answers from exploration. Namibia, for instance, is considered one of the overall best mining jurisdictions in Africa, while Ivory Coast is one of the most prospective. In the DRC, all descriptions use the superlative form, the country boasting the biggest deposits, the highest grades, and the best mines. But investment is cordoned off by the country's reputation, which, much like a person's, often gets the last word. Going along with this metaphor, if the DRC were a person, it would be a very rich one that has not yet tapped into its inheritance: Without adequate investment, DRC's US$24 trillion estimated mineral potential is nothing but a chimera.

In West Africa, we have been observing a buoyant gold sector. Improved market conditions have turned more geological discoveries into economic ones, so exploration projects are ripe, while gold mines operate at peak capacity, keeping the services sector busy and sending more cash into national budgets. We ask how are mining companies capitalizing on the gold price? What stands behind recent M&A transactions? How are juniors advancing in terms of both equity and CAPEX financing? And how prepared is the services sector to sustain the industry's growth? We also ask how West African countries and people can benefit from the bull-run in a sustainable and equitable way, examining fair taxation and policies, downstream investments and diversification.

In Southern Africa, the upswing in commodity prices has bought a much-needed uplift in sentiment, a breath of fresh air for South Africa and Namibia whose economies have been severely hit by the pandemic. Investments came in the form of technological upgrades, the pandemic creating a strong digital pull and a mentality shift that prioritizes productivity, sustainability and transparency. We discuss the rise and fall, and potential rise again of South Africa, the world's wealthiest country for its minerals, including PGMs, base metals, gold and diamonds, but whose economy has hollowed out for years. In Namibia, a country referred to as "second only to Botswana" for its diamond richness, we analyse how its mining-dependent economy transitions during a period of contrasting fundamentals.

We'd like to thank our 200 interviewees for sharing their insights that have constituted the building blocks of this book. We hope you find MACIG 2022 as we intended it – a reliable and well-rounded investment guide to mining in the African continent. •

Alfonso Tejerina
General Manager and Director
Global Business Reports
(GBR)

WEST AFRICA

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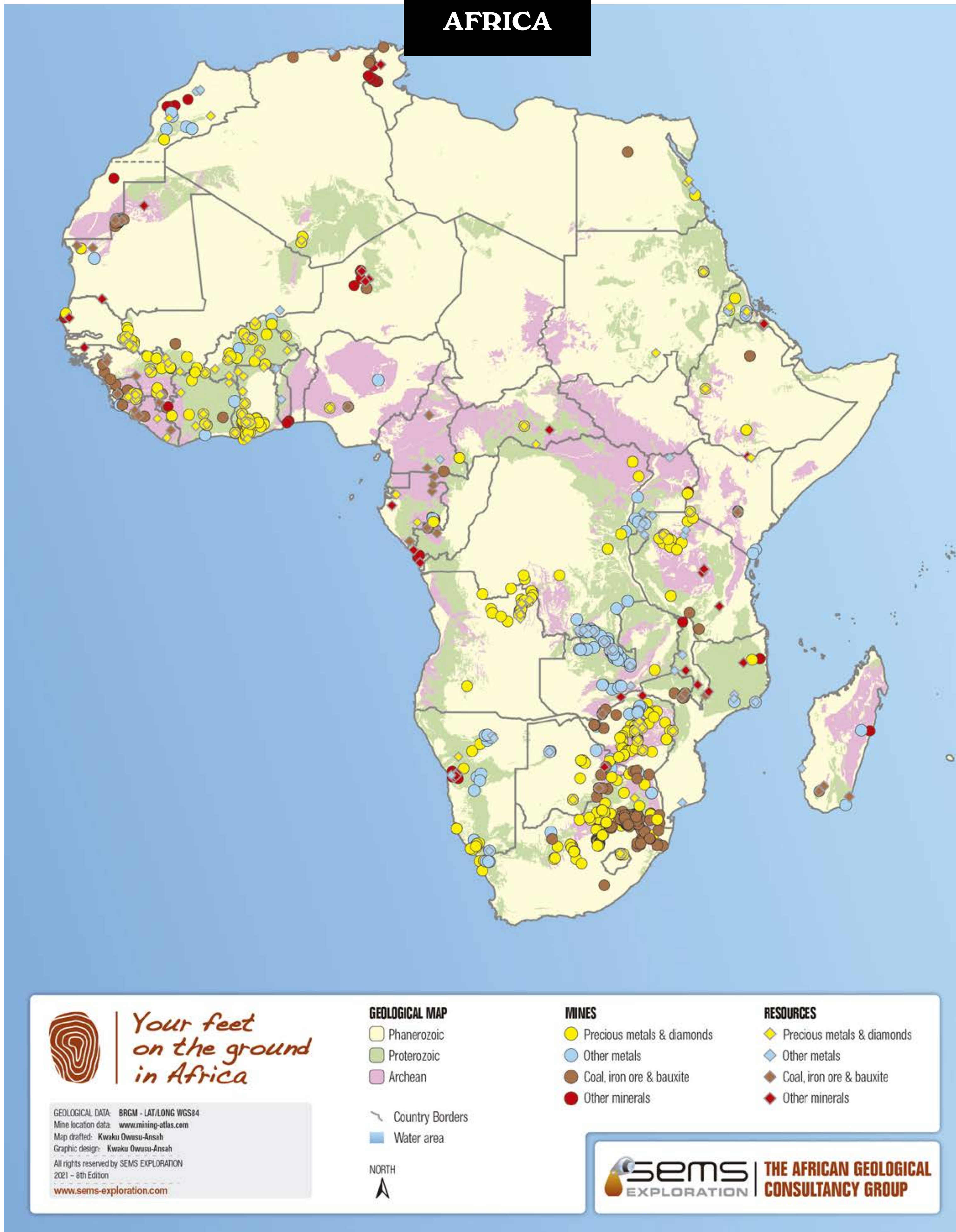
SOUTHERN AFRICA

DEMOCRATIC REPUBLIC OF THE CONGO (DRC)

Interviews for the book were conducted between May 2021 and February 2022.

AFRICA



West Africa

"We have one of the largest and most promising portfolios on the highly prospective and underexplored Birimian Greenstone Belt. This part of West Africa ranks as number one globally for discoveries, with nearly 80 million oz of gold discovered in 10 years, and a total of US$5 billion, which accounts for approximately 10% of the global exploration budget."

- Sébastien de Montessus, President & CEO, ENDEAVOUR MINING

Image courtesy of Lycopodium

Introduction: Gold and Beyond

Bigger West Africa

After a disruptive 2020 that sent gold prices through the roof, West Africa, the world's second-largest gold producing region after China, is getting bigger, growing beyond the Ghana-Mali-Burkina Faso geographies, but also beyond gold. With more minerals gathering attention, more countries in the region seen as prospective jurisdictions, and more relevance ascribed to the highly endowed region in a gold-depleting world, can West Africa meet its own expansive potential?

Swiftly recovering from an output decline in 2020, gold volumes look good: By 2024, total output by the region's top-producing trio - Ghana, Burkina Faso, and Mali – is expected to increase from 8 million oz in 2021 to 8.4 million oz. Both old and new mines support this upward projection: Ghana's oldest mine, the Obuasi underground mine operated by AngloGold Ashanti, has restarted operations following a redevelopment plan. Another Ghanaian-operating giant, Newmont announced an investment of up to US$850 million to advance the Ahafo North project, located about 30 km away from the Ahafo South mine. Ahafo North will add 3 million oz of gold over the mine's 13 years' LOM. Further away in Mauritania, Kinross is investing US$300 million to expand the Tasiast 24K project.

"Ahafo North is the best unmined deposit in West Africa. Combining the existing facilities at Ahafo South with Ahafo North, we will have an operation that will produce between 700,000 and 800,000 oz/y of gold all throughout this decade and into the next."

- Tom Palmer, CEO, Newmont

At a gold price above US$1,700/oz, mines under development have a healthy glow. The region has a good track record of bringing greenfield projects onstream in recent years. Wahgnion started in 2019, and West African Resources' Sanbrado in 2020. At the start of 2021, Australian-listed Perseus Mining brought its third mine into production, the Yaouré gold mine in Ivory Coast, producing at 260,000 oz/y for an initial LOM of 8 years. Other mines are due to pour first gold in the next 1-5 years: IAMGOLD is steadily advancing its Boto project in Senegal, while Fortuna Silver Mines gave the green light to commence the construction of Séguéla in Ivory Coast. On the junior side, companies like African Gold Group, Tietto Minerals, Roscan Gold, Mako Gold and Cora Gold are fiercely moving forward, having already published or due to present investors with the DFSs for their flagship projects.

The centuries' long history of gold production in Ghana, coupled with the impressive discoveries-turned-successful mines in Burkina Faso and Mali in the last decade have put other countries in the region on the gold map, explorers drawing geological parallels along the Birimian belt. Today, West African gold prospects stretch north-to-south from Mauritania to Equatorial Guinea, crossing new mining jurisdictions like Senegal, Ivory Coast, Liberia, Nigeria and Cameroon.

Beyond battery limits: Finding mining solutions for tomorrow

By Tim McGurk, group CEO of SRK Global and chairman of SRK Consulting UK

Engineering is about finding solutions within defined parameters. As such, boundaries are vital to controlling scope, design and cost. However, sustainability imperatives and the emerging green economy are changing the way we perceive these scope limits and the questions we ask of engineers and scientists.

There are many good reasons why engineering and scientific endeavours are best tackled with clearly defined boundaries to every project. It provides focus while ensuring the full range of relevant expertise is brought to bear, so the solution delivered can be targeted and precise. The danger here, of course, is too narrow a remit limits creativity and potentially creates echo chambers and group think.

Sustainability has moved to heart-of-mine planning, operation and closure. Minerals remain essential to social and economic development, especially those essential for the decarbonised future. Mining must continue to increase total value and ensure its influence on human and social capital is positive. Minimising adverse effects on the environment and ensuring a stable post-closure setting are critical parts of the process.

Transparency is fundamental to sustainable corporate governance. Mining companies recognise this is key to building trust. Also, environment, social, and governance (ESG) disclosure demands from stakeholders have never been stronger. For example, financial institutions and downstream manufacturers need information for their decision-making and disclosures (which are increasingly required by new laws) to demonstrate ESG credentials of their business and products.

The trend for transparency, action and improvements in ESG performance affects every aspect of mineral exploration and mining activity, including assessment of mineral resources and ore reserves. This has a particular relevance to many countries in Africa that rely on mining not only for royalties and taxes but for dividends – where state-owned mining enterprises hold carried interest in mining operations. Long-term partnerships between public and private sectors in mining rely on ore reserves, production and revenue data being trusted and reported transparently.

Two key aspects demand attention: The reliability and accuracy of the information being disseminated by organisations and the depth of data being collected and assessed within organisations.

In the first aspect, independent validation ensures that companies communicate accurate and up-to-date information for compliance, financial investment and related purposes. This calls for specialist expertise from professionals who are independent from the client and hold a reputation for integrity.

The second aspect relates to operations' ability to closely track the details of mining tasks and mining impacts. In the era of digital sensors and wireless networks available above and below ground, the potential for detailed monitoring and analysis is considerable. They can bring improvements and efficiencies to every aspect of mining operations from geological interpretation, mine planning and operations, processing, waste management, and logistics to water management and environmental and social impacts.

To meet the extent of these demands requires interdisciplinary teams that can conduct their work with an integrated project approach, i.e., by collaborating closely with each other, the client and the numerous stakeholders involved. A key focus is to identify risks and design mitigations particular to the project. Environmental impact, along with community and social engagement, is always high on the ranking of factors to be closely managed. During the design phase, if ESG activity streams do not effectively coincide with engineering streams, then significant risks can end up being ignored during the critical planning stages. Even at early stages of development, when considering a conventional project trajectory, explorers also need to consider their 'social licence' and the significance of social engagement – especially when exploration projects continue for extended periods and develop significant local footprints.

Responsible exploration, mine planning and mining needs collaboration between wideranging discipline specialists to provide well-rounded solutions that benefit miners and their stakeholders. It is incumbent upon explorers, developers and operators to embrace and nurture this expertise and to align it firmly with the engineering mandate in mining ventures. •

Tim has over 30 years of international experience in engineering and management with SRK and for major and mid-tier mining houses. His experience includes mine engineering design, mine construction project management, and mine management. He has managed multidisciplinary technical studies in gold, diamonds, iron ore, copper, lithium, potash, polyhalite and uranium throughout Europe, Africa, Russia and the Nordic region. He is a competent person specialising in stoping and caving methods.

But West Africa has more than gold. Guinea is already known as the world's second-largest bauxite producer, and Niger has also made a name as the fifth biggest uranium producer. The region also holds other untapped energy and base metals which have an opportunity to come to the surface.

2020 seems to have been watershed years for commodity markets. Gold played out to its reputation as the most trusted store of value, investors narrowing in on bullion and gold stocks at the height of the crisis. By contrast, economic pessimism put a damper on metals associated with car sales and industrialization. Yet, come 2021 and an imperfect reversal happened: gold is seeing a slide-back whereas industrial metals are making a strong return. Gold demand was 7% y-o-y lower in Q3 2021, mostly on account of higher ETFs outflows, according to the World Gold Council. At the same time, demand for metals associated with the energy-transition lead some analysts to speak about a new commodities super-cycle. This would be the fourth super-cycle in the last 100 years, and the first green one, revolving not around oil, but industrial and energy metals.

The narrative of climate change crisis is certainly not new, but it resonated stronger as the world experienced a different crisis caused by the pandemic; the recovery from both crises is prescribed with green policies, green funds, and greener behaviors. Record sales of EV cars, matched by stricter policy proposals to ban new diesel cars in the next decades, but also the urgency of energy transition pushing nuclear power deeper on the table of energy solutions, all mark a radical shift to sustainability whereby metals like lithium, uranium, cobalt and aluminum become essential. These 'future-facing metals,' to borrow James Wallbank's name for the collective bunch, are found across West Africa. Ghana and Mali's lithium, Niger and Mauritania's uranium, or Ghana and Guinea's bauxite gain significant relevance in the decarbonization super-cycle.

Lithium and other energy metals

The EV market revealed record sales in 2021. More than 10 million electric cars are on the roads today, worldwide. Although lithium demand and supply are in relative balance, the IEA expects demand to grow 40-fold in the next 20 years. If all of the 200 battery mega-factories currently in development work at full capacity in 2030, they would require 3 million tonnes of lithium a year – or 37 times more than was produced in 2020, estimate Benchmark Mineral Intelligence.

In gold-dominated West Africa, lithium assets were often overlooked, but this has changed. Lithium projects have received sure financial endorsements from both private investors and equity markets: ASX-listed Firefinch entered an agreement with Chinese producer Ganfeng Lithium, who will buy 50% of the Goulamina lithium mine's first phase output for US$130 million, enough to bring the project into production by 2023. Also in Mali, UK-based explorer Kodal Minerals is well funded to bring forward the Bougouni hard-rock open pit lithium mine, with a production of 220,000 tonnes at 6% spodumene concentrate with 71% recoverable lithium for a LOM of 8.5 years, as indicated in the Feasibility Study (FS). The project was granted a Mining License in November 2021.

In Ghana, after securing a financing agreement with Piedmont Lithium, IronRidge Resources' Ewoyaa project is set to become the country's first lithium mine fully funded to production. The Scoping Study published in 2021 supported the production of 2 million mt/y for the 14.5 million tonnes at 1.31% Li_2O inferred and indicated resources. CEO Vincent Mascolo commented: "Our landmark deal will certainly be a significant catalyst for further lithium exploration in the region."

The successful discoveries and development of lithium projects, culminating in the construction of the first lithium mine, set a positive precedent for non-precious metals in the area that has been mostly searched for gold. Explorers looking for gold now pay more attention to other minerals. It was a surprise for Awale Resources, a junior focused on greenfield gold exploration, to discover hematite alterations within an IOCG mineralization style, a type of high-grade gold coming together with copper anomalism, at its Odienné property in Ivory Coast, but the junior considers the discovery with seriousness: "This is unique in the country and it gives us a second focus within Odienné. We are taking a step back to look at the data with a copper mind," said Glen Parsons, CEO of Awalé Resources.

Awale plans to drill along the 5 km copper anomaly strike to better understand the curious geology.

Awalé's discovery was a fortunate coincidence, but Simon Meadows Smith, the CEO of Ghana-headquartered SEMS Exploration Services, reports that many of its clients show interest in other metals, especially lithium: "Lithium is certainly a commodity that many juniors are considering regardless of their core business," he said.

At the same time, developers with assets in both gold and lithium also understand that the two commodities command two different investment classes, and prefer to keep them separate. This is why Firefinch preferred to demerge the Goulamina asset into Leo Lithium, a new company to start trading on the ASX this year: "A company like us often struggles to get wholesome valuations for its different assets if these are in different spaces. By demerging we give each asset its own identity and lease of life, so that stakeholders end up with two pieces of paper and can decide if they want to invest in one, both, or neither," said Michael Anderson, managing director at Firefinch.

Uranium

For over a decade the uranium market has been waiting for a return to favor after the Fukushima disaster in 2011 and the downward spiraling prices since. The instantaneous nature of such a disaster has had a much more powerful effect on public perception than the discourse of climate disasters, which unravel at a slower pace. But at COP26, nuclear advocates bring compelling, reality-checking arguments: Renewable sources alone cannot sustain a meaningful energy transition, nor sustain a stable energy supply. "We are in the midst of a worldwide energy crisis," said Daniel Major, the CEO of uranium developer GoviEx Uranium: "We are seeing an upward pressure on the demand side as many countries are now considering nuclear power generation as part of their clean energy mix. Spot uranium prices have been increasing since the beginning of the year, rising 30% over the last four weeks alone."

With gas supply shortages in the UK, sudden interruptions in wind-powered electricity, but also the detrimental negative impact of hydropower solutions, there is a wider acceptance that nuclear power remains a solid contender for clean and reliable energy supply, especially in a context of rising demand. According to the International Atomic Energy Agency, global energy demand will increase by at least 50% in the next 25 years.

"While wind and solar will deliver part of the world's electricity production, we need a solid baseload, constant under all climatic conditions. More countries are including nuclear among green energy sources, accepting that solar and wind power cannot provide all the energy needed on the planet, particularly as the population and the level of urbanization grows and conveniences like air conditioning are becoming more commonplace," said Stephen G. Roman, president and CEO, Global Atomic.

Bauxite

With more than 90% of bauxite going through the bauxite-alumina-aluminum conversion, bauxite demand is determined by aluminum demand from the construction, automotive and electronic industries. The lightweight metal is associated with the infrastructure needed for renewable technologies, including carbon capture, EVs and solar power. After a bad 2020, aluminum is recovering, expecting a 3.3% CAGR growth between 2020-2027. Both supply and demand are tied to a single epicenter, China. As both the largest producer and consumer of aluminum, China is facing a big challenge because its supply is stressed by the need to curb CO_2 emissions, while demand augments. Amid these parallel pressures coming from China, the price of aluminum rallied to a 10-year high of US$2,726.5/t on the London Metals Exchange in August 2021. The need for bauxite-for-aluminum imports is unprecedented. •

> **"Lithium deposits in Ghana's Central Region are attracting attention from investors, where there is on-going reconnaissance and exploration work – with some studies at pre-feasibility phase. SRK Ghana is currently involved in some aspects of these studies."**
>
> **- Ivan Doku, Principal Resource Geologist and Ghana Country Manager, SRK Consulting**

West African metals in the energy transition

Questions of feasibility

Positive commodity fundamentals coupled with the right mineral endowment are insufficient to make a case for West Africa's contribution to the energy transition. To leverage their resource inheritance, West African nations and private developers need to be able to align to high international standards of sustainability and transparency, attract investment through well-framed projects, and, above all, act quickly to jump on the bandwagon of the decarbonization trend ahead of other countries.

First, the mining of metals used in decarbonization has to grapple with a paradox of their condition - that their extraction is harmful to the environment - and to prove a net positive contribution to climate change through limited environmental damages. Mishandled, uranium mining can leave a radioactive footprint from tailings and raffinates decaying to radon, a radioactive gas. Bauxite mining, on the other hand, involves the stripping of the topsoil and long-term rehabilitation; Guinea's luxuriant landscape is spotted with red earth bauxite quarries as a result. Ghana has been considering what to do about its undeveloped bauxite reserves for decades, but the proposed projects are sensitive. Out of the 900 million tonnes of bauxite estimated, about 350 million tonnes of Ghanaian bauxite are found under Ghana's Upper Guinean Forest, a tropical forest important for local biodiversity in Ghana's Ashanti region. Global Forest Watch warned that deforestation in the country had increased by 60% in 2018 compared to the previous year.

The green transition means two opposing things for aluminum: One, that the world will need more aluminum and therefore more bauxite, and two, that countries with an already large production and very high CO2 emissions, mostly China, are forced to reduce production. Africa brings into this picture some of the largest bauxite reserves in the world, Guinea having already overtaken Australia as the biggest exporter of bauxite to China, while Ghana has the potential to produce between 10 to 20 million tons a year. For now, it is producing a lot less.

In 2021, Ghana produced 1,162,000 tonnes of bauxite, according to the Ghana Chamber of Mines. In 2018 and 2019, Ghana signed successive contracts with China for the development of the bauxite industry and the Chinese government committed to a US$10 billion facility for 5% of Ghana's bauxite. Ghana also entered a Master Project Support Agreement with Sinohydro to build infrastructure projects valued at US$2 billion. However, there is no news of recent developments from these deals.

Taking matters into its own hands, the Ghanaian government announced this year a new deal worth US$1.2 billion to develop the country's aluminium industry. Ghanaian leading contractor, Rocksure International, was selected to partner state-owned Ghana Integrated Aluminum Development Corporation (GIADEC) to develop a bauxite mine and a bauxite refinery as part of a four-phased development plan by the Ghana Integrated Aluminum Industry (IAI). Fabian Limberger, chief commercial officer at Rocksure International, said: "We are proud and honoured to take part in this enormous project and to play a role in the country's economic development. We also understand the complexity and size of the task bestowed on us. This is a long project starting with exploration and infrastructure developments - such as building a railway to transport the bauxite. Only then we can think about mining and refining the bauxite."

The company will require significant financing and is looking for a partner. Bauxite mining is not capital intensive, but the infrastructure associated with transportation and processing is. In both Ghana and Guinea access to infrastructure and the money required to build the infrastructure are decisive factors in the feasibility of bauxite projects. Lindian Resources, one of the few bauxite developers in the region, plans a two-staged approach to overcome this challenge: "The short-term strategy of the company is to utilize existing infrastructure for low capital solutions to generate near-term cashflow. We speak to current infrastructure owners and developers to find the shortest route to the market. The longer-term strategy is to develop our own infrastructure with a port and rail solution to augment mining operations. An opportunity exists to access potentially the best port location in Guinea," said Asimwe Kabunga, the chairman of Lindian Resources. •

Regulation Trends

Making more of its riches

The paradox of Africa's mineral riches versus its economic poverty has been explained by many different theories, often having to do with the continent's colonial past. What they all agree upon is that mineral endowment cannot singlehandedly ensure wealth, or else Niger, which holds some of the world's biggest uranium reserves, would not make the cut as the 10th poorest country in the world. More ironic is that, while Niger's uranium powers 30% of French households, Niger has one of the worst electrification rates worldwide with 90% of its people sitting in the dark. Nevertheless, in many cases, mining has been the most potent driver of West African economies. For Ghana, the most developed country in the region, mining is a key GDP contributor, an important source of foreign currency and provides the only employment option in some remote areas. Yet, in over 100 years of mining in Ghana, none of the mining companies are Ghanaian, many white-collar jobs are still performed by expats, and the industry remains limited to exportation of raw materials without added-value processing.

In view of these facts, already in 2009 the African Union was putting together the "African Mining Vision," a framework for mineral resources to be used for more broad-based, sustainable and inclusive development. It recommended localization policies and better national levies in the negotiation with multinationals, setting the tone for a more balanced playing field. In 2021, the question of driving more benefits from mining is compounded by three factors: The imperative of post-pandemic recovery demands more receipts to be paid into national budgets; The desire that higher commodity prices are fully -and faster- translated to a local level; And, related to the former, higher mineral outputs, whether projected or obtained, call for more stable, well-balanced tax frameworks with a long-term view. Furthermore, governments need to be careful that their policies are perceived as fair and not read as instances of resource nationalism. Most crucial is that these policies continue to attract and not drive away investors.

The two principle considerations - to ensure a favorable contribution of mining for the country's development and to ensure the country's fiscal attractiveness for foreign investors – and their delicate balancing act play out differently in different countries.

At the one end of the spectrum, well-established mining jurisdictions like Ghana can afford to tax more. Ghana knows it offers investors a stable ground with clear policies, a mature servicing sector, and reputational distinction. Countries like South Africa and Ghana have been the first to weigh up how to extract the most benefits from mining without becoming too expensive as to deter investments, especially when compared to other countries. The cost of land for exploration is roughly twice as high in Ghana than in Burkina Faso and four times higher than in Ivory Coast, while its costs of production, averaging at US$1,190/oz AISC, are also higher compared to the African average.

> **"When you build a mine you do not really own it, you are renting a national asset. If you can create value, that value should be part of a pie that is shared with local communities and the people of the host country. As a public company, your responsibility to society is enormous."**
>
> **- Mark Bristow, President and CEO, Barrick Gold**

Occupying a more middle-ground, landlocked countries like Mali and Burkina Faso need to make up for higher operating costs related to security and logistics, as well as less developed in-country capabilities. At the same time, Mali recognizes its huge resource potential and sees yearly growing production. Mali produced 65.2 tonnes of gold in the last year, but it also discovered a further 65.7 tonnes of additional reserves. These numbers show that Mali has matured considerably as a mining jurisdiction, so the country is moving away from its incentive-driven tax regime of the early days. In 2020, Mali eliminated VAT exemptions and shortened the length of stability agreements from 30 to 20 years.

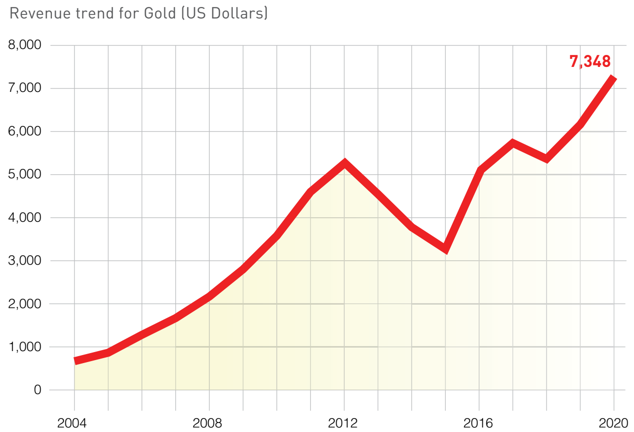
The younger mining jurisdictions are leaning in the opposite direction, ready to put forward very attractive fiscal policies as they seek to digress from an oil-dominated past, like Nigeria or Equatorial Guinea, or their agriculture-based economies, like Cameroon. Yet, emerging mining countries bear the downside of their inexperience. In Nigeria, for instance, the government incentivizes investors through generous tax holidays: Juniors, miners and processing companies are exempted from taxes for the first three years of operation, while also paying 0% import duty on equipment and machinery related to mining. However, Nigeria's fiscal regulations are still very new and they lack the clarity and specificity of those attributable to the O&G industry in the country, which makes planning for foreign investors difficult.

An incompletely developed fiscal and legal environment has also seen Ivory Coast dealing with a higher number of litigation cases over the level of compensation that mining companies should pay to the communities living in their proximity. Kouamé Klemet-N'Guessan, partner at Ivorian law firm KSK Avocats, said the country struggles, first and foremost, with the legal interpretation: "The tax administration considers that mining agreements cannot derogate from the law, but mining agreements contain provisions that need to be legally validated. The government is quite passive in enforcing the provisions stipulated in mining agreements." •

Monetization mechanisms

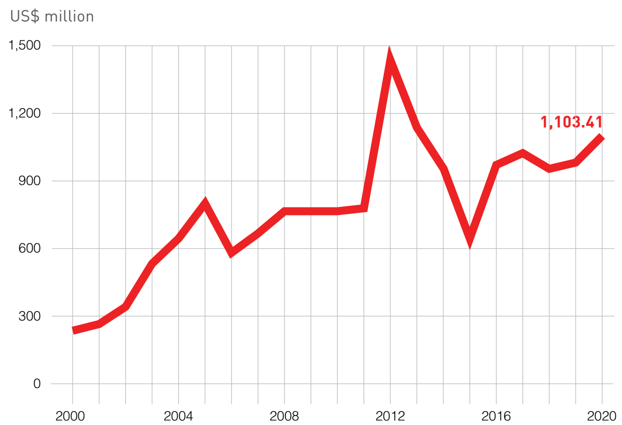
MAJOR MINERAL REVENUE IN GHANA

Source: Ghana Chamber of Mines



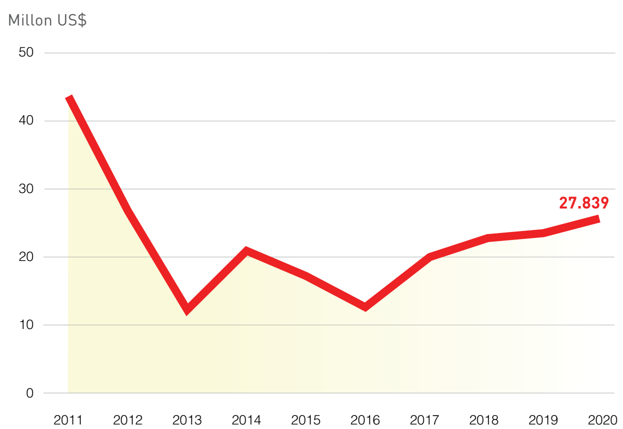
TOTAL INVESTMENTS INFLOW INTO THE MINING SECTOR (2000 - 2020)

Source: GBR elaboration of data from Ghana Minerals Commission



SOCIO-ECONOMIC CONTRIBUTION OF MINING IN GHANA

Source: Ghana Chamber of Mines 2021



*These figures only include the contributions of the Chamber's member companies.

Localized Investments

To drive beneficiation, West Africa must participate more extensively in end-to-end mining value chains, but the African value chain starts with exploration and ends with exports of ore. The government of Ghana is trying to create new mechanisms to localize investments, for instance by paying for gold for using cedi rather than US$. Understanding the importance of in-country value addition, Ghana has also invested in a new gold refinery, helped by investment from India, the world's largest consumer of jewelry gold. The country has two other private refineries, the Gold Coast Refinery and the Sahara Royal Gold Refinery. Though new in the gold space and without any domestic large-scale gold production yet, Nigeria has hurried to inaugurate its second refinery in 2021, after the Kian Smith gold refinery was opened in 2018. The two refineries produce bullion sold to the Central Bank of Nigeria (CBN) at international prices.

Countries in the region are also looking at ways to maximize the revenue generated from mining royalties. In 2018, Ghana set up the Minerals Income Investment Fund through which the country is reforming the way it manages royalties from natural resources. Seth Asante, managing partner at Ghanaian legal firm Bentsi-Enchill, Letsa & Ankomah (BELA), explained how this works: "The Fund is authorized to establish special purpose vehicles (SPV), assign specified royalty streams to the SPV, and procure the listing of the SPV on a reputable stock exchange."

As a majority shareholder, Ghana is able to trade its royalty earnings on both the Ghana Stock Exchange (GSE) and the London Stock Exchange (LSE), offering 49% of the shares to investors in the two countries.

Also looking for ways to maximize the value of mining payments at a local level, Burkina Faso set up a Local Community Fund where it allocates 1% contribution from the annual turnover of mining companies to finance infrastructure projects in 50 communities. Adama Soro, the president of the Burkina Chamber of Mines, thinks the next step for the country is to ensure proper governance of the fund: "Municipalities with 60,000 inhabitants and less than US$100,000 annual budget are now entitled to yearly budgets of up to US$3 million, but the money goes through the national treasury and the disbursement is subject to delays. There is also a lack of guidance when it comes to allocating this money to create a real impact on living standards."

Above all, Ghana's localization efforts have focused on local content policies. In 2020, Ghana passed the Local Content and Local Participation Regulations applicable to mining companies, support service companies and mineral exporters. Local content regulations had been in place since 2006, but the new law adds more sophisticated provisions on recruitment at the management level, gender diversity, local procurement of goods and services, and prescriptions on JVs between international and local service providers. A novelty for the new decree is the requirement for mining companies to list a minimum of 20% of their equity on the Ghana Stock Exchange (GSE), though the capital expenditure threshold for this requirement has not been established yet. Zoe Phillips Takyi–Appiah, senior partner at JLD & MB Legal Consultancy, sees this as a positive development: "This will grant access to local investors who may otherwise not have the opportunity to invest in some of these nationally significant projects."

While listing on the GSE is typically the domain of producing companies, Asante Gold is one of the first juniors expressing a wish to trade in Ghana as a way of further embedding in the local economy. "Listing on the GSE is a key part of our vision to build a Ghanaian mining company. Trading here will also create very interesting arbitrage opportunities between Ghana and the other markets we're listed in, like Canada and Germany, while giving local companies the chance to trade securities or get involved in the mining business in their own country," said Douglas MacQuarrie, president and CEO.

Already 35% of Asante's shares are in Ghana and almost half of its board is represented by Ghanaian nationals. After acquiring the Bibiani mine from Resolute Mining, Asante is undergoing a transition period from explorer to producer.

Formalizing artisanal mining

One of the most evident means of boosting government revenues from gold is the formalization of artisanal or illegal mining. So far, most efforts in this sense have been futile.

Informal miners, known as Galamsey in Ghana and Orpailleurs in francophone West Africa, represent a second layer of mining activities that is unregulated and harmful to the environment and to human health. But artisanal miners are also deeply entrenched in the history of these countries and an essential part of indigenous livelihoods, and possibly identities. Calling artisanal mining "illegal" and policing their practices is not a solution, and governments are still looking for the best approaches to formalize the sector for the good of the country, the environment, the mining industry, but also for the good of the informal mining communities.

This sector is by no means marginal. In Nigeria, informal mining represents most of the country's mining. In Ghana, small-scale is believed to contribute to 40% of Ghana's gold output, accounting for US$2 billion dollars of revenue generated between 2016 and 2020. In Burkina Faso, about one million orpailleurs are believed to produce the equivalent of US$1 billion/year. This is money that falls outside national pockets, and worse, it can feed into illegal value chains on the black market.

Artisanal mining is mostly a subsistence practice, lacking both the knowledge and equipment to use standard extraction techniques, which exposes the environment to contamination and poses a threat to human health. Paa Kwesi Morrison, partner at legal firm ENSafrica Ghana, explained the damages: "Galamsey will go to any lengths to access the gold inland and underground, and most of the time this is done by manually digging the ground and using toxic substances. In recent years, it has become easier for them to get hold of equipment like excavators, which amplifies the scale of the mining activity and the hazardous impacts. The most visible impact is on the rivers, where illegal miners conduct their activities and sometimes dispose of the waste. The river changes color and composition due to heavy pollution."

The Ghanaian government has intervened so far by restricting artisanal mining close to water bodies to limit pollution. Ghana has sent the army to enforce the ban. But a comprehensive approach to formalize the sector is not in place, the issue being not only a legal one but also a social and even an ethical one: Before Europeans mined gold in Ghana, rumor was that gold could be fetched from the sand on the beaches. "Locals who have been mining the soil for centuries consider gold to be a natural gift and they see themselves as legitimate owners," said Morrison.

Under the Ghanaian Constitution everything found beneath the soil or waters of the country belongs to the State. For international mining companies, this means they must apply for a license to operate. For indigenous people, they consider it a birthright to mine what's theirs, like their ancestors have done for centuries.

Tensions between formal and informal miners, the first group entitled by law, the other entitled by a sense of history, have become even more apparent as exploration ground is getting tighter. Explorers have taken up more ground in recent years as part of a regional exploration boom. Also, the deterioration of security in the north and east of Burkina Faso has pushed orpailleurs south, encroaching on private licenses. These encounters can have tragic results – in 2021, seven illegal miners were killed by police tear gas after infringing the Bissa mine in Burkina Faso.

Different governments have tried to engineer the right programs to formalize artisanal mining activities. In Burkina Faso, the recently formed National Agency for the Supervision of Artisanal and Small-Scale Mining Operations (ANEEMAS) is piloting 26 different projects to find the best ways to regulate the sector. In Nigeria, the government launched a program to buy gold produced by artisanal miners and process this into gold bars for Nigeria's Central Bank's vault. The program is called PAGMI (Presidential Artisanal Gold Mining Development Initiative).

> **At the moment, the gold extracted by small-scale miners is mostly illegally exported, without any taxes or royalties paid. We need a new reform structure to control the full small-scale mining supply chain. New policies need to fall within the current framework and encompass the full value chain, from extraction to selling.**
>
> **- Seth Asante, Managing Partner, Bentsi-Enchill, Letsa & Ankomah (BELA)**

The Ghana Ministry of Lands and Natural Resources has also announced plans to launch a "National Alternative Livelihood Program," which would include a reclamation program of the mined-out areas and offer alternative jobs to illegal mining. "The only sustainable way through which we can prevent conflict is by providing alternative employment opportunities, especially for the youth," said Morrison, hinting that local content policies could also encourage the integration of artisanal miners.

Nigeria is the first to have required mining license operators to obtain a community development agreement with the host community, through which artisanal miners can be brought into formal employment. Tree Mines Global (TMG), a small-scale mining group operating in Nigeria, shared with GBR its model of co-operation with local communities, many of whom being artisanal miners who have exploited the land of the Kabbu Bunu gold project before it was taken up by TMG: "We have signed a community development agreement to lease the land for 99 years. TMG also made different commitments to support the community with employment and skills development, as we plan to source our workforce from the local community. We decided that we will actually live within the community rather than in separate camps because we wanted to be a part of the locals. The community has a history of artisanal mining, and we include them in our operations," said Anthony A. Madagua, CEO at Tree Mines Global (TMG). •

Understanding West African Risk

Green Zone, Red Zone

In most years, violence in the Sahel would lessen during the wet season. This year, however, has been different. "The war is getting worse," said Liam Morrisey, CEO of London-based security consultancy MS Risk.

While 10 years ago, the worst that mining companies had to deal with was local banditry, today security is a big challenge, and it can be a decisive factor for exploration companies. Instability in the Sahel region started about 30 years ago, with the nationalist-separatist movement of Tuareg rebels in Mali, but it intensified a decade ago when neo-Islamic groups, predating on local grievances and bringing in both weaponry and ideology, found a new sanctuary in sub-Sahara. "Islamic extremists married up with Tuareg separatists, which created an implosion of violence," explained Morrisey.

Unlike other IS affiliates that want to form a caliphate governed by Islamic law, the ISGS is more predatory and has ethnic, nationalistic and economic undertones superimposed on the Islamist dimension. In Niger, the BBC reported that the ISGS gathers support mostly from Tolobe clans of the Fulani ethnic group, a marginalized community that has turned to local jihadist groups.

The violence spread out from Mali into the three-border juncture known as the Lipako-Gourma Triangle, straddling Northern Burkina Faso, Western Niger, and Eastern Mali, as well as reaching into the two other Sahel countries, Chad and Mauritania. In the last two-three years, both Niger and Burkina Faso have seen a severe upsurge in attacks, leaving hundreds dead. The Global Terrorism Index reported that the number of fatalities caused by the IS in Sub-Saharan Africa grew by 67% last year, affecting mostly Burkina Faso, Mali, Niger and Cameroon. Outside of the Sahel, Nigeria has dealt with its own casualties, Boko Haram causing over 19,000 deaths since 2011.

"Security risks are a challenge for Mauritania, Mali and Burkina Faso, but the country that was probably most impacted is Burkina Faso, simply because it came from such a high point about 10 years ago, when many Australian and Canadian companies picked up licenses and enjoyed great success. I doubt the country is at the top of the list for many investors in mineral exploration, and I cannot see this changing in the short term," said Simon Meadows Smith, managing director of SEMS Exploration Services.

Even though Burkina Faso still yields strong revenues for the service provider, SEMS does not work with any exploration companies in Burkina Faso for the simple reason there are not many juniors in the country. The heightened security threat translates to a higher risk of kidnap or murder, but also banditry and illegal checkpoints through which rebels finance the war; roads also become more susceptible to ambushes, which in turn leads to the militarization of the areas or curfews.

Moving forward, the situation remains uncertain. Although there are 28,000 international troops on the ground, including UN's mission MINUSMA, the French counterterrorist 'Operation Barkhane', two British non-combat military operations under 'Operation Newcombe', and a G5 coalition, these forces concentrate on Mali, while the insurgents operate in a decentralized way across the region.

France's announcement that it will halve its 5,000 troops, but also Chad's decision to fully withdraw its forces, leave a dangerous void in the region. To fill the gap left by the French, Mali has been collaborating with a controversial private Russian military company called the Wagner group, which is associated with war crimes in Libya and had been involved in various other conflicts, including in Syria, Mozambique, Sudan and the Central African Republic. Wagner troops were reportedly deployed in Mali in December 2021. While public opinion on the French presence had been sour on account of the county's colonial history, the turn to Russian mercenaries is seen as a drift from the West and an expansion of Russia's interests in Africa. Seeing the retreat of the French as a signal of victory, disparate and rival rebel factions are intensely competing against each other for recruits and territory. The two dominant groups are al-Qaeda affiliate Jama'at Nusrat Al-Islam wa'l-Muslimin (JNIM) and ISGS (Islamic State in the Greater Sahara). "Al Qaeda-leaning groups and ISGS groups are killing each other, as well as civilians and soldiers," said Morrisey.

Our red zone is the militants' green zone. They have the freedom of movement and they can racketeer local businesses, as well as insert themselves in illegal mining value chains. We all need to help one another and aid local governments to reverse this trend.

- Liam Morrissey, CEO, MS Risk

Real and Perceived Risks

"Real risk and perceived risk are two very different aspects, and real risk is in fact lower," said Nana Sangmuah, the CEO at Roscan Gold.

That risks exist, both in the form of operational risks and more serious human life risks, is understood and cannot be treated blithely. But it is important to also understand that risks are uneven, isolated, indirect, or sometimes simply perceived. Certainly, they are not indomitable. The region has been mired in episodes of violence and political unrest, yet mining has unfailingly thrived over the years.

Mirroring the escalation of on-the-ground violence, the region has also registered numerous coups over the last two years. In Sudan, Omar al-Bashir was removed from power in 2019. Bashir had himself taken power in a military coup back in 1989. In Chad, the army led what was dubbed a "dynastic coup," bringing to power the son of former leader Idriss Deby after his death. Mali had two coups in 14 months: In 2020, the military overthrew President Ibrahim Boubacar Keita in the wake of mass protests; in a second coup the leader of the first intervention, Colonel Assimi Goïta overthrew the leaders of the interim government and declared himself President. Also in 2021, a coup attempt was thwarted in Niger just before the presidential inauguration of a new president-elect, Mohamed Bazoum. Then, Guinea's third-term president Alpha Conde was ousted and replaced by Colonel Doumbouya, a former French legionnaire who blamed corruption, human rights abuses and economic mismanagement for the intervention. Guinea-Bissau also saw a failed coup attempt at the beginning of 2022. And finally, in February this year, the Burkinabe government was overthrown, ousting president Roch Marc Christian Kabore.

In the thick of all this, mining and exploration go on. After the Guinea 2021 coup, Asimwe Kabunga, chairman of bauxite exploration company Lindian Resources, said: "Lindian has witnessed limited change following recent political developments with the new leadership being supportive of mining companies. The new leadership has stated that they are opposed to corruption and economic mismanagement. If this mandate can be implemented, then this can only be positive for Guinea."

In Mali, the executives of both Firefinch and Roscan Gold travelled to the country soon after the coup, noting business as usual, at least from a commercial and operational perspective. "There is no denying that there has been political instability, but what shines through is the quality of the assets and the track record of companies like Barrick, B2Gold, Resolute and Anglo American, all with successful operating histories in Mali," said Michael Anderson, managing director at Firefinch.

Reputationally, however, political instability is irretrievably damaging the image of West African individual countries, but also of West Africa collectively. Investors can be taxing over risks obliquely understood. Andrew Dinning, the CEO of Sarama Resources, a new junior operating in Burkina Faso, thinks many of the country's assets are mispriced because not many people know violence is mostly confined to the north of the country: "Many people blanket Burkina Faso with the same risk profile across the country, but it's important to go a little deeper to understand the granularity of the risk and look for mispriced assets and opportunities."

Sarama is listed in Toronto, but it has undertaken a second listing in Australia, where they have raised A$8 million: "The ASX understands African risk well and we see many Australian companies active in Africa that are enjoying great success from both a technical and capital markets point of view," said Dinning.

With real risks manageable, the perceived level of risk is also overcome by the prospect of a great discovery, such as Burkina Faso and Mali have delivered over the last 10 years. While safety is of prime consideration for any mining player, geology rules. "Every mining executive I have spoken to has said that political risk comes second to geological risk. African issuers on TSX and TSXV predominantly operate in Burkina Faso and Mali," said Graham Dallas, head of business development at TSX and TSXV EMEA. •

Bolloré has been active in Africa for over 50 years and we have a footprint in 48 countries, so we know the length and width of Africa better than most other logistic providers. To overcome security challenges in Burkina Faso, Niger, but also Nigeria, we rely on our well-informed network and partners, working closely with the mining industry to ensure sensitive shipments are transported with the utmost care and in the safest manner.

- Dolores Biamou, Mining Projects Director Africa, Bolloré Logistics

Image courtesy of Bolloré Logistics

Insights From the Big 4:
Policy insights and recommendations

"If we think about the direct contribution of mining in taxes and royalties, the government has implemented new guarantee clauses requiring mining companies to pay an annual guaranteed dividend to the government whether they make progress or not, something which was not stipulated in the past. In the last budget statement, the minister made reference to the need for tax audits within the extractive industries to make sure that mining companies are compliant with the law."

– George Arhin,
Partner and PwC West Africa Mining Leader

"One of the key challenges is the issue of illegal small-scale mining. In some instances, Galamsey have encroached on the concessions of companies engaged in large scale mining, which tends to deprive mining companies of the opportunity to exploit their concessions fully. Also, informal mining creates significant damage to water bodies and farmlands. While the current intervention programs of the Government are yielding some positive results, it is imperative that the Government does not relent in its efforts to make this practice more responsible and safer."

– George Ankomah,
Lead Tax Partner and Energy, Resource & Industrials (ER&I) Leader, Deloitte Ghana

"In terms of fiscal rights, our mining regime is very comparable to other countries in West Africa. Ghana's mining tax rate is 35%, but a number of the mining companies have special agreements with the government to pay reduced rates. Something that I doubt many countries in the sub-region have is the number of different stability and development agreements which Ghana offers to give companies room to operate through certain exemptions. Unlike other countries, Ghana does not claim an export tax. Finally, the Ghanaian Minerals and Mining Act stipulates a range of between 3 to 6% with 6% maximum royalty rate, whereas other countries charge a lot more on precious minerals."

– Kofi Frempong-Kore,
Partner, Tax & Lead – Energy and Natural Resources, KPMG Ghana

"In 2022, the government intends to increase the list of locally procured items on the Local Content Procurement list from 29 to 34 in order to ensure that the benefits of mining are retained for socio-economic growth and development of the localities. In terms of local content, mining companies worry about the shortcomings of local enterprises with regards to product and service quality, quantity and timelines. The Chamber of Mines is partnering with the Ghana Standards Authority to improve the quality of locally produced goods. These measures are expected to help the industry reap the benefits of tighter local content laws."

– Priscilla Koranteng-Gyasi,
Partner, Ernst & Young Ghana

The Gold Producers

Organic and Inorganic Growth

A matrix of contradictory market conditions, with gold prices above US$1,700/oz and high cash flows, in counterpoint with weakened investment sentiment and under-valued assets, converge to both organic and inorganic growth opportunities for gold producers.

West Africa had a good second half of 2020 and a very good 2021. Gold Fields posted a 2020 net cash flow of US$252 million from its two Ghanaian mines, a significant growth from US$174 million in 2019. In 2021, Perseus Mining recorded a net profit 48% higher compared to the previous year and declared a maiden distribution of capital, which will eventually become a dividend. Gold Fields paid a US$250 million interim dividend for 2021, 10% of it going to Ghana's national administration.

Though gold prices surely helped balance sheets, industrious optimization works and strategic investments in organic growth have also helped. Discipline is what producers have mastered during the bear market years and is what they profess to practice in a bull market too. Instead of relaxing at comfortable margins, gold producers insisted on increasing margins further. Jorge Ganoza, the CEO of Fortuna Silver Mines, calls himself 'price agnostic,' which reflects a universal position taken by gold executives who declare they prefer to focus on their assets' fundamentals rather than on gold fundamentals. By paying attention to the variables within their control, producers can prepare to survive in any price environment. "Although I am an eternal bull on precious metals, gold is a cyclical commodity and some years will be better than others," said Ganoza.

Indeed 2020 was an unusually good year, gold prices climbing 25.6% year-on-year to an annual average of US$1,858. The World Bank expected a lower gold price average in 2021, projecting that the price would further drop to US$1,400 by 2030. The World Bank had theorized a scenario of 'stagflation,' or recession-inflation, characterized by concomitant negative or flat growth and higher costs. But inflation, exacerbated by the Russian-Ukrainian conflict and rising raw material prices, created a new turn for gold. Gold prices climbed up to US$1,900/oz in February 2022, a height hit just on a couple of times in the past 40 years.

Two contrasting economic scenarios are conceived - a rosy economic recovery and gold's demise versus prevailing global uncertainty matched by currency fallouts – as well as a third middle-ground dialectic of protracted uncertainty and continued volatility. Using much more conservative price baselines, in the US$1,300-1,400/oz range, mining operators have worked hard to keep their AISC low and ensure sustainable margins in a worst-case scenario. "This is the best time for mining companies to invest in cost optimization solutions to sustain their business when the gold prices dip," said George Arhin, partner at PwC Ghana, urging that the industry must invest now.

And investing they are. Before adventuring to exciting acquisitions, West African producers doggedly assess opportunities to improve productivity and expand the life of their existing mines through near-site exploration. In 2017, Gold Fields began a reinvestment plan at Damang and is on track to replace the depletion of mineral reserves at Tarkwa for a third time, after achieving this performance consecutively in the last two years. Resolute is also focused on expansion opportunities close to existing infrastructure at both Syama, where it reported positive drilling results from the Tabakoroni prospect, and at Mako. Diversifying to a third jurisdiction, Resolute is carrying out early exploration in Guinea.

Nevertheless, organic growth is limited. Many producers in the region have reached a flat production line. Perseus Mining has about five years to maintain a half a million oz gold yearly production. "We also want to put Perseus into a position where it can at least sustain this level of production and cashflow well into the future and to do this, not only do we need to replace the resources that we consume, but hopefully, materially add to our inventory through organic or inorganic means," said Jeffrey Quartermaine, the CEO.

Consolidations

A few head-turning transactions took place in West Africa in the last two years. The region created its first supermajor when Endeavour acquired another West African producer, Teranga Gold. Also, the first Latin American-focused producer stepped into West Africa through the acquisition of Roxgold, with a mine in Burkina Faso and an advanced exploration play in Ivory Coast. Earlier in 2021, a potential merger between Anglo Gold and Gold Fields sparked the imagination of the industry when the respective CEOs of the two majors said they would consider an operational JV between their Iduapriem and Tarkwa mines. The two mines sit 10 km apart from each other in Ghana. Combined, they would produce 800,000oz/year.

So, what is driving these consolidations and gestures of potential consolidation?

2021 was surely a popular year for high-end consolidation. The blockbuster Kirkland-Agnico Eagle US$24 billion merger created the world's third-biggest gold miner. Following the Teranga acquisition, Endeavour became the world's 10th biggest. Large-scale consolidation is driven, first of all, by the desire to create efficiencies, integrated assets proving that the sum can be greater than its parts, whether these parts are in synergic geographic position or a complementary financial position. This was the case for the merger between Teranga's Sabodala asset with Barrick's Massawa. Conjoined, the two mines became a tier-one operation. When Endeavour bought Teranga it came into the possession of not just two mines located close to each other, but the largest mine in Senegal – the Sabodala-Massawa complex. More than realizing economies of scale, Endeavour wanted to become a producer with a large enough market cap to appeal to generalist, large fund management companies.

Graham Dallas, the head of business development for TSX and TSXV in charge of African listings, thinks there is a gap in the market for listed specialist mining companies with the scale and capital to appeal to such investors. Endeavour is tapping into this gap, announcing a secondary listing on the London Stock Exchange (LSE), where it will be the largest pure gold player on the premium segment: "With the removal of Randgold there were limited options on the LSE for investors seeking significant, diversified gold production exposure. Since listing, we have gained access to a new, wider base of globally-minded investors and a deeper pool of capital. This, in turn, has enabled us to attract UK generalist funds and we are starting to see some good daily trading volumes on the LSE," said Sébastien de Montessus, Endeavour's CEO.

Dallas also thinks ESG and ESG-assessed M&A is another motive for increased consolidation. The reasons are easy to grasp – bigger companies can run more comprehensive ESG agendas and sustainability plans and can afford to invest in carbon monitorization technologies, broader benevolence projects, the greenest equipment and services, and also the branding of sustainability. ESG is now a crux of the attractiveness profile of a company and a crucial due diligence criterion within M&A deal-making for financial institutions and general trading funds with an ESG mandate. That said, how ESG influences M&A is rather a mystery. Already a soundbite in investment talk, ESG is defined with different definitions, and these definitions are differently internalized by different companies, especially in an industry as diversified in terms of size, geography and product as mining. "Much remains to be learned as many different stakeholders have their own measures of looking at sustainability. Standardizing the definition and evaluation of sustainability is what requires the most work," said Jorge Ganoza, the CEO of Fortuna Silver Mines.

Divestments

In a divestment transaction, the non-core asset of one company can become the new business spine of another. This has been the case for standout divestments whereby large gold producers sold historical, non-producing mines to juniors. Resolute sold the 100-year old Bibiani mine to Asante Gold, while Barrick and AngloGold sold their joint interest in the Morila gold mine to Firefinch. B2Gold also struck a deal with West African Resources who will acquire the 1.1 million oz Toega gold project, and Centamin has announced it is ready to consider partnership or takeover options for its Batie West exploration project.

Rather than the typical big-buys-small asset takeovers, these deals go the opposite way, from producer to junior, and from large producer to mid-tier. These reflect a production sector that prefers to laser-focus on cash-generating assets and tier-one portfolio enhancements. They also reflect a junior market that can summon the equity to make these acquisitions. Thirdly, divestments as such are unique in a gold price environment where small production opportunities become large cash opportunities – and this is the key to giving those assets a new lease of life at a time when the market is hungry for gold.

Douglas MacQuarrie, the CEO of Ghana-focused junior Asante Gold, calls Bibiani 'a sleeping giant': "It is incredibly rare to find an asset with both high upside potential and near-term production. It poured first gold 100 years ago, and I have no qualms saying that the mine will still be producing in another 50 years."

Asante bought Bibiani from Resolute in a US$90 million deal and plans to bring the mine into production by July 2022. Bibiani had been on care and maintenance under Resolute since 2014, but Asante wants to refurbish the existing mill and build an underground mine. Commenting on the transaction, Stuart Gale, the CEO of Resolute, said: "It was necessary that we made a commercial decision for the asset and we are very confident that the sale to Asante Gold creates win-win outcomes for Resolute and for Asante, but also for the country and the community."

In Mali, another 'sleeping giant' is being nurtured back into production. Morila is also an iconic mine for the region, having produced in its heyday head grades of 10 g/t, but which ran out of ore in 2009. Owned by Anglo Gold and Barrick 40% each, the mine was left to sit idle. But Firefinch, which completed the acquisition of the mine in November 2020 for US$28.8 million, plans to see Morila producing between 150,000-200,000 oz/y for 10 years in a staged approach involving mining from satellite pits and ramping up production from the main pit, and eventually going underground.

If the awakening of these two legacy mines proves successful, they may encourage further similar programs of rehabilitation, as well as shed light on the region's underground potential. Anders Berglund, regional general manager West Africa for Epiroc, thinks the rise in gold prices will be making more underground operations feasible especially on the West African coastline countries: "There are many underground projects at feasibility or pre-feasibility development stage, and the dry-out of open-pit projects into underground projects. Some of these projects might have already been in operation had it been for a more sustainable cost and safety environment." •

Sébastien de Montessus

President & CEO
ENDEAVOUR MINING

Endeavour successfully completed two acquisitions within one year. Could you comment on the integration process of the Sabodala-Massawa complex?

We have been really pleased with how the Teranga assets were integrated into our West African operating platform.

Amongst our seven mines across Ivory Coast, Burkina Faso and Senegal, we believe the Sabodala-Massawa mine in Senegal has the most potential to be a long-life, low cost, top tier asset.

Earlier in 2021 we approved the $20 million Phase 1 expansion, which will optimise the processing of the higher grade Massawa ore more efficiently and increase production by approximately 90,000 oz/y.

We are finalising the feasibility study for the Phase 2 expansion, which we estimate will increase production to above 400,000 oz/y.

Could you elaborate on your near-term exploration strategy?

We have one of the largest and most promising portfolios on the highly prospective and underexplored Birimian Greenstone Belt. This part of West Africa ranks as number one globally for discoveries, with nearly 80 million ounces discovered in 10 years, and a total of US$5 billion spent, which accounts for approximately 10% of the global exploration budget. In 2020, this region received more exploration spend than all but Australia, Canada and the US.

Since 2016, we have discovered 8.5 million ounces, at a cost of less than US$25 per ounce. With the recently acquired assets, our new 5-year exploration target is to discover 15-20 million ounces of Indicated resources over the next five years at an average cost of less than US$25/oz.

How is Endeavour driving ESG implementation?

On the social side, our priority areas are health, education, access to water and electricity, and economic development, including ECODEV, our impacting investing fund, which invests in industries outside of mining that support the broader national government economic agenda.

We have committed to a 30% reduction in emissions by 2030, as well as an ultimate goal of net zero by 2050, as part of our environmental strategy, which also includes a focus on water stewardship, biodiversity and reducing plastic waste. In June 2021, we launched the Endeavour Foundation, which is our primary vehicle to implement our sustainability projects. •

Alfred Baku

(Former) Executive VP and
Head of West Africa
GOLD FIELDS

*Alfred Baku stepped down from his role with Gold Fields in December 2021.

How have the Ghanaian assets performed in the last year?

We produced 862,000 oz in 2020. This was primarily driven by the continued build-up in production at Damang, having moved to the heart of the main ore body in H2 2020 as part of the reinvestment plan for the mine.

Our operational costs increased marginally by 2% to US$1,060/oz, from US$1,039/0z in 2019, as the pits are getting deeper and the grade quality lower. The increased gold price last year also led to higher royalty payment to the government. Nonetheless, we managed to improve our net cash flow across both operations to US$252 million in 2020, compared to US$174 million in the previous year.

Can you elaborate on your efforts to extend the LOM at Tarkwa and Damang?

For the first time in 15 years, we were able to replace the depletion of mineral reserves at Tarkwa in 2019, repeating the same performance in 2020. We are on track to realize another full replacement this year. At present levels, Tarkwa has another 15 years of life left.

Could you explain the funding mechanism and the main focus areas of the Ghana Gold Fields Foundation?

We set aside US$1 for each ounce of gold produced. Furthermore, 1.5% of profits before tax are also added into this fund, creating a solid funding base to assist local communities. The Foundation focuses on five key areas: education, health, water and sanitation, agriculture and infrastructure. Since 2004, we have invested US$79 million across different projects.

How is Gold Fields working to minimize its environmental footprint?

For both Tarkwa and Damang, we are transitioning from LPG to natural gas to power our mines. We already generate our own electricity using an LNG-powered plant for which we built an 80 km natural gas pipeline. The next step is to realize the same transition in the CIL processing plant.

Do you have a final message?

We have successfully rolled out our "Courageous Safety Leadership" programme to empower all our employees to speak up when they note unsafe behaviours or situations. •

Mark Bristow

President & CEO
BARRICK GOLD

What have been the main highlights from Barrick's West African operations?

West Africa has been the most prolific contributor to new gold in the last two decades. In Mali, Loulo-Gounkoto is a fantastic story. The 75 km of strike has kept producing, and now we are moving into the ramp-up phase of a new underground mine at Gounkoto. The complex already produces around 650,000 oz/y Au and has over 13 years of life yet, with tremendous opportunity for further discoveries.

Another important aspect of Loulo-Gounkoto is that it is Malian run and has become a mining school for our African business. Mali is also the first place where we have worked in Africa where refuse and waste disposal is commercially viable, run by village NGOs.

In Côte d'Ivoire, we built Tongon during the civil war, but no one ever interfered with the operation. It is a very well built mine with low sustaining costs, and has played an amazing role in the country's northern economy.

How have innovations at Barrick's Kibali mine in the DRC improved operational performance?

Kibali is a proper tier-one asset, producing over 800,000 oz/y Au. We recognized early on that to get the best out of Kibali we had to get low-cost power, so we built three hydropower stations. The mine has a very low carbon footprint, and the local community gets hydropower as well.

Kibali is Barrick's flagship mine when it comes to innovation, integration and automation. Because the age of the average miner in the DRC is lower, you don't get the same resistance to new technologies as you do in jurisdictions with older workforces. We built special roadways to be able to introduce high-speed, automated hauling underground, and the crushing and material handling at the bottom of the mine are now fully automated.

A new integrated data system was rolled out across all Barrick operations, and now we are starting to see the benefits of real-time data. •

Tom Palmer

President and CEO
NEWMONT

The Ahafo North project in Ghana was approved in July 2021. Can you tell us about this investment?

It is about 30 km from our existing Ahafo mine, which has multiple open pits and an underground mine. Ahafo North is a standalone mine that will be a series of open pits and a mill. The ore body has 3.5 million oz of reserve and another 1 million oz of resource. Ahafo North has an initial 13-year mine life that will produce around 300,000 oz/y, at an AISC of US$600 to US$700. We will spend about US$850 million to build it over a three-year development timeframe, and we have approved full funds with all of our permits in place.

Combining the existing facilities at Ahafo with Ahafo North, we will have an operation that will produce between 700,000 and 800,000 oz/y of gold throughout this decade and into the next. Furthermore, the upside potential to extend life across the complex makes Ahafo one of the great gold mining deposits in the world.

Which initiatives is Newmont working on to foster local talent in Ghana?

There are three aspects of work happening in Ghana that I would call out. Gender parity at Ahafo North is an example of disrupting paradigms and having the courage to do something different. Another is the apprenticeship scheme we have in place in Ghana where we train young people to operate and maintain equipment; skills that live beyond the mine. Then we have some gender-specific programs, including a New Future for Girls leadership camp, which aims to build skills and prepare women for careers in technical fields.

Can you outline Newmont's core strategy and vision for ESG?

The key to ESG progress is not standing on your laurels and to go further by making bold commitments, such as our strategic alliance with Caterpillar around BEVs or commitments to gender parity at Ahafo North. •

Stuart Gale

CEO
RESOLUTE MINING

Could you comment on the performance of your flagship Syama mine in Mali?

Syama is a large-scale complex with two processing plants and two operations – one open-pit and one underground. Syama has performed well in the June quarter, with record production from the sulphide (underground) circuit. Besides mining more ore from the underground operation than ever before, we also processed more material thanks to improvements made in the processing circuit over the last year. Unfortunately, the overall gold production was below target because we processed lower grades.

Resolute bought Mako in 2019, and later published an updated LOM. Is the mine delivering to expectations?

The Mako gold mine in Senegal was a terrific acquisition that has consistently hit all targets. During H1 21, Mako produced 63,506 oz at an AISC of $1,064/oz.

Resolute has created a multi-mine, multi-jurisdiction portfolio. What is your exploration focus?

In the near term, we will concentrate on exploration closer to our existing infrastructure

In terms of greenfield exploration, we are carrying out early-stage exploration in Guinea, where we hold a very prospective tenement.

Could you elaborate on Resolute's production and cost guidance for 2021?

Our production guideline for 2021 is expected between 315,000 oz and 340,000 oz at an AISC of US$1,290-1,350/oz.

Can you share a few words about Resolute's CSR work?

Whether it's at Syama or at Mako, I'm very happy with our team's work to ensure a good relationship with the local communities. Our aim is to make sure the benefits from our assets are translated to the benefit of the community – be this through education, training, employment, or the contribution to agricultural development.

Do you have a final message for investors and the wider audience?

We stay focused on our operations to generate profitable production, and we are very disciplined with our capital. Getting these fundamentals right will undoubtedly show in our share price long-term. As gold follows macro-economic conditions and risk sentiment, gold prices are unarguably very positive. At Resolute, we are fully focused on our assets regardless of the strength of the gold price. •

Jeffrey Quartermaine

CEO
PERSEUS MINING

Could you comment on the company's financial performance?

In FY21, Perseus recorded a net profit of A$139.4 million after-tax, compared to A$94.4 million last year, based on an improved EBITDA of A$303.1 million. These outcomes not only reflect selling our gold at a higher price, but also the benefit of the optimization work carried out at our operations during the year. This strong profit result has put Perseus in a position to declare a maiden return of capital to shareholders, which will take place later this year.

In 2021 Perseus brought its third mine into production, on target and on budget. What are your expectations of Yaouré?

Yaouré poured first gold in December 2020 and it has been producing extremely well since. On 30 June 2021, we published an updated ore reserve estimate for Yaouré of 29.6 million tonnes grading at 1.71 g/t Au and containing 2.63 million oz gold. Based on this, we have estimated a mine life of eight years, with the potential to extend through additional discoveries, both at surface and underground. We expect that Yaouré will be producing about 260,000 oz annually for the next three years, at an average AISC of US$734/oz.

What is your broader portfolio strategy?

Over the years, Perseus has not spent large amounts on new exploration, prioritizing mine developments, but now, with strong cashflows, we can once again allocate appropriate capital to exploration.

In terms of inorganic growth, we are always on the look out for value accretive opportunities.

What is Perseus's approach to community engagement?

We must recognise that we are guests in our host countries and without a strong licence to operate we have nothing. We must make sure that everybody benefits from our ventures. Also, we must ensure that we ultimately leave our sites in a better condition than when we arrived – both in terms of the natural environment and the livelihood of citizens. Across our operations, 96% of our staff are local citizens, and we contribute to a range of community programmes aimed at providing key services including health and education, in particular. •

Daniella Dimitrov

President, CFO and Interim CEO
IAMGOLD

Could you share some updates from Essakane?

Essakane is our most reliable and strongest producer, producing a record 457,000 oz on a 100% basis last year. The security situation in Burkina Faso had deteriorated in the fourth quarter, and we had a couple of security incidents then, but our operations continue unaffected. The operation is a great contributor to the economy. We are working with the surrounding communities with an extremely strong ESG program.

How will power in mining play a role in the green economy?

For an environment like central Canada and Ontario, with abundant hydro and wind opportunities, electrification makes sense. For West Africa, solar makes more sense. Wind and solar have huge variability in supply, requiring energy storage solutions to replicate the baseload capabilities that thermal provides. Newer technologies, like small modular reactor (SMRs) are a big opportunity. Battery technology and hydrogen will also play a role. If hydrogen is made using green power, a closed loop is formed, with exponential improvements on carbon emissions over time.

How do you see gold performance evolving?

So much liquidity has been put into the system that it has to have an impact – and gold is well positioned to benefit. In addition, there is a real supply side deficit forming in the industry. New discoveries are becoming increasingly rare and global gold resources amongst major mining companies have dropped precipitously over the past decade. IAMGOLD has been adding resources over this period of time with new discoveries. Finding ounces is challenging, but it is among the most value accretive activities a mining company can do. The initial resource at Gosselin of 3.4 million ounces M&I and 1.7 million ounces of inferred came at a cost of US$1.62/oz from discovery to delineation; an impressive achievement for our team. •

Jorge A. Ganoza

Co-founder, President & CEO
FORTUNA SILVER MINES

What motivated Fortuna Silver Mines to acquire West African producer, Roxgold on July 2, 2021?

West Africa has always been an attractive destination for us, and there is no other region in the world to have expanded gold reserves and production volumes quite like it. Though West Africa comes with its risks, this is a ground characterized not only by rich geological prospects, but also supportive governments.

With Yaramoko already in production in Burkina Faso, Séguéla in late-stage development in Côte d'Ivoire, and an exciting exploration pipeline in both of these countries, Roxgold presented us with the opportunity to acquire a platform for doing business, more than just assets.

How is the integration process progressing?

Integration has been very smooth specifically thanks to an aligned strategy. Our teams started working collaboratively right off the bat.

What are your expectations from Séguéla?

Séguéla stood out immediately in our assessments. In September 2021, we announced to proceed with the construction of the open-pit mine right away for a capital investment of US$173.5 million and a production schedule to mid-2023 for the first gold pour. By bringing Séguéla under our umbrella, we financially de-risked the project, showing that together we can grow bigger and faster. What I am most excited about is not necessarily the high-grade profile of the project, but its formidable exploration potential. In two years, the project has grown from a 400,000 oz Au deposit to over 1 million oz Au and growing. Each new drilling reveals new resources. With its 10 years´ LOM and expected growing gold production at low costs, I strongly believe Séguéla will be a cornerstone asset for Fortuna Silver.

What defines Fortuna Silver's sustainability approach?

In our corporate meetings, we don't simply discuss production and financial metrics, but also how we are hitting the marks on gender diversity, or how we can increase the rational use of natural resources and energy. By incorporating these questions into our daily, monthly and annual decision-making, we will achieve the five-year sustainability goals to which the Board has committed. •

Image courtesy of Tietto Minerals

The Gold Explorers

Earning back the love of investors

Whereas producers can directly leverage a higher gold price, juniors have investment sentiment to leverage. This has been volatile in the last year, with the junior segment feeling gradually more "unloved" by the market, especially in the second half of 2021: "Sentiment has not been favorable for the most part of this year, the market seeing many redemptions and names trading at their 52-weeks lows, which clearly indicates that investors are on the sidelines," said Nana Sangmuah, the CEO of Roscan Gold.

Relative to 2020, investment sentiment is indeed weaker, some disenchanted investors moving out of this space after initial fears of a pandemic-induced economic and financial collapse didn't materialize. Gold has also lost some investors to other commodities like battery metals as part of a more accelerated decarbonization trend. But sentiment remains imperfectly bound to the gold price which is still exceptionally strong. Relative to pre-2020 levels and the down cycle that had prevailed since 2012, sentiment stays moderately bullish.

Notwithstanding the disappointment of juniors, the boom market that took off in 2020 has positively affected exploration budgets. S&P Market Intelligence noted that gold exploration budgets jumped 43% year-on-year in 2021 to a total of US$6.2 billion. Budget allocations are expected to continue to grow in 2022 by 5-15%, before receding in the following years as economies stabilize. The TSX and TSXV, which represent 43% of the world's public mining companies, also indicate record-setting figures in 2021, with the strongest IPO market in the last 15 years and the best year in the exchanges' history for equity financing in the past 5 years.

The 94 African issuers in 34 jurisdictions, of which most are based in Burkina Faso and Mali, raised CAD$854 million in 2021 - a considerable upgrade from the CAD$761 million raised the year before.

The challenge for explorers is that most of the equity tends to prioritize low-risk, often brownfield projects, whereas early-stage exploration accounts for only 26% of the global exploration budget share, according to S&P. By contrast, more than half of the exploration allocations belong to majors. Seeing low market valuations, small West African juniors find the equity part of financing the most challenging. "It is difficult to be a trading vehicle for all retail investors because our story is being measured in quarters rather than months, weeks, or days, so that daily trading volume does not translate," said Larry Phillips, the CEO of Compass Gold, a junior formed in 2017 and developing the 850 km2 Sikasso property in Mali.

The incongruity between high gold prices and a lower-than-expected or below-the-market investment sentiment is also seen as an opportunity as both producers and juniors seem to be trading at a discount and getting better yields, which indicates rising market multiples. Producers are trading, in some cases, one or two times EBITDA, said Bert Monro, the CEO of Cora Gold: "I see many gold producers with very large margins. I think this is a good time to invest in gold equities."

Monro's reading of current market dynamics is optimistic, and he does not expect the gold price to drop below US$1,500 anytime soon. Cora Gold has already secured a US$21 million conditional term sheet of equity financing for the Sanankoro gold project in Mali, provided the company can successfully complete the DFS. This is signed by Lionhead Capital Advisors as a lead investor. Other young juniors rely on loyal shareholders that have supported them with every capital raise. Compass Gold's recent placement was entirely funded through pre-existing shareholders, including Endeavour Mining. Also listed in 2017, Awalé Resources similarly counts on a strong insider base, including the shareholders of its former parent company, Mariana Resources, sold a few years ago to Sandstorm Gold.

Juniors are also seeing more institutional investors and large corporate investors on their registers. Newcore Gold is another junior well-aligned with its shareholders, 27% of the company being insider and management owned, and Franklin Templeton bought 8% of the company's shares in its most recent C$11.5 financing round, so that after this raise 40% of the juniors' investors are institutional. In Ivory Coast, Mako Gold added Dundee Corporation to its list, while existing shareholder, Delphi, increased its holding to over 12%. Mako also boasts high institutional ownership of 33%. With cash in the bank and a good financial endorsement, juniors have been able to advance their projects fast, trying in the last two years to make up for 10 years of underinvestment.

Fast-tracked development journeys

West Africa is the third biggest recipient of exploration funding, after Canada and Australia. With only 10% of the global exploration budget, West Africa has massively over-delivered in terms of discoveries, 80 million oz of gold reserves having been found in the region in the last 10 years - more than anywhere else in the world. Many of these discoveries came about in previously unexplored countries, such as Mali, Burkina Faso and Ivory Coast, big parts of which remain untapped, while entirely new mining entrants like Nigeria, Senegal and Cameroon add thousands of km of untouched exploration ground.

For explorers active in the region, West Africa's geological potential, proven time and again, is truly exciting. Minimal mining activity in all West African nations but Ghana, combined with close-to-surface deposits across the Birimian belt, make for easy and cheap discoveries. The average depth at which gold is found in Africa is around nine meters below the surface, according to Steven Poulton, the CEO of Altus Strategies. Discovery costs are also very low; Chesser Resources, for instance, reported a discovery cost of just US$12/oz at its

shallow Diamba Sud project on Senegal Mali Shear Zone.

West African gold is not only easy to find but also easy to mine and easy to process, with close to surface mineralization lending itself to simple open-pit operations with good recovery rates. Metallurgy can make or break a project, reminds Nana Sangmuah, the CEO of Roscan Gold. In West Africa, good metallurgy makes projects, sometimes offsetting lower grades. Montage Gold, a new lister on the junior segment in Toronto, found relatively low average grades of 0.65 g/t Au at its flagship Koné project in Ivory Coast, but the deposit's soft rock, its uncommonly wide ore body of 200 m and the fact that it dips at 45 degrees make Koné amenable to a large-scale, low-cost operation with an easy-to-mine and easy-to-process ore body. "We opted for a large, 11 million tonnes processing plant which allows us to realize economies of scale thus lowering the cut-off grade to 0.2-0.3 g/t and the strip ratio to less than one," said Hugh Stuart, the CEO of Montage.

Positive metallurgy results also allowed African Gold Group to increase the reserve base of its Kobada project by converting the 400,000 oz of measured and indicated sulphide resources into reserves. "Sulfides can be quite challenging to process, requiring finer grinding than the oxides. We were very pleased to find what we call 'free milling,' which means that the sulfide ore does not require ultra-fine grinding due to gold particles trapped in the ore," said Danny Callow, president and CEO of AGG.

African Gold Group obtained 95% recoveries and proved that the sulfide ore can be processed through the designed gravity and CIL plant without any major changes.

For Canadian junior Roscan Gold, metallurgical tests for the Kandiolé project came back with a silver by-product, together with very encouraging recoveries of 97% in the oxides and 92.9% in fresh rock. The project is also de-risked by the proximity with neighboring mines, including the Luolo-Guonkoto complex and the Fekola mine, which may allow Roscan to synergize with adjacent processing plants rather than building its own, something the company will have to decide later on.

"Gold is money and nothing else. In a world where fiat currencies get devastated by market forces, gold presents itself as a robust store of wealth. In the end, gold does nothing, it simply sits there, preserving value, while fiat currencies go up and down."

- Douglas MacQuarrie President & CEO, Asante Gold

On top of a great geological reputation, West Africa has also built a reputation for developing successful mines on time and under budget. One of the lowest-cost mining operators on the ASX, West African Resources has evolved from junior to mid-tier producer after the greenfield Sanbrado gold project in Burkina Faso poured first gold in 2020. The deposit had been discovered just four years before. Sanbrado is expected to produce more than 200,000 oz/y at an impressive AISC of under US$800/oz, making it one of the lowest-cost mining operators on the ASX. In Ghana, Cardinal Resources saw two large producers competing for its takeover, Cardinal eventually accepting the offer from Shandong Gold. Cardinal's Namdini project received the mining license to operate for a renewable 15 years' period. Success stories of explorers-made-producers and assets commanding the attention of big majors in iconic takeovers send an encouraging message to other juniors in the region waiting for their big hit.

Exploration activity has certainly gathered pace in the last year, with many juniors resuming delayed drilling campaigns from 2020, or enthusiastically launching into new programs. Some are executing their biggest drilling campaigns to date. Newcore Gold is driving a huge 90,000 m drilling campaign, the largest in the company's history, at its Enchi gold project in Ghana. The company's 2021 PEA and resource update only includes 20,000 m of this program and, in the next six months, the company will be focusing on both on-strike drilling at its four gold deposits, as well as drilling below 150 m. "Historically, exploration at Enchi mostly focused on drilling the shallower oxide material with the current pit-constrained resource having an average vertical depth of only 63m. We have started hitting some high grades as we drill deeper, so drilling beyond the current pits and to depth will continue to be a strong focus," said Luke Alexander, president and CEO of Newcore Gold.

London-listed Cora Gold has also completed its largest drilling campaign so far at its Sanankoro project - 43,000 m of drilling focused to grow the mineral resource. The company has announced an updated mineral resource estimate 200% bigger compared to the results of the maiden resource and plans to publish the DFS in 2022.

Other West African juniors have also made great progress towards presenting more concrete resources as well as publishing their feasibility studies. African Gold Group has published an updated DFS for its Kobada project, showing investors a reserve base 66% bigger compared to 2019-2020 results. The junior continues drilling: "We are now looking at a 1.25 million oz reserve with 16 years LOM and a production guideline of 100,000 oz/y for the first 10 years. As it stands, the project is very compelling, though we think there is significantly more there and we can keep drilling and add oz, but we thought it was the right time to present a detailed DFS," said CEO Danny Callow.

In Ivory Coast, Mako Gold postponed the publishing of a maiden mineral resource at the Napié project, deciding to expand drilling at its main Tchaga project, but also re-start drilling at a second prospect, Gogbala, which is only 4-5 km away from Tchaga and has also returned great intercepts: "Reflecting on our vision to make a high-grade, world-class discovery we decided to keep drilling, expand our focus to include both Tchaga and Gogbala, and ultimately put a larger maiden resource out," said Peter Ledwidge, founder and MD of Mako Gold.

While vivaciously advancing their flagships, West African juniors did not hesitate to expand their land tenures, sometimes buying licenses adjacent to their main project, and other times securing land in completely new jurisdictions to diversify their portfolios.

Larger exploration areas naturally give explorers more chances of success. Looking across the region, juniors in Ivory Coast tend to boast the biggest landholdings. StellarAfrica Gold, a junior with exploration ground in Morocco and Mali, has just acquired from Altus Strategies a 770 km2 land package consisting of two permits. Other Ivorian-focused juniors boast very large land areas: Montage is developing a land package of over 1,400 km2, Awale holds 1,200 km2 at Boundoukou, while Tietto Minerals' flagship Abujar sits on a 1,114 km2 license.

While some buy for scale and new prospects, others look at licenses that can add oz into existing projects. In Ivory Coast, Mako Gold obtained 100% ownership of the Korhogo permit, a pure greenfield project easily accessible from its flagship Napié. In Mali, Roscan is also looking for land connected to the main ground of its Kandiolé project. The junior acquired the Bantanko permit which is oriented west of the inferred position of the Senegal-Mali-Shear-Zone, right between the SMSZ and the Siribaya Mankouke Seko (SMC) corridor where Roscan's Kandiolé is found.

The value of adjacent discoveries, be them small, is well highlighted by Hugh Stuart, the CEO of Montage Gold, which is developing the Koné gold project in Ivory Coast: "District exploration can transform Koné from a solid operation into something quite spectacular," he said.

The company is focused on identifying satellite deposits and has its eyes on Petit Yao Central target, located about 8 km away from its main Koné project. "Once we have a large-scale, low-cost operation running, we do not need to find another million oz deposit," Stuart said, noting that it is also a lot easier to find 50,000 oz than 1 million oz and that adding 50,000 oz to 100,000 oz from a smaller higher-grade deposit makes a huge difference in terms of project economics.

With a well-defined resource base, positive metallurgy and economics, and high upside potential, CAPEX financing is a final test for juniors who want to move their projects into construction. According to Danny Callow, this is a challenging financing phase because aspiring mid-tiers do not generate the same market movement as young explorers do with every drill hole that hits gold. Instead, construction-ready projects present investors with detailed, complex project data that require a more thorough analysis. "The market tends to forget more advanced developers," said Callow.

According to him, coming to the market with a CAPEX financing need of US$150-200 million becomes a cat-and-mouse game as late-stage developers will require a catalyst, or a large chunk of money already secured, typically in the form of debt, to get equity funds on board.

Tietto Minerals managed to find that catalyst for its fully permitted – and now fully funded – Abujar project in Ivory Coast, raising a total of A$130 million in a two-tranche private placement. Abujar is under construction with no debt and is expected to pour first gold in CY2022. Tietto brought in the same construction team that built the Sanbrado mine in Burkina Faso. Recognizing the great achievement, Tietto's founder and CEO, Caigen Wang, reflects that CAPEX financing is particularly difficult for a company that is transitioning from being a junior to a single asset producer: "Indeed, many investors prefer to wait for the project to be mature and financed before putting their own money down," he said.

But the bigger challenge Wang sees is reinventing Tietto from junior to producer, a transition that involves both an internal mindset shift, and an external one; in convincing the markets that a junior can build and run the mine.

The higher gold prices are helping project economics, reducing payback periods and supporting higher projected returns. At the beginning of this year, Orezone announced to have secured the US$189 million funding needed to bring its flagship Bomboré project into production by Q3 2022. Bomboré, Abujar and Namdini are next in line to become West Africa's newest gold mines. •

Graham Dallas

Head of Business Development, **EMEA, Toronto Stock Exchange & TSX Venture Exchange EMEA**

"In the first nine months of 2021, our African mining issuers raised over C$1 billion – which is more than they raised in total in 2020"

How important is mining to TSX and TSXV EMEA?

Though I am responsible for business development (primarily new listings) across Europe, the Middle East, and Africa, the mining business is mostly concentrated in Africa, where we have over 100 issuers with 300 plus projects in 34 different jurisdictions. Our listed issuers have raised over 37% of all mining money raised by public companies anywhere in the world in the past five years.

How have TSX and TSXV performed in 2021?

Despite the challenges, we can say this has been a terrific year for TSX in terms of the number of transactions, registering new listings, and equity raised. These successes are a result of the sophistication of capital markets aided by communications technologies, but also a reflection of the strong performance of mining companies. The first half of 2021 was record-setting, with the strongest IPO market in the last 15 years and the best half-year in our history for equity financing in both of our equity markets. In total, we saw 35 corporate IPOs on both TSX and TSXV.

What is driving M&A activity in the mining industry?

I can identify two main factors driving M&A in Africa and beyond: The first is growing a company's scale to appeal to a wider investor universe, specifically to generalist investors. There is a gap in the market for large, listed specialist mining companies (focused on precious metals, but probably also other minerals) with sufficient scale and liquidity to attract professional fund managers. Companies like BHP, Rio Tinto, or Anglo American are big, but they are diversified and exist in different investor realms. I suspect this is what drives companies like Endeavour or Kinross to bulk up their business to a market cap where a professional fund manager could target them. Only specialized funds will deploy small investments into small companies, so generalist, big-money companies require scale.

The second factor is ESG. This broad term can simply be defined in a mining context as operating mines in a credibly sustainable way. However, this is more challenging for smaller companies, who are limited to the day-to-day dollar spends, while larger miners can afford both financial and human capital to enable sustainable practices – for instance, by rolling out different carbon measurement technologies. Larger companies will also be able to sell their assets easier to ESG-mandated funds. These factors, I believe, are driving further consolidation in the market. It will be interesting to note the impact of ESG investments in mining, which is more diversified in terms of scale, geography and products compared to the O&G industry.

How do you think equity markets currently value mining companies? Are there any commodities or jurisdictions getting more attention in Africa?

In the first nine months of 2021, our African mining issuers raised over C$1 billion – which is more than they raised in total in 2020 (C$761 million). The same trend appears globally: by September this year, the global mining industry had raised C$7.9 billion on TSX and TSXV, almost the equivalent of all 2020 raisings. I stay optimistic that the market is in very good shape and well suited to allocate capital to the exploration and development sector.

Narrowing down to jurisdictional level, as a rule, mining companies love operating in a safe country, but every mining executive I have spoken to has also said that political risk comes second to geological risk. African issuers on TSX and TSXV predominantly operate in Burkina Faso and Mali, followed by Namibia, Ivory Coast and South Africa.

Trends come and go for different commodities, and today it appears that industrial metals involved in the transport and industrial revolution, like copper, nickel, or aluminium, are getting more traction, but this is a trend affecting large operations more so than juniors. In the gold space, the price has been steady.

Do you have a final message to share with our international audience?

Mining is key to TSX and TSXV just as our two stock exchanges are key to the global mining industry. Mining and the Toronto markets are well-entrenched into each other. Mining is understood in Canada better than in any other major economy, and this is because in Toronto, the exchange, regulators, bankers, analysts, and professional investors all show an honest appreciation of mining. •

Insights From the Financiers: Scouting for Investment Opportunities

The financial institution: Africa Finance Corporation (AFC)

"AFC continues to have a multipronged approach to investment. Our aim is to tackle the infrastructure gap, which is one of the main reasons why many projects in Africa are not financed. In fact, we have invested in the Nouvelle Gabon Mining (NGM) project to connect the entire ecosystem and to address the wider infrastructure challenges. In West Africa we will continue implementing our ecosystem strategy, which implies using mining as a catalyst for investment in other areas including the power sector, the railway sector and other ancillary infrastructure sectors. We are trying to replicate this ecosystem approach in countries such as Sierra Leone, Liberia and Guinea.

One of the institution's top objectives is to grow its balance sheet from US$7.5 billion to US$10 billion within the next 2-3 years, while maintaining its risk profile as low as possible through risk management. In 2021 alone we have added five new member countries, making 32 member countries in total, reflecting our commitment to make AFC a truly pan-African institution. We also recently successfully issued a Eurobond at its lowest yield to date thanks to our funding in the financial markets."

– Osam Iyahen, Senior Director, Africa Finance Corporation (AFC)

The private equity firm: Ibaera Capital

"Ibaera invests exclusively in the development of new projects that will increase the world's supply of what we call 'Future Facing Minerals' – those minerals that are essential to achieving the world's aspirations for energy transition that will underpin global decarbonization and a greener economy. Metals such as copper, gold, nickel, cobalt and zinc.

The entire future-facing minerals portfolio represents an attractive investment opportunity. Not only do we expect to see continued escalation in future-facing commodity prices, but quality, construction-ready assets in this sector are becoming very scarce and more highly valued. We are not specifically focused on one commodity over another; instead, we look at whether there are assets out there that can be effectively developed.

Our investors are very large, sophisticated international investment firms or high net worth individuals that are committed to leading the world to net zero emissions. The minimum investment made by any one investor in our 2017 fund was US$5 million and we expect a similar threshold for the current fund."

– James Wallbank, Managing Partner, Ibaera Capital

The mining royalty generator: Altus Strategies

"Our business model remains unchanged: to generate low-risk exposure to the exceptional returns that can be generated in our notoriously high-risk industry. We achieve this by growing a diversified portfolio, by working with third parties to finance the development of our projects and by retaining as well as acquiring royalty interests. We call this the 'sweet spot' of mining investment: the combination of short-term discovery upside with long term perpetual royalty income.

In terms of the assets we're after, we prioritize geology and exploration risk rather than acquiring second-rate ground in lower risk jurisdictions. Except for South Africa, the average discovery depth in Africa is only nine meters below the surface, so discoveries are both faster and cheaper on the continent. After 10 years of underinvestment in the sector, I expect investment in exploration to increase substantially in the years ahead, with many more gold, copper and other discoveries to be made in Africa."

– Steven Poulton, CEO, Altus Strategies

Next-generation mining

A vision for the future

Safe, sustainable, socially conscious, digitally connected and autonomous are the catchwords of the 'mine of the future'. Both juniors and producers subscribe to this vision, while service and equipment providers are playing their part in turning the vision into reality. But first, license operators and supportive businesses alike must tackle current realities, the practical matters of implementing ESG practices in West Africa, and the risks of not doing so.

The social element

Simon Meadows Smith, the managing director of SEMS Exploration Services, thinks the social impact is the most delicate part of ESG in West Africa because mining can be a completely new activity for many local communities who live in remote areas and may have never come into contact with miners before. Early dialogue is crucial, stresses Smith. Junior companies seem to follow this rule, engaging from the beginning with their host communities through consultation work. The worst that a junior can do is not speak to local chiefs and dwellers before an upcoming drilling program, warns Peter Ledwidge, founder and CEO of junior company Mako Gold: "This is the quickest way to turn a community against you."

Mako Gold has hired an international consultancy company to make sure its CSR mandate is well thought through and its staff receives the right training in order to liaise with local communities at its Napié project in Ivory Coast. Juniors can also contribute through small material investments which bring mutual benefits and which are tailored to the needs of the community. Mako has contracted Geodrill to install a water bore and it is fixing the local roads shared between locals and the operator. With a longer history in its host country, GoviEx Uranium wants to forge synergies with local NGOs in Niger as a way to increase the scale of its community programs in education, health, access to water and sustainable farming.

The attention that juniors pay to the social license before a mining license is a mark of business pragmatism aside from other moral concerns. In a recent survey by EY Mining & Metals, more than half of global mining executives identified the social license as the biggest risk to their business. Moving up to the producers, host communities are gradually regarded as shareholders more than stakeholders, an attitude applauded, in turn, by listed shareholders. Big mining operators have formalized investment mechanisms to make sure company gains translate into community gains. Gold Fields has invested over US$79 million through its Gold Fields Foundation in Ghana in the last two decades. For every oz of gold produced, Gold Fields sets aside US$1 for the fund, topped up with 1.5% profit after tax. In June 2021, Endeavour Mining launched the Endeavour Foundation with a base in Abidjan; this will be a vehicle for investing in host communities. In Burkina Faso, Russian mining company Nordgold has invested in the development of a community forest in the province of Outbritenga.

Energy & electrification

Most mining companies have officially set internal carbon targets. Trevali is working to reduce its greenhouse gas emissions (GHG) by 25% between 2018 to 2025. Endeavour wants to become net-zero by 2050. In 2021, Resolute Mining determined a target of 30% GHG emissions by 2025 against 2015 levels. Because energy consumption is one of the main GHG sources, these producers have first checked their energy supply. This year, Resolute installed a large off-grid hybrid power plant at its highly automated Syama mine in Mali, a process commissioned by Aggreko. The plant will use a combination of thermal, solar and battery stored energy. While producers are in the process of shifting, gradually, to alternative power sources, juniors are taking the opportunity to set the foundations for non-diesel operations. Montage Gold has chosen a LNG-solar hybrid plant for its Koné project in Ivory Coast, whereas Cora Gold will power its accommodation camps for Sanankoro with solar hybrid electricity.

Sustainability is only one of the reasons why hybrid combinations of solar, LNG and batteries are chosen. In fact, the replacement of diesel generators with greener alternatives is both cheaper (Resolute will be saving about 40% of energy costs at Syama) and more practical (Syama, Sanankoro nor Koné being connected to the main power grids). The same is true for many mines in the region. "The West African energy

> **"In a bid to reduce carbon emissions, the global mining industry is assessing solutions that can ensure a greener footprint at their operational sites. However, this trend is not yet visible in Ghana. We only receive inquiries for our diesel and gas-operated engines, but we are ready to be the partner of the industry in the transition to greener options since we have a full segment dedicated to co-generation and alternative sources."**
>
> **- Doris Afanyedey, General Manager, Cummins Ghana**

landscape has drastically changed over the last six years as natural gas was discovered offshore Ghana and Ivory Coast. LNG pipelines are currently being tracked from Ghana into Burkina Faso and Ivory Coast, so I expect this will become a very popular energy alternative," said Hugh Stuart, the CEO of Montage Gold.

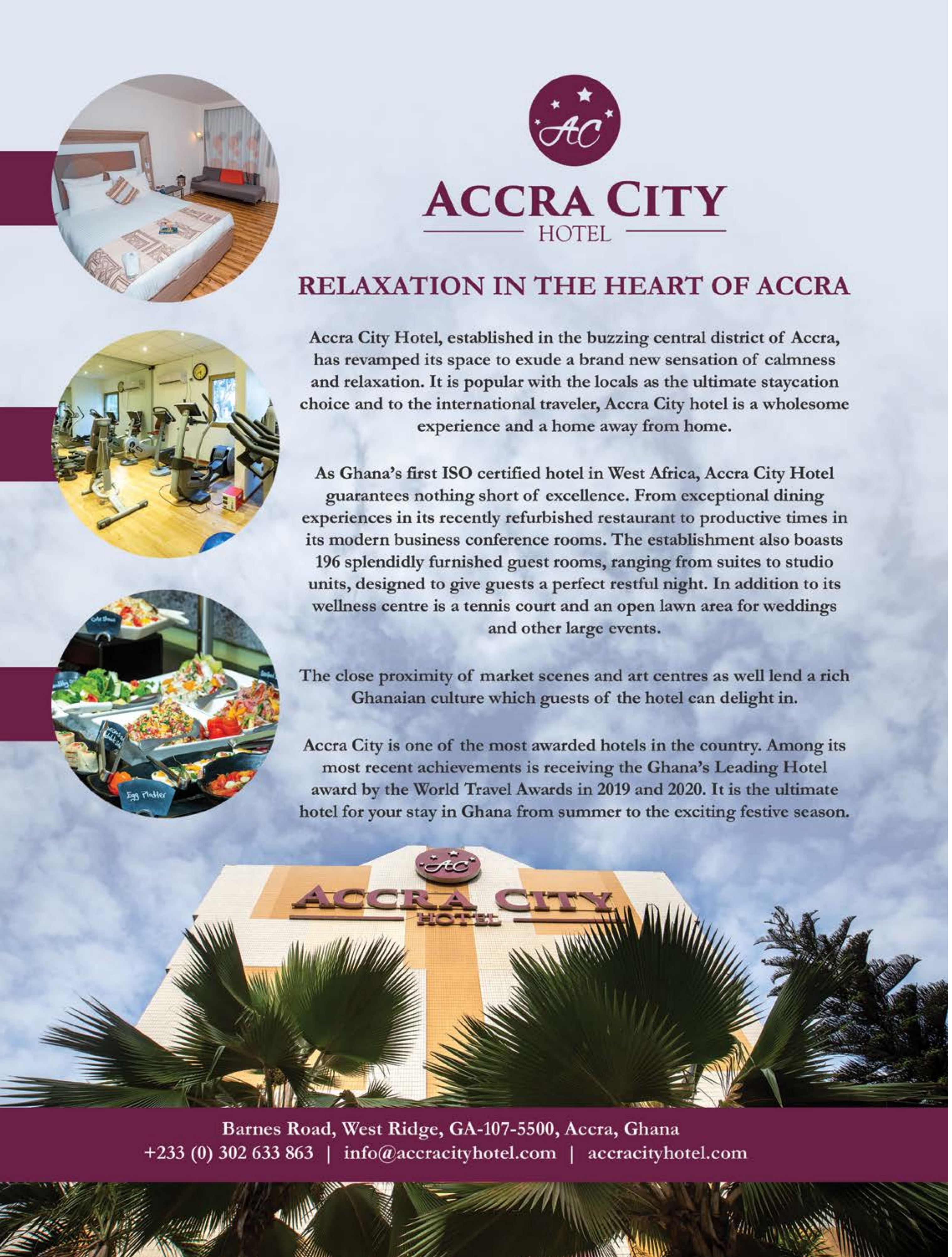
Genser Energy, a Washington-headquartered electricity and LNG supplier with a West African focus, has recently worked with Orezone to supply clean LNG-and-solar hybrid power at the Bomboré project. Bomboré will be the first mine in Burkina Faso to use LNG, but it will certainly not be the last one, as Genser entered an agreement with the Burkinabe government to supply LNG to the national grid.

Genser is expanding its services from Ghana into the Sahelian countries with an offer of both renewables and tracked LNG from Ghana: "We want to provide countries like Burkina Faso the opportunity to reduce energy generation costs and cut back on their carbon dioxide and sulfur dioxide emissions. Having gold mines as foundational customers in LNG infrastructure also enables the country to industrialize. For instance, rather than building a straight-line gas network in Ghana, we routed the pipeline so that different industries and mining sites can utilize the line today or in 10 years," said its CEO and founder Baafour Asiamah-Adjei.

Ghana's energy scene is quite different from the rest of the region as Ghana produces an energy surplus that it exports to other countries. Yet, there are still gaps in its supply. Officially, 84% of the Ghanaian population has access to electricity, but the supply is often of low quality and unreliable, with low voltages that do not support large-scale appliances. Also, the 84% electrification rate does not include informal dwellings and new buildings. By 2024, Ghana aims to provide 100% of its population with access to electricity. Behind the posted high electricity supply, the country still has what Asiamah calls suppressed demand: "Ghana's energy surplus is only apparent, and the huge growth opportunities for both the grid and for private enterprises are immense when we think high-quality and long-term."

With a mission to 'electrify African countries', electric cable supplier Nexans Kabelmetal has found a good opportunity in Ghana's expansionary demand for both conventional cables, but also for solar DC cables. The company is the first local producer of DC solar cables in Ghana, an investment it has made with the future in mind: "We decided to develop the DC solar cables locally, even though sales for these products are relatively low at this moment. We are nevertheless optimistic that solar power will be growing in the country because this is a cheap energy source and there is mounting pressure from both the international community and the private sector," said Eric Waldner, CEO of Nexans Kabelmetal Ghana.

The switch from fossil fuel sources to battery stored energy also includes mining equipment and vehicle suppliers. Large OEMs like Epiroc are committed to having all of the equipment portfolio battery-powered by 2030. "Electrification is already a game-changer in the industry. We want to align our operational culture with that of our clients and to drive change," said Anders Berglund, regional general manager at Epiroc West Africa, but not without cautioning that it is dif-



ficult to predict the rate of change, and that electric vehicles will likely co-exist with diesel-fueled machines.

It is reasonable to ask whether West Africa is ready for a big electrification transition or is this a superfluous trend in a region where some countries still have an unstable power supply or rely on coal to produce energy. Battery-powered machines and vehicles would only make sense if the source of energy is clean, argues Stephen Smithyman, the CEO of Kanu Equipment, the continent's leading dealer for Liebherr and Bell equipment: "Realistically, Africa is not at a stage where it can adopt electric equipment. The general power sources would have to be revisited if we are to strive towards a holistic green economy."

Alternative fuels, recycling and waste management

While mass electrification remains tied to the greenification of power sources, West African mining service providers bring other innovative solutions to help alternate from fossil fuels and to recycle waste materials, though these efforts lack the policy support to warrant broad-based application. They do not, however, lack the industry's receptivity. Swedish vehicle manufacturer Scania has introduced in the transport sector alternative fuels like methanol and biofuels, which are enjoying a good reception in countries with inadequate energy supply. James Awumee, mining manager at Scania, also shared other ways through which the mining industry can reduce energy use: "Haulage represents about 40% of the overall energy consumption within the mining industry. We design engines and equipment with energy efficiency in mind. We also support customers to optimize their operations through specialist training to reduce their carbon footprint and costs: For example, the driving style contributes significantly to energy consumption patterns and properly-trained drivers can save up to 10% on fuels."

Going deeper into the mining value chain, from mining vehicles, to vehicle tires, Canadian company Kal Tire offers 'everything around the wheel' products and services – from tire management, repair and retreading, to tire and product supply. Because the production of tires is both energy and carbon-intensive, Kal Tire has come up with solutions to prolong the life of the tire, running the only off-the-road (OTR) retread plant in West Africa. The retreading of earthmoving tires is a remanufacturing process of a worn tread with a new one. The Canadian manufacturer has launched an accredited 'Maple Program' through which it rewards customers that buy retreaded tires: "The customer receives maple leaves according to the percentage of their fleet that runs on retreads, recorded in an annual certificate that also showcases the total CO2 and oil savings made through retreading tires. Customers can then show evidence of their carbon-reducing initiatives in their Sustainability Reports," said Darren Flint, VP UK and West Africa, Kal Tire's Mining Tire Group.

But beyond that, West Africa has no end-of-life solutions for used tires. After the Chilean government imposed a recycling legislation on used tires, Kal Tire has built a recycling plant where worn-out mining tires are recycled through thermal conversion. "Such a directive is inexistent in West Africa, but we'd be pleased to work with the large mining companies in the region to advocate for the introduction of tire recycling legislation in Ghana," said Flint.

For a long time, the general sustainability approach has been focused on avoiding immediate issues. Water management company Veolia has noted that mining companies are increasingly more preoccupied with sustainability beyond their operations and are thinking more about the mine's future rehabilitation as well as fixing past issues: "Many if not all mines in Ghana are facing issues with brine management, because the treatment installed in the

past resulted in the large production of brines, concentrating the pollution rather than eliminating it for good," explained Laurent Piat, the managing director of Veolia Ghana.
Veolia is looking at various long-term solutions to deal with this challenge. At AngloGold's Obuasi mine the company is running a feasibility study of the water management process, conducting pilot tests to reduce the salts build up in the water system: "We are looking at the best ways to deconcentrate the brine produced by the reverse osmosis process to make sure that mining operations over the next 25 years will not be affected by saturated salts concentrations," said Piat.

Digitalization and automation

"The mining industry talks a lot about digitalization, machine learning, AI and so on, but the implementation is lagging. I believe this has to start top-down, with the CEOs buying into the benefits of digitalization not just for operational data but also for ESG data," said Viv Preston, director at data management company maxgeo.
maxgeo sells software and digital solutions for the mining markets in Australia, Africa and Canada. Over the past two decades, maxgeo has witnessed the mining industry grappling with digitalization by excessively focusing on the administrative role rather than the end user or consumer. Today, however, Preston thinks the world has come to a point where it can divide digitalization into 'the last 20 years' and 'the next 20 years,' the demand for data accessibility and data transparency growing exponentially during the pandemic. Preston's colleague, EMEA manager Maryke Maree, said: "I would like to see a mining and exploration environment that is actually embracing that 'mine of the future' concept and that has gone completely digital."
Across the value chain, digitalization and automation offer the mining industry more customized services with precise outcomes and trackable performance. The blasting industry has been among the first to advance these technologies, driven by a safety imperative. Innovations in blasting technologies follow two key trends, informs Bernard Kaninda, Africa regional director at Maxam: technologies that adapt to the geology of each rock and digital technologies to store blasting data on the cloud. Maxam's X-Energy integrated energy application system combines both smart explosives tech (Smart Rioflex) and cloud tech (the Maxam Blast Center). The result is an interactive model where blasting can be tailored to the geology of the rock and the explosion adjusted to the density of the rock. The technology is now adopted by three West African operators.
Blasting companies are also moving a step further towards autonomous tools. Orica launched the FRAGTrack fragmentation measurement tool, which gives real-time analysis and insights on the outcome of the blasting process. The technology was already implemented at Newmont's Akyem mine in Ghana last year where two FRAGTrack cameras were installed on two Liebherr 9400 face shovels. The cameras give spatial coordinates and timestamps which allows the client to accurately attribute the results to a specific blast. "Orica is envisioning an autonomous future: We are already using wireless detonators known as WebGen in Syama, Mali, and we are in engagement with Newmont's Subika UG to run some trials in the coming few months. This application significantly reduces safety risks by removing people from the brows and rills, and enhances productivity significantly, especially in underground operations," said Martin Addy, territory manager for explosives at Orica Ghana.
Though companies like Epiroc or Orica might have equipment ready for digitalization and automation, digital infrastructure lacunas, including a lack of qualified people and poor internet connection, are slowing adoption. •

Ghana as a Regional Hub

Cross-border opportunities and challenges

West African service and equipment providers have experienced very steep highs and lows since 2020. Project closures, border restrictions and higher raw material prices coincided with increased demand from across the region. The exploration and mining activity hype, but also the mining industry's growing preference for contractors as a means of controlling operating costs, revealed a gap in the supply of services and equipment in countries like Ivory Coast, Mali, Burkina Faso, Liberia and Senegal. This gap puts Ghanaian support services on the spot. So can West African countries manage their services deficit by borrowing Ghanaian capabilities?
At the Ghana Chamber of Mines, President Sulemanu Koney has a dream to see Ghana becoming the services hub for the region and is funding a study to understand what this would take. Ghana is well qualified for the job and it already serves as the base for many international and local service and equip-

"Ghana is clearly a second-to-none jurisdiction in the region. When setting up a business in West Africa, companies will not only check Ghanaian assets but also Ghanaian service capabilities. Other countries are getting the attention of investors, but it will be a long time before Ivory Coast or any other country can catch up with Ghana's hundred years of experience and history in mining."

- Sampson Koduah, West Africa General Manager, Intertek Minerals

ment companies servicing the mining industry across West Africa. The country has a competitive contracting sector, complete value chains for equipment and deliverables, as well as specialized services including metallurgical laboratory capacity. Ghana's decades-long expertise in mining reinforces local contractors and consultancies in other African countries that are just starting their mining journeys. For example, Nigerian small-scale miner Tree Mines Global chose a Ghanaian contractor with experience in alluvial mining. Ghanaian service providers enjoy the reputation of international expertise that is not too international, lending them an advantage over Western contractors.

Both Ghanaian and international companies operating from Ghana have a history of projecting their services across the region. In 2021 blasting company Maxam entered Mali and Burkina Faso, and Orica, present in Ghana since 2005, also works in Mali with companies like Resolute Mining, and in Burkina Faso for West African Resources. Both are eager to consolidate this footprint. Companies with established bases in the top three producing countries are looking further afield, Epiroc planning to open new entities in Liberia, Ivory Coast, Sierra Leone and Senegal, as well as increasing its West African team by 20%. Ghanaian firm EDM African Services hopes to become one of the key suppliers of rock drilling tools outside of Ghana.

A few things are promulgating further expansion in the region. At the broader level, the African Continental Free Trade Agreement (AfCFTA) entered into force in January 2021, creating a huge trading bloc of 1.3 billion people. In the context of a liberalized pan-African market, Ghana has a competitive advantage over other countries in the continent because it can supply diversified products and services required in other markets, whereas many African nations have very similar production and export structures that do not lend themselves to intra-African trade. For example, a lack of locally produced electric cables in ECOWAS countries will allow cable manufacturer Nexans Kabelmetal to leverage both the AfCFTA and the ECOWAS membership to export its products in countries with this supply gap.

Market dynamics make these expansions timely. Intertek, which has a minerals facility in Tarkwa, Ghana, has observed significantly higher mining and exploration activity since October 2020, giving it the opportunity to grow capabilities across the region: "Many new players are joining the market, while those who have kept a low profile over the years are now resurfacing stronger, which is translating into clients approaching us for the first time, or returning after a long exploration break," said Sampson Koduah, West Africa general manager.

It's not only gold that drives demand. Peter de Leo, the managing director of Australian EPC leader Lycopodium, has noted many emerging West African projects in battery minerals, fertilizers and mineral sands being reviewed or reassessed: "As a trend, the energy transformation is gathering more pace in the mining sector. Resource companies are outpacing governments in terms of their quick adoption of greener solutions, especially as lower-carbon sources are starting to make more economic sense."

There are also negative reasons why Ghanaian equipment and service providers should look over borders. Service and equip-

West African governments must learn how to better engage the private sector and stay open to private-public relationships that benefit both sides. While in the past, we would wait for international players to take over grounds and invest in Africa, I believe the right time has come for local people to lift Africa out of poverty, collaborate fairly with authorities and invest in our own assets.

- Peter Quarm, Director, Dutylex

In West Africa, in Ghana, Benin, Togo, Sierra Leone and Ivory Coast we operate through distributors, working closely with our partners to increase our presence in these markets. We are looking to build a warehouse in Ivory Coast, as well as a production plant in this region. Despite registering a higher volume in sales in the past year, logistic costs coupled with regular maritime transport rescheduling have hindered our revenue growth, making it ever more pressing to produce locally in the countries where we distribute.

- Stéphane Rabut, Global Explosives Director, Titanobel

Besides further establishing ourselves in our areas of activity and countries of focus, our goal is to increase our CSR contribution: De Simone wants to make sure we share the advantages of our work with the local community and to show we are not there only to benefit from the situation, but to help. We are looking for different ways to get involved, not only participating in the programs designed by miners but also developing our own initiatives.

- Federico De Simone, Director, De Simone Group

ment suppliers in Ghana feel that countries like Ivory Coast or Mali will be the future bread-earners as Ghana gradually matures. Samuel K. Gyan, the regional managing director for SGS Ghana, Liberia and Sierra Leone, said he cannot remember the last new mine developed in Ghana. Whereas brownfield developments like the Ahafo North investment are certainly creating great movement in the services sector, explorers have diverted their budgets to neighboring countries like Ivory Coast or Burkina Faso where land ownership and VAT fees are lower: "The number of new mines in Ghana has plateaued because greenfield exploration is lacking, thus the government must improve the fiscal environment to allow junior exploration companies to thrive. While first in Africa for gold production, Ghana ranks fourth in terms of exploration investment," said Gyan.

Ghanaian service and equipment providers have all the reasons to expand, but this is not easy during normal times and has certainly not been easy during the pandemic. For dealers of consumables and equipment, planning became a headache, having to build on inventories and find adequate storage for the higher stocks. Service companies also had a tough time mobilizing staff to different mine sites in light of travel restrictions. As for logistics companies, they were caught in the middle of keeping the industry moving - all while the mining industry needed more support and could not afford delays.

Each of these challenges is exacerbated by poor infrastructure, a significant bottleneck for continental expansion. It can take weeks for a contractor to transport large equipment over single-lane roads between different countries. Because contractors expand into new countries on a project-by-project basis, relocation needs to be justified by long-term projects. This is why Ghanaian local mining and civil engineering company Ramoth Services will only accept projects abroad where the advantages outweigh the challenges.

Ghana's infrastructure is comparably better to other West African countries, ranking second best in the region, and twelfth in Africa, according to the 2020 Africa Infrastructure Index. The country's transport ministry recently announced positive developments, including the near competition of Sunyani Airport's rehabilitation. Ivory Coast is also seeing significant investments. French logistics company Bolloré has inaugurated a second container terminal together with its JV partner, AMP Terminals and the Ivorian government. The new port will be a transshipment hub for neighboring coastal countries, as well as an entry point for landlocked countries: "The Ivory Coast terminal will foster intra-African trade, creating high-performance logistics systems and bolstering the development of local processing industries," said Dolores Biamou, mining projects director for Africa at Bolloré Logistics. •

Local Content and Competition

Local content and local capacity: The missing dots

"African politicians, if I may generalize, have a difficult job balancing free market policies with promoting local businesses and driving localization initiatives. I do not feel that Ghana is running an aggressive nationalization program and the competition between local and international companies remains unbiased and free."

- Fabian Limberger, Chief Commercial Officer, Rocksure International

"The old model of flying in expats to do the technical job combined with a few locals doing the rest of the work on the ground has to change and has started to change," said Simon Meadows Smith, the managing director of Ghana-based firm SEMS Exploration Services.

Except for Simon, everyone at SEMS has West African origins. Across West Africa, local content laws have been introduced or are due to be introduced as a way of encouraging, and legally prescribing, local participation of businesses and people in mining value chains. Ghana has finetuned its localization requirements in a fresh 2020 decree, and Burkina Faso has announced in 2021 a novel decree to help promote Burkinabe business owners. The intentions are clear – to give local companies and local people more arbitrage in the competition with foreigners and seek to remediate not only a local-foreign competition but also a SME-multinational one. The impacts of such policies do not always, however, follow the script and may have different consequences for both sides.

When it comes to local procurement of goods, local content requirements are not compatible with other laws. Incentives to buy locally may be cancelled by import incentives: Ghana has created the Mining List, a catalogue of mining-related equipment eligible for VAT reimbursements, which ultimately promotes cheaper non-Ghanaian consumables. Furthermore, many products made in Ghana are more expensive than those bought from international markets and some are either not available in the country, or their local supply is very limited. Nexans Kabelmetal, for instance, imports all raw materials but aluminium for its local production: "The low stock of products and raw materials mitigates against buying locally. If local content laws are to be effective, we need more cohesive policies that grant both the availability and benefits of locally purchased products," said CEO Eric Waldner.

In terms of people, local employment quotas have tasked international companies to hire locally, but before that, they must develop the local talent they can hire from. These laws have been broadly successful. In Ghana, 90-95% of staff working for international companies are already Ghanaian nationals, but the remaining 5-10% represent higher-paid roles. The updated local content regulations in Ghana stipulate that local staff should occupy higher positions like general manager or mine manager, and that they should also provide gender-inclusive recruitment. These two aspects have been the latest focuses of international operators. Canadian tire manufacturer Kal Tire has a 98% Ghanaian team, and the few expats making up for the difference are mandated with training locals to become managers. Meanwhile, Epiroc is working to encourage more women to enter the mining industry.

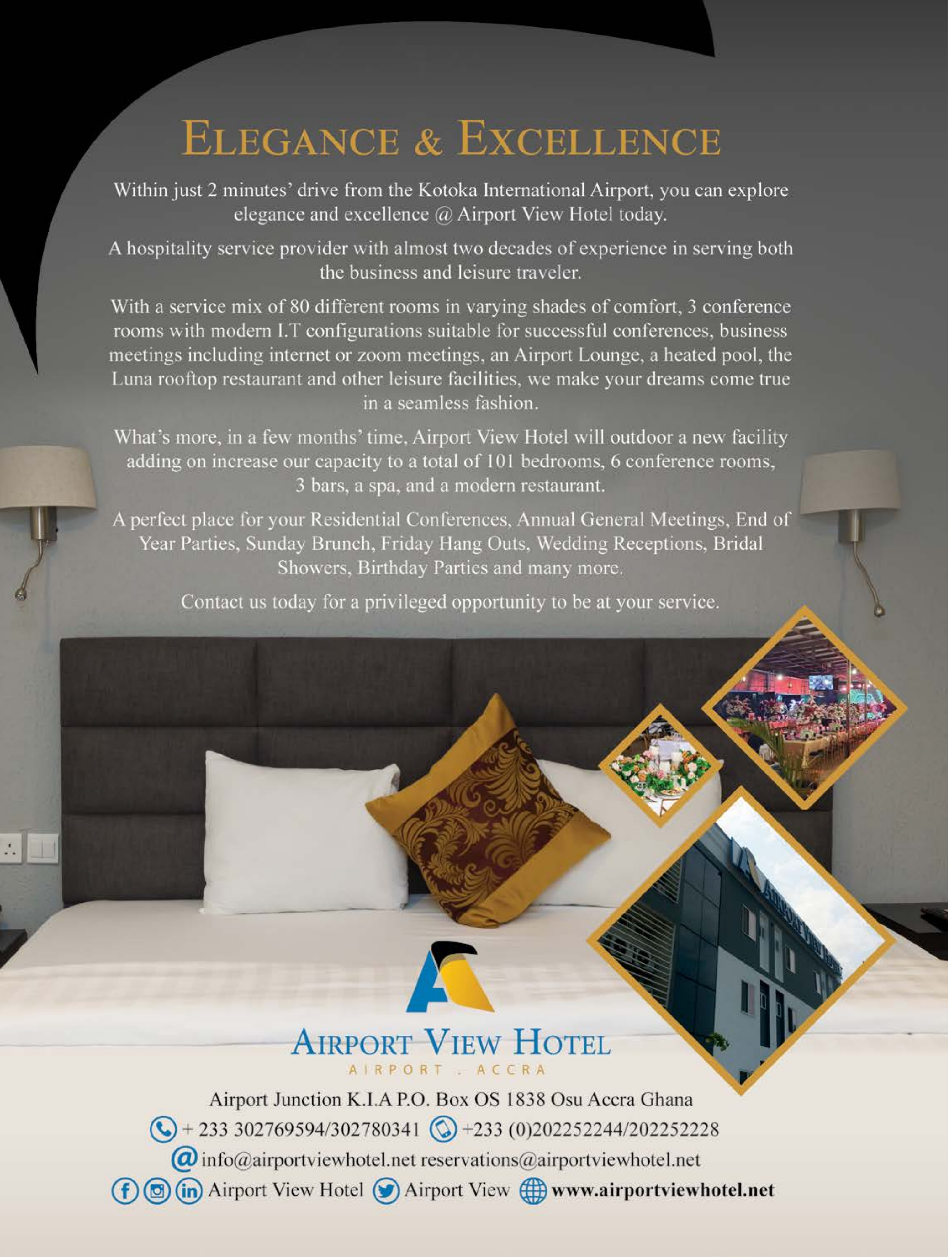
The importance of local leaders has been exacerbated by the pandemic, which constrains international hires, squeezing the talent pool for engineers, construction managers and geologists. Some international companies have also partnered with local universities to both sponsor and scout young talent. Maxam collaborates with the University of Mines and Technology of Tarkwa and sponsors interns through a program called YESS, now also extended to Burkina Faso. Maxam's current regional operational manager has been recruited through this program.

Supporting skills development is more challenging for international contractors without a permanent in-country base. 30-years old Australian EPC and EPCM company Lycopodium is running development and learning programs focused on know-how transfers to empower locals to become leaders and knowledge-holders in their own right, said Peter de Leo, managing director: "It's incumbent on all of us to build local capacity, not just because this is the right thing to do, or because this is the way to improve people's lives in a tangible way, but because travel restrictions have severely hindered foreign recruitment creating a talent shortage."

Local content has been largely effective at prompting local skills development and today Ghana is actually exporting its talent to other African countries. Where the balance needs to be drawn is at the expat quota, which, argues Bill Witham, the CEO of AAMEG (Australia-Africa Minerals & Energy Group) should not fall under 4% for local content to remain meaningful and reasonable: "Any country will, at some point, require expertise from abroad, so setting expat limits under 4% of the workforce is unrealistic for some projects, especially during construction. Local employment is certainly encouraged and desirable, but not to the extent when good intentions end up compromising the quality and economics of a project. Local content laws should not be abused to the point where corruption can take place or investors leave the country because it becomes impossible to operate in."

Market competition

Local SMEs often find themselves trapped: To service large mining companies, they need to upscale and upskill, but to obtain the money to upscale, they need to be large enough and show a good track record of contracts to satisfy lenders. Access to capital is the most challenging aspect for local companies. Even when the banks approve a loan, borrowing costs are very high, with interest rates over 10%



in Ghana, while the cedi's depreciation against the US$ makes the acquisition of equipment from abroad particularly expensive. "Local banks have incredibly high interest rates and steep collateral requirements because they perceive SMEs as high-risk borrowers. This is a massive impediment for many local players that are unable to boost their business without bank financing; meanwhile, international players enter the market with a lot of ready-to-spend capital whilst operating at scale economies thus giving them a competitive advantage with respect to selling prices," said Ernest Nsiah, managing director of Ghanaian supply and delivery company EDM African Services.

The difficult access to capital is a result of twin factors, explained NanaAma Botchway, managing partner of female-led law firm N. Dowuona & Company: "The first issue is the bank's reduced appetite for risky loans when there is scope to be profitable at lower risks with a selected and well-known client base. On the other hand, the SME sector is not helping itself; especially when they start out, SMEs tend to have an informal structure in the marketplace and they are unable to provide all the necessary corporate governance and documentation expected of them."

By contrast, international companies can leverage commensurate capital, experience, logistics infrastructure, which has a "bullying" effect on the market, thinks Kwame Amponsah, general manager of local contractor Ramoth Services. To compete, companies like Ramoth enter a price battle, offering overhead costs and a readiness to meet the client's required pricing.

International contractors agree with the necessity of levelling competition. Peter de Leo, the managing director of Lycopodium, thinks local content is very "warranted," even though it can be challenging to implement. Lycopodium has been working with all the big names in West Africa. It has also been awarded the contract for EPM services at Ghana's biggest current investment, the Ahafo North, and is also at the forefront of the main upcoming mines, working at the Bomboré gold project in Burkina Faso, the Séguéla gold project in Ivory Coast, and the Goulamina lithium project in Mali.

Local content laws seek to fix the competition local-international and SME-multinational through requirements that the industry engages Ghanaian-owned and Ghanaian-managed service providers for technical, engineering, accounting, legal, and financial services. This intervention was deemed necessary in the first place because of the disproportionality of capital between SMEs and MNCs, but also to fight off a misperception of lower quality when the job is done locally.

Fabian Limberger, the CSO of leading local contractor Rocksure International, the single contractor running Perseus's Edikan mine, feels it is fair that regulators give a nudge to mining companies so that they pay greater attention to local companies, but that ultimately, skills should be the main factor. "Local content laws cannot and should not override merit-based considerations. For the past 10 years, Rocksure has won tenders because of our performance record and we are well-positioned to prove ourselves in a continuous competitive environment based on this premise."

Rocksure has been on the other side of the coin, having a contract outside of Ghana removed from them despite over-performing targets, which Fabian sees as a direct contradiction of free competition principles.

As a result of the stricter requirements to engage local services, more international players are opening up to JVs to satisfy local participation criteria and avoid any potential setbacks. Martin Addy, the territory manager for explosives at Orica Ghana, is looking to affiliate with a local company very soon, saying it has become "a must" to partner with a local entity to stay relevant.

Local players are also keen on partnerships. "One of the best mechanisms that can increase the effectiveness of local content laws is the encouragement of JV partnerships between international and indigenous players," said Ernest Nsiah, managing director of EDM African Resources. "EDM wants to be seen as complementary to key international players like Epiroc and Sandvik. We have always recommended them to prospective customers for the purchase of capital equipment; we expect that the collaboration will be reciprocal in the years ahead." •

West African Country Files

Image courtesy of Gold Fields

GHANA

CAPITAL
Accra

POPULATION
31 million

GDP GROWTH 2022 (PROJECTED)
4.1%

TOP EXPORTS
gold, petroleum, cocoa beans

CONTRIBUTION OF MINING TO GDP (2020)
11%

ESTIMATED PEOPLE WORKING IN MINING
34,363

MINERAL RESERVES
gold, bauxite, manganese and diamonds

GOLD PRODUCTION OUTPUT 2020
138.7 tonnes

HIGHEST GOLD PRODUCTION TO DATE
149.1 tonnes (2019)

MAIN PRODUCERS
Gold Fields, Newmont, Perseus Mining, AngloGold Ashanti, Kinross, Golden Star Resources

MAIN JUNIORS
Asante Gold, Newcore Gold, Cardinal Resources, Azumah Resources, Goldstone

MINING CORPORATE TAX
35%

FREE CARRIED INTEREST
10%

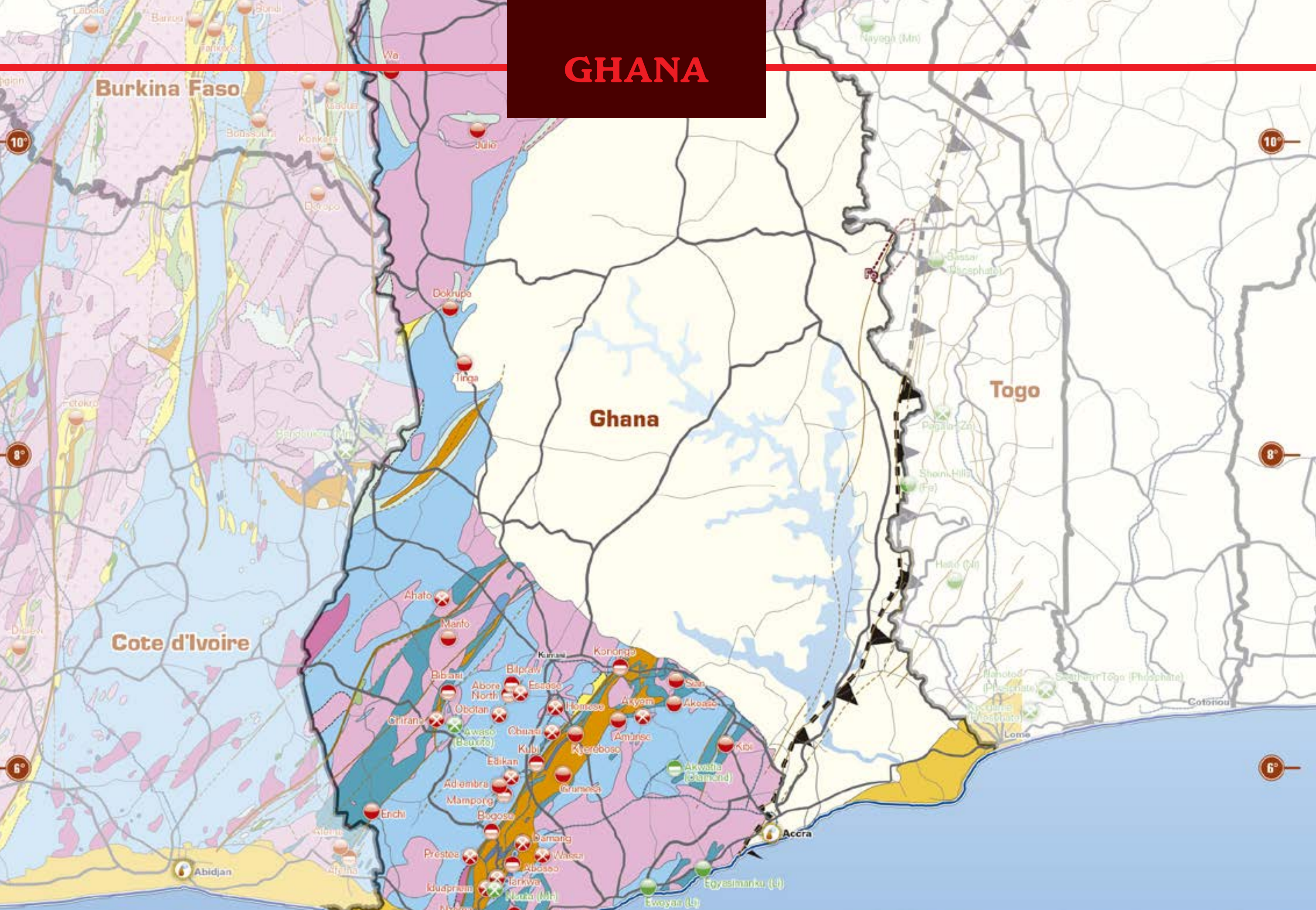
MINING ROYALTIES
5%

EASE OF DOING BUSINESS (RANKING)
118 out of 190

ACCESS TO ELECTRICITY
83.5% of the population

Sources: Ghana Chamber of Mines; World Bank; International Trade Center; EITI; IEA; World Bank; AfDB; PwC

GHANA



Sulemanu Koney

CEO
GHANA CHAMBER OF MINES

Could you bring us up to date with the latest developments at the Chamber?

With respect to local content, the Chamber worked with the Ghana Standards Authority to establish standards for electric cables, supported some prospective investors with data on inputs demanded by its member companies and facilitated meeting opportunities with the mining firms and finance houses. Indeed, the Chamber commenced discussions with the umbrella organization of commercial banks in Ghana, Ghana Association of Bankers, to design a tailored financing scheme for firms embedded in the value chain of the mining industry.

On female participation in the mining sector, the producing member companies of the Chamber have set ambitious targets to increase the female-to-male ratio at their respective mines.

The Ghana Chamber of Mines' Tertiary Education Fund (TEF) was launched in 2019 with a five-year endowment of over US$2 million. In the initial funding window, the accrued funds were earmarked for projects at the University of Mines and Technology, which is the foremost tertiary institution for training mining professionals in the country and sub-region.

The Ghanaian mining industry suffered a 12% YoY reduction. Can you comment on the industry's performance in the last year and share your projections for 2021-2022?

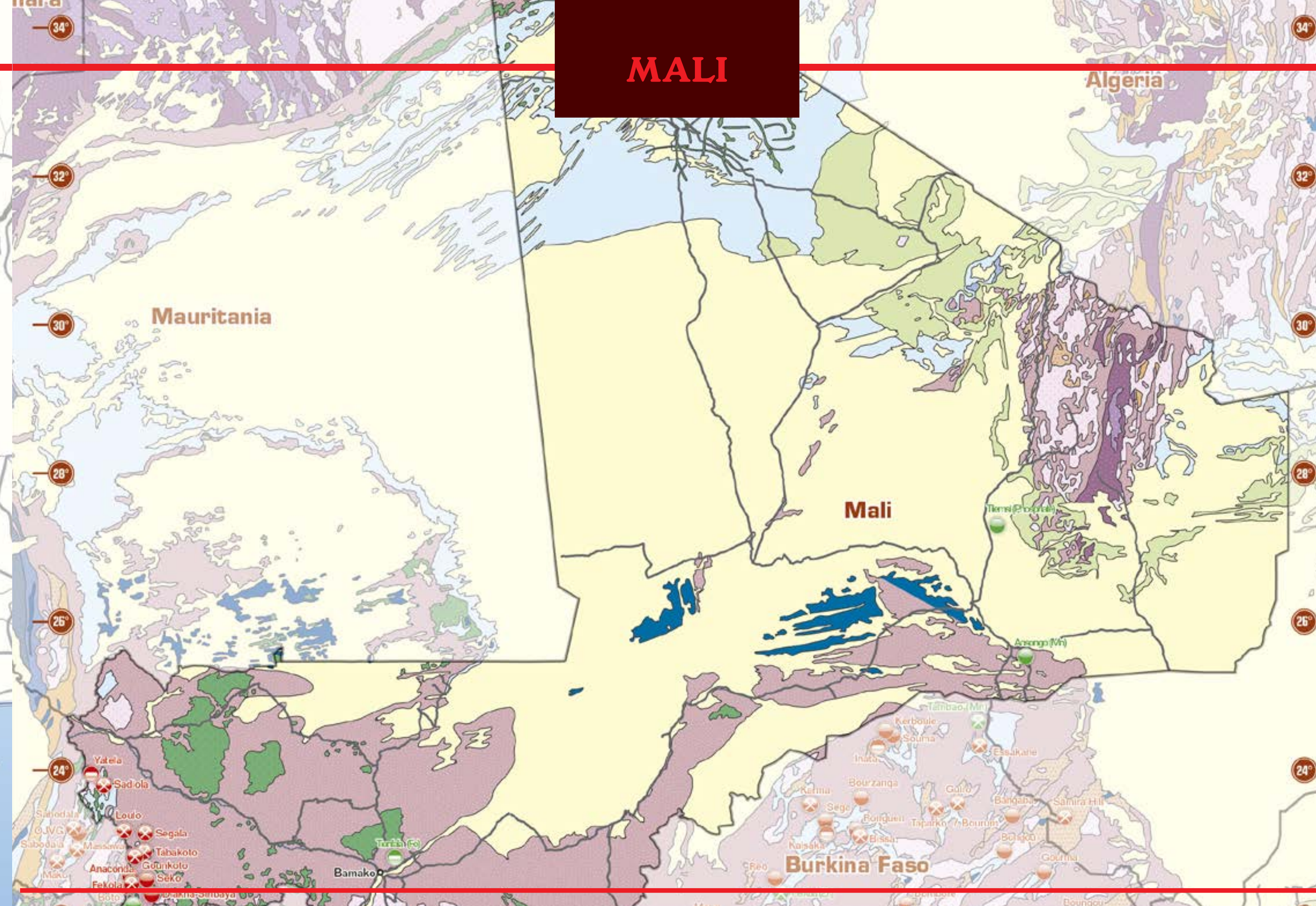
The decline in gold production in 2020 was primarily attributable to developments in the small-scale sector. The introduction of an export tax on gold produced by small-scale miners induced a sharp contraction in the quantum of gold exported by small-scale miners, from 1.59 million ounces in 2019 to 1.18 million ounces in 2020. In the large-scale sector, production also dipped by 4.8%, from 2.99 million in 2019 to 2.85 million ounces in 2020. The downturn in production was on account of a variety of mine-specific issues.

In the 2021-2022 period, the Chamber expects gold production around 3.1 million ounces.

What incentives can boost exploration in the country?

The Chamber has requested the government to exempt exploration firms from VAT on services consumed in the course of mineral exploration as well as review the regulatory land holding costs downwards. •

MALI



CAPITAL	POPULATION	GDP GROWTH 2022 (PROJECTED)	TOP EXPORTS
Bamako	20.9 million	5.70%	gold, cotton

CONTRIBUTION OF MINING TO GDP	ESTIMATED PEOPLE WORKING IN MINING	MINERAL RESERVES
8-10%	3,635	gold, bauxite, manganese, iron ore, limestone, phosphates and uranium

GOLD PRODUCTION OUTPUT 2021	HIGHEST GOLD PRODUCTION TO DATE	EASE OF DOING BUSINESS (RANKING)	ACCESS TO ELECTRICITY
63.4 tonnes	71.2 tonnes (2020)	148 out of 190	49.6% of the population

MAIN PRODUCERS

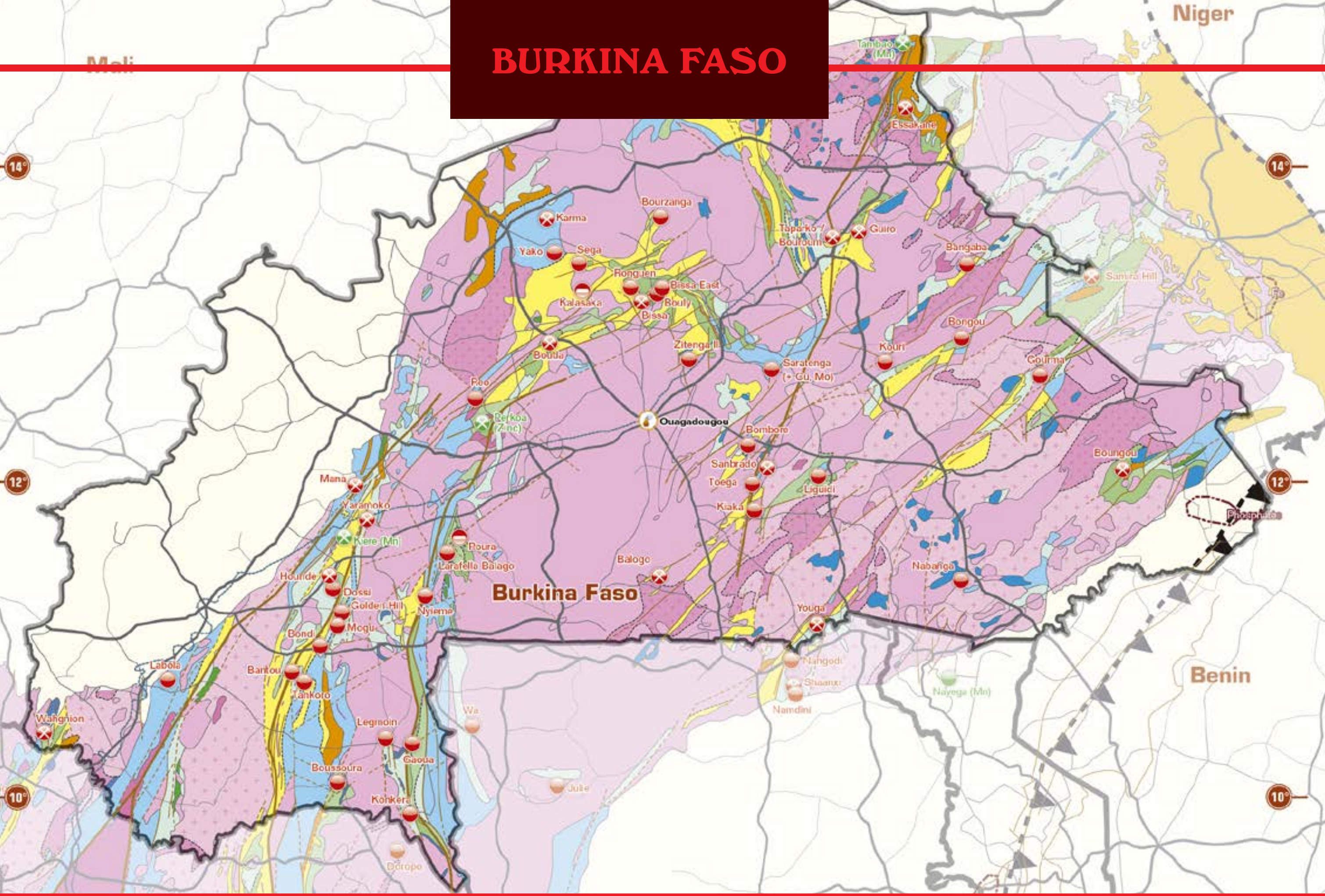
Barrick Gold, B2Gold, Resolute Mining

MAIN JUNIORS

Cora Gold, Roscan Gold, Firefinch, Kodal Minerals, Oklo Resources, African Gold Group, Stellar AfricaGold, Compass Gold, Marvel Gold, Leo Lithium (upcoming listing on the ASX)

MINING CORPORATE TAX	25%
FREE CARRIED INTEREST	10%
MINING ROYALTIES	3%

Sources: UN, World Bank, International Trade Administration, EITI, Reuters, IMF, IEA



BURKINA FASO

CAPITAL	POPULATION	GDP GROWTH 2022 (PROJECTED)	TOP EXPORTS
Ouagadougou	20.9 million	2.7%	Gold, cotton, zinc

CONTRIBUTION OF MINING TO GDP	ESTIMATED PEOPLE WORKING IN MINING	MINERAL RESERVES
10%	9,651	gold, zinc, copper, manganese

GOLD PRODUCTION OUTPUT 2020	HIGHEST GOLD PRODUCTION TO DATE	EASE OF DOING BUSINESS (RANKING)	ACCESS TO ELECTRICITY
60 tonnes	60 tonnes (2020)	151 out of 190	21.9% of the population

MAIN PRODUCERS

Endeavour Mining, IAMGOLD, Trevali, Nordgold, Fortuna Silver Mines, Centamin

MAIN JUNIORS

Orezone, Arrow Minerals, Sarama Resources, Tajiri Resources

MINING CORPORATE TAX	28%
FREE CARRIED INTEREST	10-15%
MINING ROYALTIES	16%

Sources: UN, World Bank, Coface, EITI, IEA, Fitch Ratings

Bachir Ismaël Ouédraogo

Minister
MINISTRY OF MINES, QUARRIES, AND ENERGY, BURKINA FASO

What is the key priority of the Ministry of Mines for 2022?

Our focus for the coming year will be on adopting and implementing the local content decree adopted following the Minister's announcement in September 2021 that relates to the local supply of goods and services in the country.

However, we recognize that there are barriers to the deployment of local content such as the weakness of the legal framework, insufficient production infrastructure and the absence of training adapted to the requirements of the field. Therefore, we are promoting the creation of a skilled national workforce and value addition through refineries and fine coal processing for example.

How is the country managing the escalating security threats?

Several initiatives are being undertaken to reassure investors such as founding the national office for the security of mining sites (ONASSIM) which is designed to guarantee better security conditions for mining investors. Thanks to the efforts of ONASSIM, all mining sites have contingents of Defense and Security Forces able to cope with attacks.

However, it is also necessary to secure the access routes to industrial and artisanal mines to avoid tragedies such as the attack on the Boungou mining company. The authorities are tackling this issue head-on.

What is the policy framework and approach to formalize artisanal miners?

In Burkina Faso, small-scale gold mining is an ancient practice that generates income for the two million individuals who practice it.

As a result, between 5 -10 tonnes of gold fraudulently exit the country annually. In 2015, the State decided to revisit its supervision policy on the sector through the creation of the National Agency for the Supervision of Artisanal and Semi-Mechanized Mining Operations (ANEEMAS). This made it possible to supervise artisanal miners, the marketing of gold and the preservation of the environment. ANEEMAS, which currently has 10 management offices.

Other mechanisms are implemented to encourage players in the gold mining sub-sector to move towards semi-mechanized or even semi-industrial mining. For example, we are going to start refining activities to secure gold production sites and innovate in terms of traceability. •

Adama Soro

President
CHAMBER OF MINES BURKINA FASO

What have been the most recent developments and priorities within the Chamber?

The Chamber of Mines inaugurated a new Board in June 2021 and we have been working on a new strategy structured around three axes: The remobilization of the Chamber to attract more members and encourage more proactive and informed participation; The positioning of the Chamber as a key actor in the country's socio-economic development; And the strengthening of the collaboration with the government around security, local content, mining investment and ESG. The mining industry in Burkina withstood well the pressures of the pandemic and has recorded growth, with approximately 62 mt gold 2020 production.

Could you bring us up to date with the security situation on the ground?

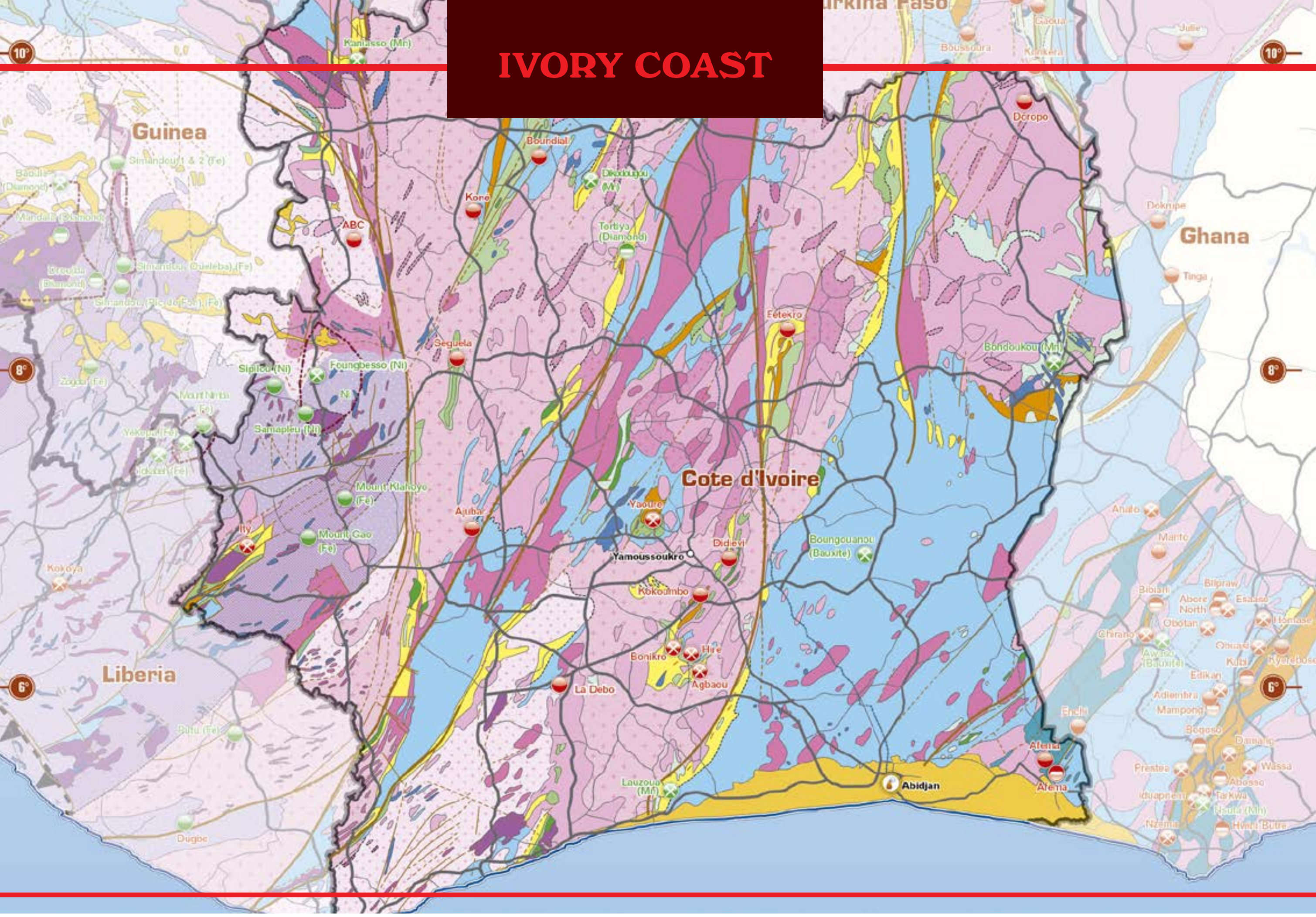
We recall with deep regret different acts of violence, including the 2019 death of a Canadian geologist, and incidents on some mining convoys. Unquestionably, the last few years have been challenging on the security front. This has taken a huge toll on mining operations, as well as curtailing the exploration ground in high-risk security areas. The government is fully aware of the dire consequences stemming from this predicament and we are working together on a comprehensive plan to contain the violence. Private companies cannot protect themselves and they need the government to step in firmly.

How can the contribution of mining to local development be magnified?

There are two main aspects to increasing the beneficiation from mining. The first one is through the Local Community Fund established in 2017 and collecting 1% contribution from the annual turnover of each mining company to develop local infrastructure in 50 communities. This fund gives leverage to each community to invest in schooling, education, health, and inclusion of women and youth in the local economy. However, to be effective, we need to improve the governance around handling these funds.

The second aspect is local content. The government has recently adopted a new decree on local content just late in September 2021 stipulating that mining companies should prioritize local suppliers when rolling out their procurement strategy suppliers. •

IVORY COAST



CAPITAL
Yamoussoukro

POPULATION
26.38 million

GDP GROWTH 2022 (PROJECTED)
6.50%

TOP EXPORTS
Cocoa beans, gold, petroleum oils, rubber

CONTRIBUTION OF MINING TO GDP
1.5%

ESTIMATED PEOPLE WORKING IN MINING
13,993

MINERAL RESERVES
gold, diamonds, iron, manganese, nickel, bauxite

GOLD PRODUCTION OUTPUT 2021
41.8 tonnes

HIGHEST GOLD PRODUCTION TO DATE
41.8 tonnes (2021)

EASE OF DOING BUSINESS (RANKING)
110 out of 190

ACCESS TO ELECTRICITY
76% of the population

MAIN PRODUCERS
Barrick Gold, Endeavour Mining, Perseus Mining

MAIN JUNIORS
Mako Gold, Tietto Minerals, Montage Gold, Sama Resources, Stellar AfricaGold, Awalé Resources

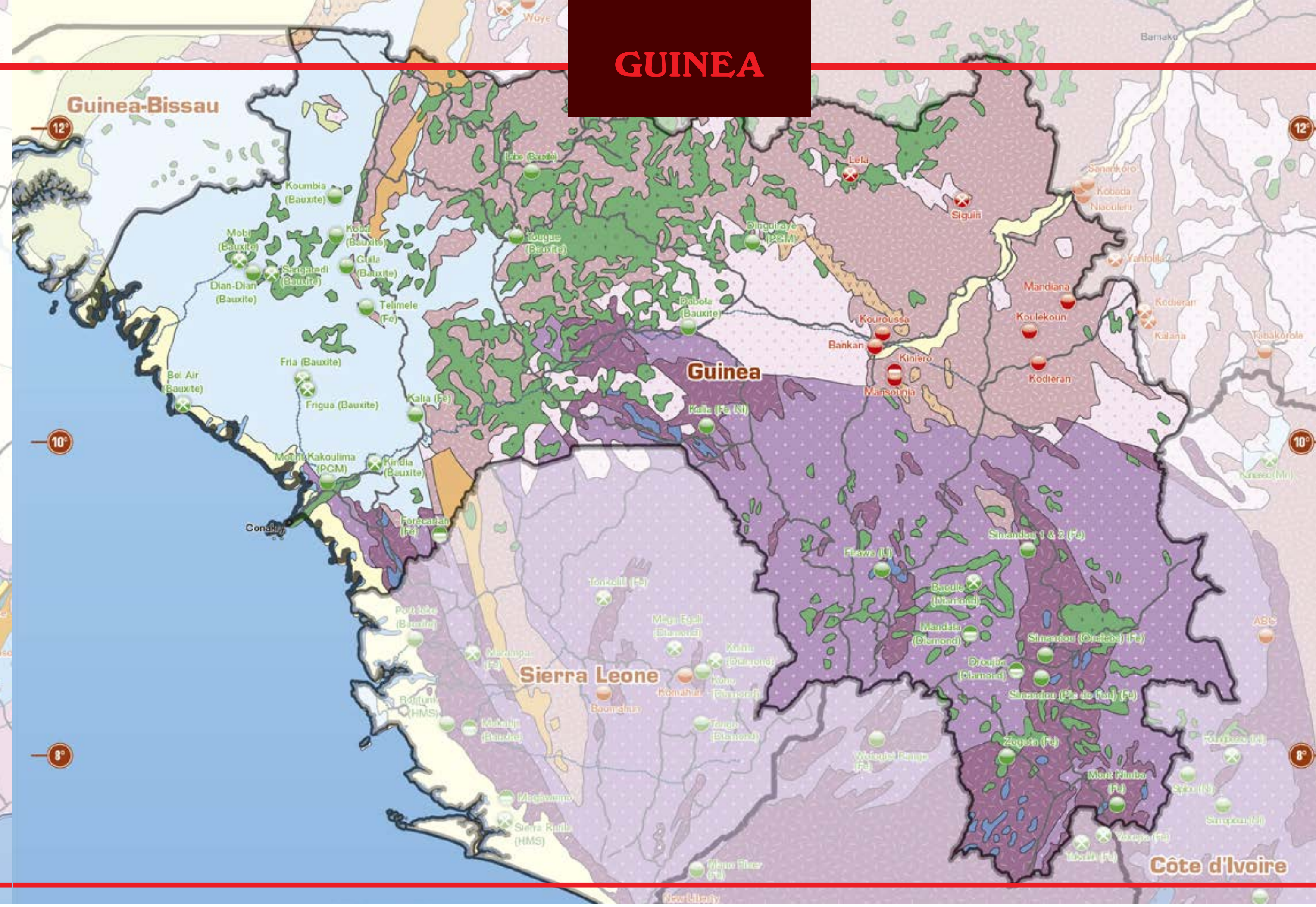
MINING CORPORATE TAX
25%

FREE CARRIED INTEREST
10%

MINING ROYALTIES
3-6%

Sources: World Bank, UN, AfDB, Chamber of Mines CIV, EITI, IEA

GUINEA



CAPITAL
Conakry

POPULATION
13.1 million

GDP GROWTH 2022 (PROJECTED)
5.1%

TOP EXPORTS
Gold, bauxite, diamonds

CONTRIBUTION OF MINING TO GDP
35%

ESTIMATED PEOPLE WORKING IN MINING
10,000

MINERAL RESERVES
bauxite, gold, diamonds, iron, nickel

GOLD PRODUCTION OUTPUT 2020
56.9 tonnes

BAUXITE PRODUCTION OUTPUT 2020
82 million tonnes

EASE OF DOING BUSINESS (RANKING)
156 out of 190

ACCESS TO ELECTRICITY
45.7% of the population

MAIN PRODUCERS
Nordgold, Avocet Mining, Managem

MAIN JUNIORS
Predictive Discovery, Hummingbird Resources, Lindian Resources

MINING CORPORATE TAX
30%

FREE CARRIED INTEREST
15%

Sources: World Bank, KPMG, UN, World Gold Council, EITI, Fasken, IEA

NIGER

Hadizatou Ousseini Yacouba

Ministry of Mines
NIGER

What have been the main milestones realized by the Ministry?

The main advances made in the mining sector over the past two years have focused on improving the governance of the sector. In July 2020, Niger adopted by decree the National Mining Policy document. This constitutes a unifying framework for all players in the mining sector. The ambition of the mining policy is to make the mining sector a powerful lever for Niger's development while keeping it competitive and attractive to investors.

Secondly, Niger's mining code has been revised to take into account certain current concerns and improve the sector's attractiveness; this is currently pending approvals.

What is the significance of ECOMOF taking place in Niamey this year?

The ECOWAS Commission and the Government of the Republic of Niger are collaborating to organize the 3rd edition of the ECOWAS Mining and Petroleum Forum, ECOMOF 2021, to be held in Niamey from February 16-18, 2022. ECOMOF is the gathering of the highest government delegations from the fifteen member states of West Africa of ECOWAS.

It is an opportunity for us to invite potential investors from around the world and interest them in the mining, oil and energy sectors.

What are your main priorities in the next 1-2 years?

Our priority is first to ensure the revival of the mining sector in our country and to make it play an important part in the country's growth. This revival is essentially conditioned by the strengthening of existing structures and the diversification of mining production and partners. We have therefore set about improving governance, knowledge and promotion of the country's mining potential.

Do you have a final message to share with our readers and your broader stakeholders?

The Ministry is leading a program of improving knowledge of the mining potential, diversifying partners, improving governance and the increasing of the contribution of the extractive industries to the development of our country. •

CAPITAL	POPULATION	GDP GROWTH 2022 (PROJECTED)	TOP EXPORTS
Niamey	25.1 million	7.8%	gold, uranium ores, petroleum

CONTRIBUTION OF MINING TO GDP 8.1%

MINERAL RESERVES Uranium, gold, coal

URANIUM PRODUCTION OUTPUT 2020	EASE OF DOING BUSINESS (RANKING)	ACCESS TO ELECTRICITY
2,991 tonnes	132 out of 190	13.6% of the population

MAIN PRODUCERS
Orano: Somair and Cominak

MAIN JUNIORS
GoviEx Uranium, Global Atomic

MINING CORPORATE TAX	28%
FREE CARRIED INTEREST	10%
MINING ROYALTIES	5.5%

Sources: Niger Ministry of Mines and Steel Development; World Bank; International Trade Center

NIGERIA

Olamilekan Adegbite

Minister of Mines and Steel Development
NIGERIA

What are the main developments in Nigeria's mining industry?

More investors are investing in the Nigeria mining industry. The African Natural Resources and Mines Limited in Kaduna is on the verge of completing its Integrated Iron Ore Mining and Processing Plant with an initial production capacity of 4.704 million tons of steel per annum, which will be scaled up to 5.85 million tons per annum soon. Similarly, the Segilola gold mine project in Osun State operated by Thor Exploration is expected to produce 80,000 ounces of gold annually and has commenced operation. Indeed, our effort at de-risking the sector through the Nigeria Integrated Mineral Exploration Project, NIMEP for private sector investments is paying off. NIMEP has discovered new findings of gold, nickel, lithium oxides, platinum, tungsten and sliver, thereby adding new stock to the national mineral inventory. Our bitumen drilling project is also yielding good results.

We have also commenced cluster projects in the six geopolitical zones in order to enhance local content along the mineral value chain. This is in line with our mandate to fast-track mineral processing in the country using a cluster approach. Each cluster is being equipped to support a network of miners, processors, skills development providers, logistics providers, amongst others. Currently, we are also establishing a complete and comprehensive electronic National Geo-Data Centre, which will include geoscientific data. The Geo-Data will be accessible in a digital format to all investors and researchers. With regards to gold, we are creating an ecosystem to minimize the high rate of illegal gold mining and smuggling and increase the government's revenue from the resource.

What incentives does Nigeria offer to foreign investors?

Incentives include customs and import duties waiver for plant, machinery and equipment imported for mining operations, tax holidays of between three to five years, free transferability of funds and permission to retain and use earned foreign exchange, capital allowances of up to 95% of qualifying capital expenditure, amongst other incentives.

Nigeria is the mining jurisdiction where you can earn one of the highest rates of return on your mining investment. •

CAPITAL	POPULATION	GDP GROWTH 2022 (PROJECTED)	TOP EXPORTS
Abuja	211.4 million	2.9%	oil, natural gas, vessels

CONTRIBUTION OF MINING TO GDP <1%

MINERAL RESERVES Gold, coal, limestone, zinc, cobalt, coltan

GOLD PRODUCTION OUTPUT 2016-2020	EASE OF DOING BUSINESS (RANKING)	ACCESS TO ELECTRICITY
1.3 tonnes	131 out of 190	61.6% of the population

MAIN JUNIORS
Thor Explorations, Kogi Iron

MINING CORPORATE TAX	20-30%
MINING ROYALTIES	3-5%

Sources: Nigeria Ministry of Mines and Steel Development; World Bank; International Trade Center

Insights from the ground by main juniors:

GHANA

Asante Gold, developing the Bibiani Gold Mine brownfield Project

"I call Bibiani a 'sleeping giant' as one of the foremost Ghanaian mineral deposits. It poured first gold 100 years ago, and I have no qualms saying that the mine will still be producing for another 50 years 21because. Bibiani holds at least 10 million ounces in exploration potential. Today, we have an aggressive timeline to bring Bibiani back into production by July 2022."

– Douglas MacQuarrie, President & CEO, Asante Gold

Newcore Gold, developing the Enchi Gold Project

"The updated PEA outlined an open pit mine and heap leach operation with very strong economics, including an after-tax NPV5% of C$212 million at a gold price of US$1,650/oz, with an after-tax IRR of 42%. These results are driven by a low upfront capital requirement of C$97 million. We also completed an update Inferred Mineral Resource Estimate of 70.4 million tonnes grading 0.62 g/t gold containing 1.4 million ounces gold. Our PEA and resource update only included 20,000 m out of our largest-ever, 90,000 m drill program."

– Luke Alexander, President & CEO, Newcore Gold

Ibaera Capital, developing the Black Volta Gold Project

"We acquired Azumah Resources and its flagship Black Volta project in 2020, investing over US$40 million to bring the project to a construction-ready phase. Since last year, we completed a DFS and gained the government's approval for the commencement of construction. Black. Our target is to have the funding committed by the end of this year to move into construction."

– James Wallbank, Managing Partner, Ibaera Capital

BURKINA FASO

Arrow Minerals, developing the Vranso Gold Project on the Boromo Belt

"I genuinely think Vranso is one of the most de-risked projects in the region considering the amount of historical data it holds. Here we made the Dassa discovery — an 8,000 m strike length of continuous shallow oxide mineralization, located on the Boromo Belt. A dozen years ago, there were no gold mines in Burkina Faso and today there are 14 operating mines with a few more under development."

– Howard Golden, Managing Director, Arrow Minerals

Sarama Resources, developing the Sanutura Gold Project on the Houndé Belt

Sanutura is our most advanced project, it is 100% owned, covers over 1,400km2 and is situated in the Houndé belt, one of the most prolific gold belts in West Africa which hosts gold mines like Endeavour's Mana and Houndé mines and Fortuna Silver's Yaramoko mine. The Project hosts two gold deposits, the 2.5 Moz Tankoro Deposit and the smaller but higher grade 0.5Moz Bondi Deposit. Importantly, around a third of the resource is oxide and over two thirds of the resource grades greater than 2 g/t Au using a higher-grade cut-off. Once we have the results from our planned 50,000m drill campaign, we will update the resource and look at the next steps, which will most likely include a PEA."

– Andrew Dinning, Founder and CEO, Sarama Resources

Insights from the ground by main juniors:

MALI

Firefinch, developing the Morila Gold Mine brownfield Project

"We have outlined a staged approach to see Morila producing 200,000 oz by 2024. Over the next 6-12 months mining will come from the satellite pits, but once we have de-watered and pre-stripped the Morila Super Pit, we'll resume mining the main ore body. Given the high-grade intersections we had, we will explore the possibility for a small underground exploration, which can potentially push production to 250,000 oz. Through further optimization, we expect to reduce our AISC of US$1,100/oz to under US$1,000/oz."

– Michael Anderson, Managing Director, Firefinch

Roscan Gold, developing the Kandiolé Gold Project

"Kandiolé already counts six discoveries with exceptional progress at Mankouke South. As we speak, we work towards delivering a maiden resource. On top of these, we have just initiated an additional 16,000 m drilling campaign and we still have a 15,000 m drilling backload at the lab to be received. Our detailed metallurgy tests came with 97.6% recovery for the oxides and 92.9% recovery in fresh rock, a few percentages higher than in the preliminary met tests."

– Nana Sangmuah, CEO, Roscan Gold

African Gold Group, developing the Kobada Gold Project

"After delivering on our DFS in July last year, we raised funds and carried out more drilling, for the first time testing the sulfides to incorporate all the data in an updated DFS. A key highlight of the 2021 DFS is the growth in our reserve base, which is 66% bigger compared to 2019-2020 results. We are now looking at a 1.25 million oz reserve with 16 years LOM and a production guideline of 100,000 oz/y for the first 10 years."

– Danny Callow, President & CEO, African Gold Group

Cora Gold, developing the Sanankoro Gold Project

"Sanankoro is our most advanced project, and we are working towards the publication of a DFS in H1 2022. The DFS is based on the recently updated MRE, which saw our total resource inventory increase by 200%. The MRE was supported by our largest ever drilling campaign of over 40,000 m, completed in October 2021. In our final release of drilling results, we published headline hits of 17 m at 17.13 g/t Au from 89 m at the Zone B deposit."

– Bert Monro, CEO, Cora Gold

Compass Gold, developing the Tarabala Zone on the Sikasso Property

"Drilling different sections of the Tarabala trend, we found mineralized intersections more than 15-20 m wide with grades around 0.5 g/t, which are sufficient to sustain a commercial open-pit operation. These results encourage us to drill deeper to 100 m or more below the mineralization using diamond drilling to get more precise answers about the orientation of the veins and the structure of the rock at depth. This is the focus of our drilling campaign till the end of 2021."

– Larry Phillips, CEO, Compass Gold

Insights from the ground by main juniors:

IVORY COAST

Mako Gold, developing the Napié Gold Project

"Ivory Coast is the destination of choice in the region thanks to a very stable, pro-mining government, which, ever since 2011 when the political troubles ended, adopted a diversified economic strategy, encouraging mining investment to diversify from the agricultural focus. Ivory Coast has excellent infrastructure and a skilled local workforce. We are very proud to say we only have local people on the ground, while 20-25 years ago there was a confluence of expats typically taking these roles."

– Peter Ledwidge, Founder and MD, Mako Gold

Tietto Minerals, developing the Abujar Gold Project

"By October 2021 and with the announcement of our much-expected DFS, Abujar presented a compelling 1.45 million oz reserve project forecasted to produce 260,000 oz/y in the first year of production, and 200,000 oz/y over the first six years. Over the course of the entire 11 years initial LOM, Abujar should generate a revenue of US$2.87 billion, with plenty of opportunities to grow into this base. Abujar is fully permitted and we work against the clock to pour first gold by Q4 2022. We kick-started the construction with site infrastructure upgrades and the construction of the camp."

– Caigen Wang, Founder and CEO, Tietto Minerals

Awalé Resources, developing the Bondoukou and Odienné Projects

"We believe in good, underexplored regions. Ultimately we are not trying to find a small deposit, but a regional district play, with lots of blue skies, where we can build a mine. In the northeast of the country, Bondoukou is a 1,200 km2 land package that has seen intense artisanal work along productive structures, but it has never been drilled before. Odienné is found in the northwest and consists of 800 km2 permit applications, which used to be owned by Randgold in the 1990s."

– Glen Parsons, CEO, Awalé Resources

Montage Gold, developing the Koné Gold Project

"In many ways Koné is a classic shear zone hosted gold deposit, however it is uncommonly wide for this part of the world, exceeding 200 m width over the main part of the ore body compared to the region's average of 10-50 m. While it has relatively low grade at 0.65 g/t Au, its width, and the fact that it dips at 45 degrees, make Koné amenable to a very large-scale, low-cost operation, with an easy-to-mine and easy-to-process ore body."

– Hugh Stuart, CEO, Montage Gold

Sama Resources, developing the Samapleu Nickel-Copper Project

"After conducting airborne surveys in 2013 and in 2018, we discovered we are looking at an intrusive complex of 2 billion years, the same age with the Pyrenean Greenstone belts. The erosion had brought this very pristine, never altered or metamorphosed mineralization, to the surface. In 2018, Ivanhoe Electric joined in with a financing of US$25 million."

– Marc-Antoine Audet, CEO, Sama Resources

Insights from the ground by main juniors:

NIGER

Govi Ex Uranium, developing the Madaouela Uranium Project

"Madaouela is fully permitted, and we are doing preparations for the final feasibility study. Madaouela is forecast to produce approximately 2.5 million lb/y uranium for 20 years at a production cost of US$22/lb for the entire LOM, and US$18/lb for the first five years. Madaouela has significant exploration upside, but our focus is to complete the FS by June this year and see the project financed after that.
External perceptions about countries like Niger are far from the reality on the ground – uranium has been produced continuously for decades, the mining code has not changed since 2006, and the country has had a democratic change of government every 4-8 years. We see a new wave of commercial ventures coming on board, together with big infrastructure developments like a brand-new airport at Niamey."

– Daniel Major, CEO, GoviEx Uranium

Global Atomic, developing the Dasa Uranium Project

"Dasa is the largest, highest-grade uranium deposit discovered in Africa in the last 50 years. The project is fully permitted, having received the mining permit at the end of 2020 and the environmental compliance certificate in January 2021. Our main priority today is to complete the feasibility study (FS) by the end of 2021. We are working on infrastructure developments, including site and camp improvements, and we recently signed a letter of intent with Canadian mine contractor CMAC-Thyssen to begin the initial underground development. The plan is to break ground for the mine portal in Q1 2022, with the Box-Cut excavation scheduled for January 2022. Niger needs more promotion to attract foreign investors and a success at the Dasa project will go a long way to making that a reality. Niger is a great place to work, with a supportive government and local population, and I believe, the country is starting to get recognition on the world stage both for mining and oil."

– Stephen G. Roman, President and CEO, Global Atomic

NIGERIA

Tree Mines Global, developing the Kabba Bunu small-scale gold mining operation:

"Two years ago, we obtained a small-scale mining lease from the federal government for the alluvial deposits and the primary rock deposit. The area covers a highly mineralised part of one of the exploration licensed areas. The Kabba Bunu lease is about 3.5 km2 but this is part of a larger exploration license and we will be making more mining applications once we unravel more deposits. Our growth strategy is linear; we are starting small and forming a solid basis from where we can grow. Concomitantly with the alluvial mining, we are doing geochemical studies, mapping, and trenching in preparation for resource definition drilling for the primary rock. Nigeria is a promising mining destination and I would invite foreign investors to tap into the country's many minerals that remain locked in the ground."

– Anthony A. Madagua, CEO, Tree Mines Global (TMG)

Southern Africa

"As a continent we are rich in natural gas and energy minerals/metals such as copper and cobalt and these deposits will ensure that economic growth continues for Africa and that more governments will promote the use of greener energy technologies."

**- Shirley Webber,
Coverage Head of
Natural Resources & Energy,
ABSA Group**

Image courtesy of Afrimat

The Road To Recovery

Southern Africa's perseverance and battle with Covid

Covering around 6.8 million square kilometres, bordered by the Indian and the Atlantic Oceans, Southern Africa is blessed with approximately half of the world's vanadium, platinum and diamonds, in addition to 36% of gold and 20% of cobalt, inevitably making the economic narrative of Southern African states inextricably intertwined with their mining sectors. If petroleum reserves are excluded, South Africa alone is estimated to host US$2.4 trillion worth of non-energy minerals, granting it the title of the wealthiest mining jurisdiction in the world, according to the International Monetary Fund (IMF). Nonetheless, the region's geological wealth has not been translated into significant economic development and society remains plagued by inequality and poverty, which were only worsened by the outbreak of Covid with the resulting lockdowns.

Throughout 2020, investments in the region were at risk as mines were placed on care and maintenance and production was halted for a period of time. The region is approaching the end of its battle with Covid after being the first witness of the more infectious variants of the disease.

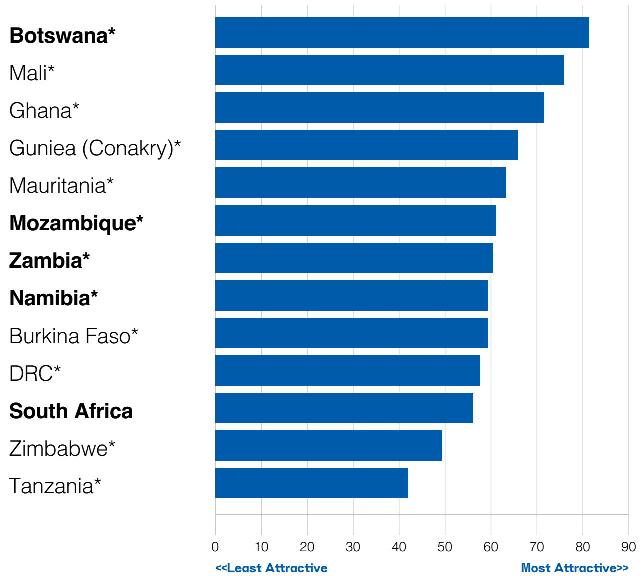
According to the African Development Bank (AfDB), Southern Africa was the region hit hardest on the Continent by the pandemic, however, it has begun to recover after an economic contraction of 7% in 2020 and is projected to grow by 2.4% in 2022. As developed economies secure enough vaccines to cover their population twice, African nations with fewer options and limited purchasing power struggle to vaccinate even the minority of the population. The slow vaccination rate is partly caused by vaccine scepticism and issues concerning distribution, such as the lack of health infrastructure staff. According to the IMF, it is unlikely that many African countries achieve widespread availability of vaccines before 2023. However, "the mining industry is one of the country's leaders when it came to vaccinating its 450,000 employees as well as their dependents and community members living near mines," commented Roger Baxter, CEO of the Minerals Council in South Africa. "We are above 75% of employees fully and partially vaccinated, which is well above the national average."

Botswana could be the first African country to vaccinate its entire population, but in Namibia, general scepticism is slowing progress, as half of the Namibians say they are unlikely to get vaccinated even if the government provides additional

INVESTMENT ATTRACTIVENESS INDEX - AFRICA

Source: Fraser Institute

*Between 5 and 9 responses



reassurance regarding the vaccine's safety, according to an Afrobarometer survey published in early June 2021.

The health crisis has also caused a surge in government financing needs, which will result in a surge in the average debt-to-GDP ratio around the region, which is expected to increase by 10 to 15% in 2021, according to the AfDB. Most countries will require fiscal consolidation policies to ensure their debt is kept at sustainable levels.

While the pandemic poses a significant risk to mining investments in Southern Africa, the region must also battle with corruption, inequality, insecurity and a lack of stability. According to data from the World Bank, there seems to be a correlation between mining's contribution to GDP and inequality around the region's main mining players, with the exception of Botswana. The worsening socioeconomic inequities and political tensions undermine confidence in Southern African economies, especially in Mozambique, where the growing insurgency in Cabo Delgado is stirring age-old social issues and

Image courtesy of TOMRA Sorting Mining

ethnic rivalry, and in the region's mining giant, South Africa. Zhimin Li, CEO of Chinese-owned Wesizwe, the Bakubung platinum mine operator, explained that security is one of the group's biggest operational risks in South Africa. "We are witnessing an average of 50 – 60 life-threatening crimes per day in South Africa. The government should be more proactive in creating a more favourable environment for foreign investment when it comes to security," he said.

Mining has made a notable impact on Southern African economies due to its considerable economic multipliers that create positive spillovers such as employment, training and government revenues. Research from the World Bank published in 2019 weighed the costs against the benefits of the industry in Southern Africa and indicated that the net benefits of mining are positive in the region as it created linkages in the region's economies for the development of value chains. This report will explore the industry's supply chain and investigate its implications for the region's economic development. •

"Although significant opportunities remain in South Africa and the region, there are some significant hurdles that we need to get past to enable growth and development and to attract much needed foreign investment.

- John Martin, Vice President of Southern Africa, Kal Tire

Regional Trends

Adapting to the new norm

The pandemic has hindered export performance in the region that is struggling with the logistical bottlenecks affecting its trade with China, the US and the EU, particularly when coupled with the Russia-Ukraine war, which is putting further pressure on supply chains, trade and logistics channels. "The pandemic has proven that having product flows to the marketplace is key to success and long lead times will no longer be acceptable in any territory," commented Justine Stubbs, managing director of Axis House, the Johannesburg-based global supplier of reagents and technical services to the mining industry. "This has made us review our position in some of our newer territories and we aim to stock products in-country or form partnerships with local manufacturers to reduce lead times."

Physical presence on the mine sites has been limited, and some mines, such as Menar's assets in South Africa, Debswana and Gem Diamond's in Botswana, Weatherly's Tschudi copper mine in Namibia and Vendanta's Skorpion zinc mine in Namibia, were placed on care and maintenance or decreased their production between Q1 and Q2 of 2020. "Our mining operations stopped with the exception of our iron ore mines, where authorities allowed us to mine under stringent protocols which we adhered to successfully," confirmed Andries Van Heerden, CEO of JSE-listed Afrimat, the operator of the iron ore assets Demaneng and Jenkins.

Gold Fields' South Deep was also placed on care and maintenance for the first four weeks of Q2 2020 in compliance with government restrictions and lost approximately 32,000 oz due to Covid related stoppages in 2020, according to Martin Preece, executive vice president of Gold Fields in South Africa.

The extent and depth of the spread of the Covid virus's second and third waves will determine the region's growth trends for 2021 and 2022. However, the mining industry is unlikely to witness any major slowdowns as remote operations and exemptions from lockdowns will facilitate its performance. Metal prices are also expected to be favourable: "The combination of the commodity demand and price forecast that we are currently experiencing indicates a positive future for the African mining industry," confirmed Shirley Webber, coverage head of natural resources and energy at ABSA Group, one of Africa's largest diversified financial services groups with a presence in 10 countries across the continent.

Spencer Eckstein, director and business development manager at Ukwazi, a South African based mining services provider with operations across the SADC region, concurs: "Increasing commodity prices have created an environment where mining companies are more willing to take investment risks," he explained. As a result of closures and lockdowns, service and equipment providers had to be creative to carry out scheduled maintenance trips, training, sample gathering, aftersales and delivery. For example, Evolve Mining was working on an inspection for an iron mine which it was forced to conduct fully virtually and remotely using drones. "A 3D model was built using the data from the drones, which left our geologists mesmerized due to its level of detail and accuracy, and allowed them access to the high walls, which would not have been obtained through traditional on the ground inspection," elaborated Trevor Garden, CEO of Evolve Mining and African Mining and Crushing (AMC). "It also allowed us to save thousands of man-hours in travel as each individual was in the comfort of their home office."

Alternatively, the South Africa Capital Equipment Export Council (SACEEC), which relies on trade shows and face-to-face interactions to promote South African equipment globally, was forced to adapt under CEO Eric Bruggeman's leadership. "SACEEC was one of the first councils to offer an interactive webpage. Within two months, we were able to put our members in front of all their clients on a virtual platform that is still running today," he said.

The pandemic redefined working culture and labour dynamics across the world. "Post-pandemic, I see us continuing with remote work via digital platforms considering the considerable cost savings and time savings of interacting with clients virtually," explained Frank Beerthuis, managing director of Vermeer Equipment Suppliers, the exclusive distributor of Vermeer branded equipment throughout Sub-Saharan Africa. "Depending on the client requirements, we would want to continue our day-to-day interaction virtually. However, we will still conduct our product support, operator training and service activities face-to-face and on-site."

There emerged some winners, such as South African family-owned crane supplier and manufacturer Condra Cranes, known for deliveries in record-times, which made it competitive relative to suppliers from abroad that were facing delays. "The reason our equipment has been so successful in the current sales environment, which is difficult, is partly due to the recent boom in resource prices. The mining industry is trying to move mineral commodities as fast as possible while the prices are strong," explained Kyle Kleiner, sales director at Condra Cranes.

Another positive impact has been the acceleration of the adoption of technologically advanced automated solutions in a traditionally conservative industry. John Manuell, local division manager of ABB, forcasts: "Post-pandemic mines will continue on this digitalization trend as the huge benefits of remote operations have become apparent."

Overall, the Southern African mining industry withstood the external pressures of the health crisis and benefited greatly due to the surge in commodity prices, which has renewed appetite for exploration across the region and will positively impact production in 2021. As a result, the region is forecasted to witness economic growth of 3.1% in 2021, according to the IMF. •

> **"The industry learnt valuable lessons throughout the pandemic and now has to continue to apply those to increase productivity and efficiency. The impact and uncertainty of the pandemic continues, but there seems to now be a glimmer of hope on the horizon."**
>
> 
>
> **- Kerikora Kavari, Account Executive: Mining & Metals, Standard Bank Namibia**

Sustainability & ESG Gaining Momentum

The green mining revolution

Rivalled perhaps only by oil, the mining industry's environmental impact is considerable and is a cause for concern. Even though the sector has a net positive impact on the development of Southern African nations, it also carries with it direct and indirect negative externalities, such as the lack of diversification in mining-led economies, as well as a negative environmental impact due to its energy-intensive processes, massive diesel-powered equipment, tailings dams with their associated hazards, in addition to explosives and chemical stews to extract the desired metals that introduce toxic elements, noise and disruption into the surrounding environment.

Since climate change is one of the most pressing challenges of our age, the mining industry is more than ever under the spotlight and is investing in redefining itself as an active player in minimizing the global carbon footprint. As investor and social pressure is mounting, ESG is the new buzzword for the industry globally. According to a PwC report on global mining practices published in 2021, companies with higher ESG ratings had an average total shareholder return of 34% over the past three years – which is 10% higher than the general market index.

The pandemic presented an opportunity to re-evaluate current practices and reset ESG plans and timelines. According to a mining industry survey in 2021 conducted by the international law firm White & Case, 45% of key industry decision-makers see ESG goals as the most significant risk in the industry, followed by Covid (13.6%). In addition, 79% identified ESG issues as pivotal to investors' decision-making.

Currently, the industry is witnessing billion-dollar investments in ESG and in developing technologies to initiate the journey towards carbon neutrality. BHP, Rio Tinto and Anglo American have all set targets to become carbon neutral between 2040 and 2050. In South Africa, Anglo American Platinum (Amplats) has two pilot projects underway to introduce remotely operated hydrogen fuel cell-powered equipment underground. Sibanye Gold has commissioned a methane-fired electricity generating plant at its Beatrix gold mine, making it the first to use natural methane for power generation in South Africa.

In the transition to green mining, solar energy is at the helm. "Power consumption in mines is exceptionally high and now solar solutions can meet expectations of power generation implemented through hybrid systems," confirmed Hadyr Koumakpai, general manager of JA Solar in Africa, a Chinese-owned manufacturer and distributor of solar cell and module products.

In addition to lowering carbon footprints, mining companies are also investing in fostering a positive social impact through local beneficiation, recruitment and investments in the infrastructure of surrounding communities. For example, the Siyanda Bakgatla platinum mine, a subsidiary of the Siyanda Resources group of companies, is giving the Bakgatla-Ba-Kgafela community 27% ownership of the mine according to Hope Tyira, the mine's executive head of sustainable development. "We also gave 7.3% ownership to our employees, who then benefit through dividends. As shareholders, the community and our employees are aligned with our values and mission and put in the effort to contribute to the project's success," he explained.

> **"An increasing focus to reduce carbon emissions and improve worker safety is at the centre of the electrification revolution in the mining industry."**
>
> **- Brett Kimber, CEO, Eazi Access**

There is no doubt that the significance of ESG and sustainability has risen substantially amid the increased focus on global warming and climate change. By adhering to ethical mining practices environmentally and socially, and integrating them into their initiatives, mining companies can ensure operational continuity and keener interest from investors. ESG represents one of the mining industry's most significant opportunities for long term value creation.

"South Africa is currently taking the lead in decarbonization, although there is also significant progress being made in Zambia and Ghana. We have also recently seen opportunities for decarbonization and off-grid electrification arising in the DRC, Mozambique, Ethiopia and Namibia," expanded Rob Hounsome, Africa regional manager of SLR Consulting, an environmental and engineering advisory specialist.

A future for green hydrogen in African Mining?

Interest in hydrogen as a vector for clean energy is on the rise globally as companies are looking to drive long-term strategic value by incorporating low-carbon technologies. "We are optimistic regarding hydrogen's future contribution and expect billions to be invested in hydrogen," confirmed Andries Rossouw, Africa energy, utilities and resources leader at the PwC office in South Africa.

Eric Verner, CEO of Howden Africa Holdings, an air and gas handling equipment supplier, explained: "The cost of producing green hydrogen is reducing rapidly and in the next few years will be at the point of inflexion where it is competitive relative to other fuel sources, particularly when the cost of carbon is included in the equation."

South Africa envisions a hydrogen valley, stretching for 835 km from Anglo American's Mogalakwena mine, where they are already looking to generate hydrogen from a 300 MW solar plant to use hydrogen fuel cells for their truck fleet, along the industrial and commercial corridor to Johannesburg and the coast at Durban. This could create a domestic hydrogen economy worth up to US$10 billion annually and presents an export potential of US$100 billion a year, according to French energy multination ENGIE, which is working on the feasibility study of the hydrogen valley with South Africa's Department of Science and Innovation, South African National Energy Development Institute, Anglo American and Bambili Energy.

"The feasibility study assessing the potential demand and production possibilities for green hydrogen should be completed by August 2021. It will have identified interesting pilot projects, which will then be further explored to kick-start hydrogen applications in the region and contribute to the hydrogen valley development," elaborated Vincenzo Giordano, director of sustainability solutions for ENGIE Impact. "We hope to have completely developed the hydrogen valley project by 2030."

The regional PGMs industry will be central to this transformation since PGMs play a critical role in Polymer Electrolyte Membrane (PEM) electrolysis used to produce hydrogen at a large scale and in fuel cells.

However, there are some issues that arise concerning this clean fuel considering its transport and storage. Bruce Anderson, CEO of 247Solar, a US-based solar solutions supplier, is not as optimistic regarding the near future of hydrogen in mining: "Hydrogen will not be relied on anytime soon. This is because of its associated supply challenges that resemble those of other fuels such as diesel. The first challenge is making it at a lower cost. The second is transport issues to the off-grid mines."

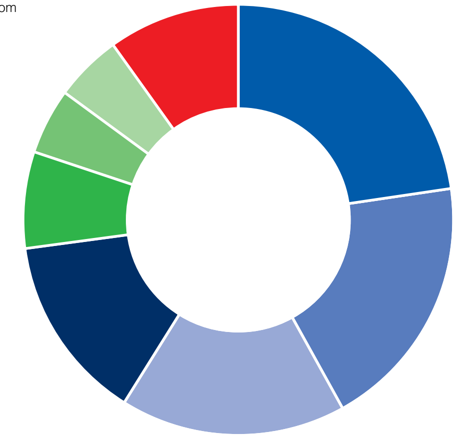
On the other hand, Rossouw of PwC explained that it could be transported in the form of ammonia and other derivatives, then converted at the mine. However, it is unlikely for mines to start producing hydrogen on a large scale on-site soon. Hydrogen-powered vehicles will be the first widespread application of the fuel. According to a Deloitte report in 2020, hydrogen fuel cells in the mining industry are at the 'prototype' stage.

These challenges do not, however, negate its benefits, which are often misrepresented and underestimated, according to Ian Fraser, managing director of RTS Africa Engineering, hydrogen electrolyzers supplier in the region and a member of the Africa Hydrogen Partnership (AHP). "Hydrogen fuel cells are an ideal technology to power road vehicles, especially large commercial vehicles and mining fleets. When used in a fuel cell, you only get electrical energy and water. Therefore, green hydrogen could drastically reduce carbon emissions," explained Fraser.

Once the cost and logistics-related challenges are addressed, hydrogen could dominate the world's transportation and energy industries. Market research and strategy consultant Global Market Insights suggests that the hydrogen generation market alone could be worth U$160 billion by 2026, and Southern Africa has world-class renewable potential that can be leveraged to supply clean energy in the form of green hydrogen to the world—simultaneously, diversifying the region's economies. •

AREAS TO TARGET TO BECOME MORE ENERGY EFFICIENT

Source: Eskom



Materials Handling	23%
Processing	19%
Compressed Air	17%
Pumping	14%
Fans	7%
Industrial Cooling	5%
Lighting	5%
Other	10%

Precious Metals

PGMs

While disruptions caused US$8.8 billion worth of losses in precious metals output globally in 2020, according to Forbes, the rebound was rapid and strong. Platinum group metals' (PGMs) prices fell steeply in March of 2020, before rebounding strongly with prices of platinum, palladium and iridium nearing record-highs.

According to a PwC report covering 2020, total market capitalisation in the South African mining industry, which sits at the helm of global PGM production accounting for 96% of global PGM reserves, witnessed a 52% year-on-year increase, attributed primarily to the increase in market capitalisation of companies in the gold and platinum group metals (PGM) sectors and total revenue increased by 4%, also driven by PGMs and gold but also iron ore. For the first time in 10 years, PGMs overtook coal as the number one revenue generator in South Africa, reaching R190 billion in 2020, which is more than the value of iron ore and gold sales combined. The PGM industry is also the largest mining employer in South Africa, according to the Minerals Council.

PGMs consist of six metals: platinum, palladium, rhodium, ruthenium, osmium and iridium, of which rhodium has the highest price. Even though supply deficits increased platinum prices over the course of 2020, its price has halved over the last decade. Meanwhile, the price of rhodium increased tenfold and the price of palladium eightfold. Sibanye-Stillwater, the world's largest primary producer of platinum and second-largest primary producer of palladium, therefore prioritised palladium production.

The majority of PGMs in South Africa can be found in the Bushveld Igneous Complex (BIC), where three horizons (the Merensky Reef, UG2 Chromitite and the Platreef) are mined. Platinum and palladium production from the BIC accounts for approximately 75% and 40% of annual global production, respectively. Anglo American, which produces 37% of the world's platinum, aims to almost double production in 2021 to 4.2 – 4.6 million oz/y from its three mines in the BIC. Tharisa is following suit with a plan to increase overall production to 160,000 oz/y in 2021, compared to 143,000 oz/y in 2020. "Operationally, the third quarter was one of the strongest in the company's history, with record mining and processing rates, supported by strong PGM and chrome pricing," highlighted Tharisa CEO Phoevos Pouroulis.

The region's producers expect a strong 2021 for PGMs, amid vaccine rollouts, tightening regulations on emissions and rising consumption. Even though the future of PGMs is threatened by the replacement of internal combustion engines (which rely on PGM-laden catalytic converters) with battery electric vehicles that do not rely on the metals, long-term demand will remain strong as hydrogen-powered platinum fuel cells attract attention. This transformation alone could generate US$35 billion by 2025, according to the Minerals Council. The demand for PGMs is also driven by jewellery.

Gold: the safe-haven asset soars

Gold remains one of the most coveted metals and is held as a global store of value. Gold prices reached US$2,067 per ounce in August 2020 as a result of the unprecedented global stimulus packages, record low interest rates and rising uncertainty. Gold production in South Africa decreased in 2020 by 13.7% to 90.8 mt/y, according to the Minerals Council. Production has been declining over the last decades from its peak of 1,000 mt in 1970, which is a testament to the weak structure of South Africa's gold production underpinned by ageing mines, declining grades and load-shedding. However, record-high prices allowed total sales to increase by 2% in 2020, reaching R78.2 billion.

Harmony, one of the few remaining South African gold producers squeezing profits from ageing assets and the largest gold producer in South Africa by volume, saw its production fall by 15% in 2020. "Over the past three years, we have added 300,000 higher grade gold ounces to our portfolio through acquisitions while further diversifying our portfolio," highlighted CEO Peter Steenkamp. "We are focusing on integrating our new assets into our portfolio and believe these have given us great opportunities to extend the life of mine."

> **The rapid depreciation and volatility of cryptocurrencies resulted in a widespread rethinking in the strategy of investing in them, resulting in a return to gold by long-term investors.**
>
> **- Cobus Loots, CEO, Pan African Resources**

Gold Fields' South Deep saw its net cash flow more than double in 2020 compared to 2019, and the mine's production increased by 2% to 227,000 oz/y from 222,000 oz/y in 2019. "It is estimated that South Deep lost approximately 32,000 oz due to Covid related stoppages and impacts in 2020," explained Martin Preece, executive vice president in South Africa for Gold Fields. However, South Deep was the stand-out performer for the company in 2021, with production exceeding the original guidance of 280,000 to a total of 293,000 oz.

Meanwhile, mid-tier Pan African Resources (PAR) produces the majority of its gold from tailings retreatment, in addition to underground operations at the Barberton and Evander mines, where annual production is at 100,000 and 85,000 oz/y, respectively. "In Barberton approximately 80% of production is from underground mining and 20% is from surface tailings retreatment. Meanwhile, at Evander, approximately 55,000 oz come from tailings retreatment," elaborated Cobus Loots, CEO of PAR.

South African gold producer DRDGOLD is a specialist in gold recovery from retreatment of surface tailings at its Far West and Ergo assets. Harmony also produces approximately 100,000 oz/y from mine waste solutions. The process allows for a reduced operational environmental impact as waste is reprocessed. Heap leaching has been a key advancement in the ability to treat tailings, especially for low-grade ores.

There are a significant number of old tailings dams in the region that present opportunities for companies to reclaim using new technology. Nick Tatalias, managing director of the mid-tier engineering firm METC Engineering, that designs and builds metallurgical plants for mines, explained that tailings retreatment can become quite expensive and that project scale and ownership pose challenges. "In South Africa many tailings-dams have been around for a very long period of time and have undergone many previous attempts at re-processing. Each project must be carefully examined. Where possible it is often an advantage if geographical tailings areas can be consolidated and retreatment plants built jointly," elaborated Tatalias.

Namibia's gold production is dominated by two players: B2Gold and QKR Namibia. B2Gold's Otjikoto mine, located between the towns of Otjiwarongo and Otavi, produced 168,041 oz in 2020, and is expected to produce between 190,0000 – 200,000 oz in 2021. The Vancouver-based mid-tier producer is developing the Wolfshag underground project at Otjikoto, which should commence operations in January 2022.

QKR Namibia's open-pit Navachab gold mine experienced some setbacks due to cash constraints. Production at Navachab has been falling for the last two years, however, it is expected to bounce back given the development of satellite high-grade ore bodies. To mine the remaining estimated 4.4 million ounces of gold the mine requires approximately N$400 million investment, according to the Namibian National Planning Commission (NPC). •

Martin Preece

Executive Vice President South Africa
Gold Fields

What was South Deep's production performance in 2021 and what is your guidance for 2022-2023?

South Deep was the stand-out performer of our group assets during 2021 with production exceeding original guidance, despite challenges related to COVID-19. The mine continued to show significant operational improvements during the year. Production increased by 29% to 293,000 oz from 227,000oz in 2020.

Encouragingly, South Deep generated net cash of US$97 million, 157% higher than the US$34 million generated in 2020.

Looking beyond 2021, production is guided between 309,000 oz/y and 312,000 oz/y for 2022 and we remain optimistic that South Deep will continue on its growth trajectory of a 20-30% increase in production over the next 3-4 years.

Can you provide an update on progress of the South Deep solar plant?

Following a further optimisation study, capacity for the 40 MW solar plant has increased to 50 MW.Once completed, the solar plant will provide around 24% of South Deep's annual electricity consumption, translating into annual cost savings of around R124 million and reducing our carbon footprint by 110,000 t/y, not only enhancing the sustainability of our mine, but also contributing to Gold Fields' long-term commitment to carbon neutrality.

Could you outline the extent to which you rely on automated and remote equipment and machinery at South Deep?

The adoption and successful deployment of technology and remotely operated equipment remains an imperative for South Deep and will give us an opportunity to leverage a step change in our safety and health performance as well as our productivity. •

Peter Steenkamp

CEO
HARMONY

What are your key projects and how are these going to create value for Harmony shareholders?

We are busy with seven projects aimed at creating significant value for all our stakeholders. These key projects include the Kareerand tailings expansion, which will allow Mine Waste Solutions, our surface retreatment operation, to recover over 100,000 oz/y Au for over 16 years. We are extending the life of Moab Khotsong to 24 years through the high-grade Zaaiplaats project. Other projects include the Target 1 optimisation, while the Doornkop and Tshepong projects will extend the life of these mines and improve volumes and production. In Papua New Guinea we have extended the life of Hidden Valley as we progress the Wafi-Golpu permitting. Lastly, as part of our decarbonisation strategy, we are excited to be rolling out our renewable energy project which will deliver over 167 MW of solar power to our mines by FY25.

Can you tell us more about these decarbonisation initiatives?

We understand the important role we play in driving change. While our mines are reliant on Eskom for their power, we are in the process of de-risking and decarbonising through these renewable projects and other energy savings initiatives. This strategy is expected to save us over R500 million a year in costs. We are planning to reduce CO2 emissions by 20% by 2026, 40% by 2031 and 60% 2036.

How is Harmony addressing safety and ensuring a safe working environment at all times?

Safety is a priority and we are currently focusing on our cultural transformation journey called Thibakotsi, which means 'to prevent harm' in Sotho. We have put in place a comprehensive risk management framework to drive this cultural transformation. We believe an empowered, disciplined, engaged and proactive workforce will enable us to reach our objective of zero-harm. •

Base and Energy Metals

Zinc, copper and iron

Base metal prices increased throughout 2020 and 2021 due to the recovery in demand coupled with liquidity in global markets. Copper hit an all-time high of US$10,460 per tonne in May 2021. Meanwhile, zinc, the galvanizing metal, was in oversupply before the pandemic but is witnessing a positive outlook due to increased demand from China and supply constraints.

Australian-explorer and developer Orion Minerals owns a significant copper-zinc deposit at its Prieska mine. The project is fully permitted and ready for construction, it only lacks funding, which should be finalized by Q3 of 2021. "By combining the Prieska project, producing approximately 22,000 mt/y copper, and the Okiep project, Orion Minerals is on a path to producing more than 50,000 mt/y," commented Errol Smart, managing director and CEO of Orion Minerals.

In Namibia, emerging copper producer Trigon Metals is constructing the open-pit Kombat mine, from which it expects its first concentrates before the end of 2021. The mine's forecasted production is 4,000 mt/y. "Because Kombat was operating previously and the main infrastructure is already in place, our production costs are low. We have higher grade resources underground, but the operation is starting as open-pit," elaborated Trigon's president and CEO: Jed Richardson.

Also in Namibia is the cornerstone underground zinc and lead Rosh Pinah mine, operated by Trevali Mining. In 2020, the mine achieved the highest milled tonnes in its history. Another milestone reached in 2020 was the completion of the PFS for the mine's US$93 million expansion project, indicating possible project completion in 2022. However, the Feasibility Study, published in August of 2021 indicated the execution of the expansion is expected to be from 2022 onwards, spread over 24-36 months. "Once expanded, Rosh Pinah will be a world-class asset as we are investing in modern mining techniques and technology," explained Ricus Grimbeek, president and CEO of Trevali. "For example, systems were put into place in the processing plant to automate the recovery process. We are also operating a semi-autonomous front-end loader underground, enhancing safety and optimizing the loading time."

Another base metal with exciting prospects is iron ore, which witnessed a price increase of 16% year-on-year in 2020. Iron ore mining contributes around 12% of mining volumes in South Africa, according to the Minerals Council. As economies restarted after the pandemic, there was a shortage of iron ore supply that has led to a sharp price increase of the metal.

In South Africa, the leading iron producer is Anglo American's Kumba Iron Ore, which operates the Sishen and Kolomela mines. In 2020, Kumba's production decreased by 16% year-on-year to 9.57 million mt. The company is planning a US$246 million investment in its Sishen mine to extend its life to 2040.

"We are also developing our Kapstevel South mine at Kolomela while continuing our exploration programme in the Northern Cape as we develop our resource pipeline," announced CEO of Kumba, Themba Mkhwanazi.

Namibia hosts a small iron ore mining industry, with Lodestone's Dordabis leading the way. Lodestone Namibia is the country's first operational iron ore mine with a JORC resource base. Its Dordabis project is located 75 km southeast of the capital city Windhoek. It will be an open-pit operation using conventional gravity and magnetic separation processing route to produce 2.5 million mt/y of high-grade iron ore concentrates (68% Fe) with an expected life of mine of over 17 years. "We hope to start construction on the plant for the demonstration phase in early 2022, with production commencing late in the year," said Emmeric Angermund, CFO of Lodestone.

Vanadium

In addition to its vast platinum resources, the Bushveld Complex in South Africa is also home to high-grade primary vanadium deposits, making it the third-largest vanadium producing country after China and Russia. Historically, vanadium supply and demand has been coupled with that of steel, since vanadium is added to steel to improve its properties, which accounted for 92% of its demand in 2019. However, the long-term growth prospects for the metal are also driven by demand for Vanadium Redox Flow Batteries (VRFBs), which compete with lithium-ion batteries. It is anticipated that by 2025 demand will outperform supply by at least 20,000 tons per year. "According to Roskill, VRFBs are expected to increase vanadium demand by a CAGR of 56.7% by 2030, and today, supply is already becoming constrained and there is limited new supply expected from greenfield projects given high barriers to entry, " commented Fortune Mojapelo, CEO, Bushveld Minerals. "The medium to long-term market fundamentals of vanadium remain attractive and existing primary producers such as Bushveld Minerals are best positioned to deliver new supply."

Vanadium mining in South Africa is dominated by junior players, such as Bushveld Minerals, Vanadium Resources and Ironveld. Vanadium Resources' Steelpoordrift project is the world's largest vanadium deposit. Measured, indicated and inferred resource currently stands at 660 million mt, with 350 million mt in the measured and indicated categories. "The resource is also extremely high-grade with an in-situ grade of approximately 0.74%, compared to other deposits with an average in-situ grade of roughly 0.50%," added CEO Eugene Nel.

Meanwhile, the vertically integrated Bushveld Minerals' resource base is approximately 550 million mt, operated by its subsidiary Bushveld Vanadium. The LSE-listed company is also developing the world's largest electrolyte plant outside of China. "We are leveraging our low-cost scalable production base to build a leading downstream vanadium-based energy storage platform to enable us to play a key role across the VRFB value chain," highlighted Mojapelo. "We commenced with building an electrolyte manufacturing plant that will see us produce electrolytes for the vanadium redox flow batteries (VRFB) market."

Uranium

The radioactive metal was a top performer in the first half of 2020, mainly due to global supply disruptions in Canada and Kazakhstan.

Uranium mining is of considerable importance to Namibia's mining industry, as the country's uranium mines supply 10% of global uranium production. From 2000 to 2018, uranium was only second to diamond mining in its contribution to GDP, according to the Namibian National Planning Commission (NPC). Namibia was ranked as the fifth-largest uranium producer in the world in 2018.

Namibia's largest operating uranium mining companies are Swakop Uranium, majority-owned by China General Nuclear, Rössing Uranium, Langer Heinrich Uranium and Orano Mining Namibia. Uranium-focused juniors include Bannerman Energy, Reptile Uranium and Elevate Uranium.

Bannerman Energy's Etango-8 project completed its scoping study in 2020. The project's initial studies in 2015 envisioned a 20 million mt/y throughput, however, it is to be developed as an 8 million mt/y operation instead, which decreases capital costs significantly. "We are at the end of a PFS which is expected to deliver approximately 3.5 million pounds of triuranium octoxide per year over an initial operating life of about 15 years," highlighted Werner Ewald, managing director of Bannerman.

The company raised A$12 million in early 2021 to finance taking the project forward to a definitive level.

2020 was also a pivotal year for ASX-listed Elevate Uranium, formerly Marenica Energy, which made two discoveries at the Hirabeb and Koppies projects. The company raised A$5.4 million in November 2020, which will fund exploration campaigns in Namibia and define drill targets.

"Today, supply is already becoming constrained, and there is limited new supply expected from greenfield projects given high barriers to entry. The medium to long-term market fundamentals of vanadium remain attractive."

- Fortune Mojapelo, CEO, Bushveld Minerals

Elevate's unique patented beneficiation process, known as U-pgrade, decreases capital and operational costs by 50% relative to conventional processing, according to Elevate's managing director, Murray Hill. "It increases the grade prior to leaching by removing the bulk of the non-bearing uranium minerals, reducing the mass through the process to the point where we have less than 5% of the mass going to the leaching stage," elaborated Hill. •

Themba Mkhwanazi

CEO

KUMBA IRON ORE

How significant is Kumba Iron Ore to Anglo American's regional operations?

Inspired by our purpose to re-imagine mining to improve people's lives, we are committed to ensuring beneficial co-existence with host communities and to working collaboratively with our suppliers, communities and partners to ensure the development of thriving, healthy and inclusive communities beyond mining. In striving to ensure that our host communities are sustainable beyond life-of-mine, we place an emphasis on progressively increasing levels of procurement from localised suppliers, supported by our supplier and enterprise development initiatives. We contribute R51 billion of shared value to the region's economic environment and to the national fiscus. In the most recent results, R1.7 billion was spent with host community businesses and R85 million on social development projects, of which R12 million was our Covid-19 contribution.

What are the biggest challenges facing the South African mining industry today?

South Africa has the triple challenge of poverty, inequality and unemployment in many of the communities where Kumba operates. To respond to these, our ambitious Sustainable Mining Plan attempts to create a healthy environment and foster and sustain thriving communities, and commits us to a series of ambitious goals relating to twelve of the UN's 2030 Sustainable Development Goals:

We manage the relationship with our host communities through our social performance management system, the Anglo American Social Way. It sets out the requirements all our managed or operated sites need to meet. It also covers how we engage with communities, mitigate adverse social impacts, and pursue development opportunities

We have a strong record of supporting transformation and contributing to South Africa's growth and development and will continue to do so. Our approach has always been to "go beyond compliance" in all of our efforts to transform our business.

Climate change is one of the defining challenges of our time. Recognising the complex global challenge it poses and understanding the implications is a critical strategic issue for us.. •

Joe Walsh

Managing Director
Lepidico

Can you provide an overview of Lepidico?

Lepidico is a lithium development company listed on the ASX (LPD) since 2016, and aims to become not only a supplier of choice for sustainable lithium chemicals, but also other globally strategic alkali metal compounds. We are differentiated by the proprietary energy efficient process technologies that allow us to produce high-purity chemicals from lithium mica and lithium phosphate minerals. The company's strategic objective is to commercialize its technologies, which have been developed over the past eight years, thereby providing the chemical industry with much needed low-cost alternative sources of lithium, caesium and rubidium.

Pegmatite deposits at the Karibib project in Namibia have historically been mined for petalite and tantalite. However, significant quantities of lepidolite, both in-situ and in surface stockpiles, remain. These resources represent the mineral source for Lepidico's Phase 1 project, a vertically integrated development that includes a flotation plant at Karibib that will produce a mineral concentrate for conversion to chemical at a new plant to be built in Abu Dhabi, which employs the company's process technologies. This represents a unique development opportunity for production of lithium, caesium, rubidium and potassium – all in-demand alkali metals, the first three of which are on the U.S. Government's Critical Minerals list.

L-Max is our main process technology, which allows us to leach the lithium and other metals within the lepidolite into solution and produce a series of high-purity chemical products. LOH-Max is another process technology that enables a lithium sulphate intermediate to be converted directly to lithium hydroxide without production of sodium sulphate, a potentially problematic by-product of conventional processes.

In addition to lithium, lepidolite also contains significant concentrations of caesium, rubidium and potassium. These alkali metals are selectively separated into a valuable by-products stream by L-Max.

Have you reached a final investment decision on Phase 1 of the project?

A definitive feasibility study (DFS) was completed in May 2020. Since then, we have secured the requisite permits and approvals in Namibia, while permitting is well advanced in Abu Dhabi where a 25-year land lease has been signed. Binding lithium offtake has been agreed with European trader Traxys, with offtake for other products targeted for mid-2022. A full funding package for the integrated project is expected in the September quarter 2022.

In October 2020 we entered into a mandate agreement with the U.S. Government's International Development Finance Corporation, which provides funding for projects with solid environmental and social credentials located in developing countries.

What are Lepidico's strategy and objectives for the next two years?

Lepidico's strategic objective is to build a sustainable lithium chemical business, vertically integrated from the mine via concentration and conversion to fine chemical production, by leveraging our proprietary process technologies L-Max and LOH-Max, and thereby demonstrating their commercial viability. Based on our DFS, we will produce approximately 5,000 t/y of lithium hydroxide, plus our valuable by-products. Assuming we make a final investment decision by September 2022, we plan to start mining in Namibia in the second half of 2023, commission the floatation plant in early 2024, followed by the Abu Dhabi chemical plant a quarter later. Commercial production is targeted for mid-2024. We have excellent environmental and social credentials. Our greenhouse gas emissions and water usage are low versus the industry. We will also provide considerable economic benefits to local communities by employing some 115 people at Karibib and creating an estimated 700-800 indirect jobs in the region. •

Ricus Grimbeek

President and CEO
Trevali Mining

Can you give us an overview of Trevali's assets and resource base around the world?

Trevali operates three mines: the Pekoa mine in Burkina Faso, the Caribou mine in Canada and finally, our flagship asset, the Rosh Pinah (RP) mine in Namibia. Approximately 85 to 90% of our revenue is generated from the sale of zinc with additional by-product revenue coming from lead and silver. We are also exploring around our current operations with the intention of discovering and defining additional resources to extend mine life. Another focus area of ours is developing our joint venture opportunity with Vedanta Resources at Gergarub in Namibia, a sulphide ore body.

We have big plans for our RP mine. We published a Feasibility Study (FS) on August 17, 2021, which studies the potential to nearly double production at the mine and at an all-in sustaining-cost of 72 cents per pound of zinc, with a mine life of 12 years. The FS indicates the execution of the expansion is expected to be from 2022 onwards, spread over 24-36 months. Once expanded, RP will be a world-class asset as we are investing in modern mining techniques and technology. For example, systems were put into place in the processing plant to automate the recovery process. We are also operating a semi-autonomous front-end loader underground, enhancing safety and optimizing the loading time. We conduct data cleansing work and analysis from our operational base in Vancouver and are planning an integrated planning and scheduling system for our production and maintenance at RP.

Can you elaborate on Trevali's efforts to reduce its environmental footprint?

We aim to reduce our greenhouse gas emissions by 25% by 2025, compared to 2018. To reach this goal we are implementing several initiatives across the portfolio. For example, as part of the RP2.0 expansion project, we will have a smaller tailings footprint as a significant portion of the tailings will be pumped back underground through the use of a paste backfill plant. Also, in April 2021 we signed an agreement with Emesco to supply us with solar power for 30% of our energy consumption at RP.

How did the pandemic impact the zinc market?

The zinc market witnessed an oversupply of concentrate before the pandemic hit, which was later consumed by the smelters in China during the outbreak as supply struggled, especially in South America. At the moment, there is a supply deficit as expansion projects got delayed and no new mines were built. We expect this supply constraint to last several years. Demand will likely remain solid as zinc is a raw material in solar panels and is essential for galvanization and infrastructural developments.

What makes Namibia an attractive mining investment destination?

Namibia is one of the best mining jurisdictions to operate in, with easy transport links and a skilled workforce who we rely on at our RO operation. There is also an ongoing dialogue between mining companies and the government, which is rare, so we are fortunate to be operating there.•

Errol Smart

Managing Director & CEO
Orion Minerals

Can you highlight some of Orion Minerals' achievements since 2019?

Orion has made significant progress against our strategy to capitalise on the positive near-term base metals market and focus on investigating opportunities to achieve early production. In August 2021 we exercised our exclusive option to acquire a controlling interest in the majority of the properties comprising the Okiep Copper Project (OCP), which is in the heart of an area that has delivered significant historical copper production – with previous owners, such as Newmont and Goldfields, producing 30,000 - 40,000 t/y of copper over many decades.

The acquisition followed a positive Scoping Study that confirmed the potential for early cash-flow and 'Proof-of-Concept' copper production. Results confirmed that OCP deposits have the potential to be mined at low cost by both open pit and underground mining methods.

OCP is an outstanding opportunity for Orion to establish a second major base metals production hub alongside our flagship, fully permitted, Prieska copper-zinc project and establish ourselves as a key supplier of metals that are critical for global energy transformation. With both projects located in South Africa's Northern Cape Province, our objective is for future production from OCP to supplement Prieska's forecast production of 22,000 t/y of copper and 70,000 t/y of zinc.

Key among recent developments was our decision to investigate the merits of phasing the development of the Prieska project in a manner that brings forward the start of production and allows for dewatering of the underground workings to commence ahead of the final investment decision for the full-scale project construction as planned in our 2020 Bankable Feasibility Study. This should allow us to produce our first concentrate 14 months earlier than originally envisioned.

What renewable energy sources are you incorporating at Prieska?

We are in discussions on collaboration with juwi and the Central Energy Corporation (CENEC) to look at how Prieska can be included as part of CENEC's Prieska Power Reserve Project, which is set to become one of the largest renewable energy hubs in South Africa, generating solar and wind energy and storing this as hydrogen and ammonia.

Can you elaborate on the regulatory framework for mining in South Africa?

Mining remains one of the crucial cornerstones of the South African economy and its mining legislative and regulatory framework has been in place for close on two decades. The mining charter is workable, particularly for newcomers like Orion Minerals that structure their business with the expectation of having to meet community and ESG obligations. The industry is, however, under pressure due to reduced spending on infrastructure and unstable electricity supply. •

Diamonds Re-Gaining Their Sparkle

Southern Africa is rich in this crystalline hard carbon structure that witnessed heightened market pressure under the pandemic. The plummeting demand for diamonds affected prices and production significantly globally, causing a 20% decrease in production. In Namibia, the mining diamond industry witnessed a 14.9% decline in 2020 compared to 2019, as rough diamond sales were negatively impacted due to cutting and polishing factories' closures in India. Many Namibian diamond mines went on care and maintenance, and the government even announced tax relief for land-based diamond operations.

Namibia's Debmarine, a subsidiary of De Beers, reported a 13% year-on-year decline in production in 2020 and a 5% decrease in revenue. The De Beers Group's total rough diamond production also decreased by 14%, driven by continued planned reductions in response to the lower demand for rough diamonds caused by the Covid pandemic and operational challenges. Meanwhile, in Botswana Debswana, jointly owned by De Beers and the Botswana government, also cut production by 29% to 16.6 million carats, and Vancouver-based Lucara Diamond ended Q3 of 2020 with a US$5.4 million net loss. “Our revenues were certainly impacted by the pandemic, not because of losses but rather due to deferring income to a later stage when we could achieve better prices,” commented Eira Thomas, president and CEO of Lucara Diamond.

> **The increased confidence in the market was driven by the US and Chinese demand for both rough and polished goods. Demand is rising for both the European and Indian markets. While COVID 19 remains a global challenge, the positive sentiment in the diamond market is expected to be sustained.**
>
> **- Lynette Armstrong, Acting Managing Director, Debswana**

Surprisingly, in South Africa the diamond industry was the only one to record increased production in 2020 (an increase of 12.3%). Nonetheless, the alluvial diamond mining industry, which represents 25% of local diamond production, suffered greatly. "The diamond market initially witnessed severe losses as the pandemic disrupted sources of income," commented Gert Van Niekerk, chairman of the South African Diamond Producers Organization (SADPO), a representative body of small-scale diamond miners. "The devastation was felt across the whole supply chain. We were forced to start producing to retain our employees."

Overall, the diamond industry withstood the crisis better than expected. "In March 2020, we were all very concerned but started to see a clear recovery towards the end of the year. We are now sitting at a high which I have not experienced," commented Marco Wentzel, chairman and non-executive director of South-African based Trans Hex Group, one of the oldest alluvial diamond mining companies in South Africa. "The diamond market recovered rapidly, giving us confidence in the resource and product."

As the market recovered, investments in development have resumed. For example, Lucara Diamond secured US$220 million for its Karowe mine underground expansion in May 2021. The expansion will require a total investment of US$514 million and will draw its first ore in 2026. “We will sink the shaft over the next two to three years and ultimately start our lateral underground development. By the time the open pit is nearing its natural end of life in 2025/2026, we will be ready to deliver the ore from underground, feeding the mill at the same steady-state capacity that we are mining at today,” commented Thomas.

Debswana, which contributes approximately two-thirds of Botswana's foreign exchange earnings, is assessing financing options to invest US$6 billion to expand its Jwaneng underground mine. The mine's last US$2.2 billion expansion transformed it into one of the biggest open-pit diamond operations, and the planned underground expansion will make it the world's largest underground diamond mine, including more than 360 km of tunnel development. It is expected to achieve full production by 2034, producing as much as 9 million carats annually. The operation is of huge significance to De Beers and represented 41% of their total production in Q1 of 2021.

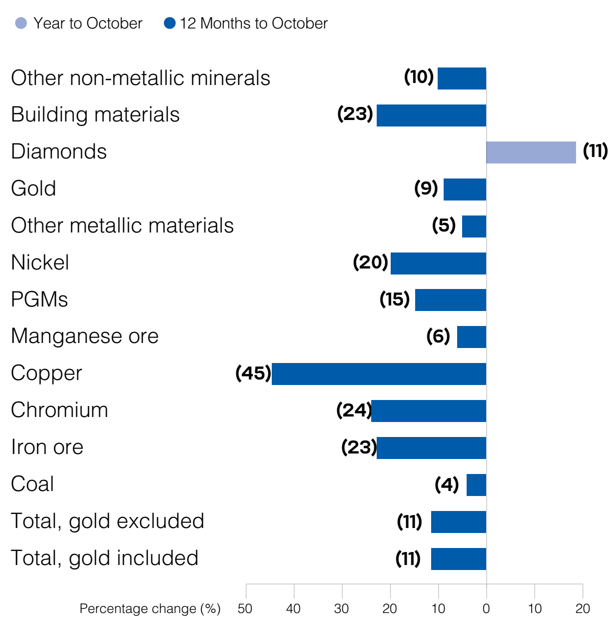
A significant amount of diamonds are mined off the coast of Southern Africa. Namibia has the richest known marine diamond deposits in the world, estimated at more than 80 million carats, according to De Beers. Marine diamond recovery produces larger volumes annually than the country's land mines.

Are synthetic diamonds a threat?

While Covid posed a short-term threat to operations, as markets recover, both the synthetic and the mined diamond industry are looking to spark demand. The competition with lab-grown diamonds poses a more long-term threat to diamond mining. Production of lab-grown diamonds, which is predominantly in China, increased from 2 million carats in 2018 to over 6 million carats in 2020, according to Bain & Company, a management consulting firm.

COMMODITY PRODUCTION PERFORMANCES IN 2020 COMPARED TO 2019

Sources: Statistics South Africa, Minerals Council South Africa



> **There is a false narrative that synthetic diamonds are more environmentally friendly. Studies from the Natural Diamond Council have demonstrated that in general, naturally mined diamonds have a CO2 footprint which is three times less than those of laboratory-grown diamonds.**
>
> **- Eira Thomas, President and CEO, Lucara Diamond**

Earlier in 2021, Danish jeweller Pandora announced it would stop selling mined diamonds under its new ESG policy. Pandora came under fire since the move implied that naturally mined diamonds were less sustainable and more unethical and it is assumed that lab-grown diamonds are automatically more ethical. They are formed using high pressure and extreme heat to mimic the Earth's mantle, which led to the occurrence of natural diamonds between 1 – 3 billion years ago.

However, the environmental credentials of synthetic diamonds were brought into question by the Diamond Producers Association, which conducted research that suggested that greenhouse gas emissions from lab-grown diamonds are three times that of naturally occurring diamonds. The Diamond Foundry disagrees, suggesting that mined diamonds have a substantially larger environmental footprint. “The mining industry also contributes to socio-economic and growth, which can significantly benefit a country's economy,” elaborated Thomas. “There is a false narrative that synthetic diamonds are more environmentally friendly, which is not the case.”

Diamond miners have been working hard overall to reduce their environmental footprint and invested in blockchain technology to enhance transparency. Researchers at Anglo American (parent company of De Beers) are working on developing the "mineral carbonation" project to reduce the mined diamonds' carbon footprint by capturing carbon dioxide in kimberlite.

However, Bain & Company's survey across three key markets, China, India and the US, concluded that consumers across these markets do not see a substantial difference in sustainability between lab-grown and natural diamonds, but they do see a difference in their market perception. Lab-grown diamonds are deemed by consumers as artificial, fake and affordable – which clashes directly with the luxurious identity of diamonds traditionally. "I do not believe that synthetic diamonds are a threat to mined diamonds at all. There is an intricate value to a mined diamond that will always be there, and lab-created diamonds cannot replace that," concluded Wentzel.

The Journey to Modern Mining

The challenges and opportunities of mining industry 4.0

2020 proved that innovation and technology are vital to all industries as they seek to adapt to rapidly altering circumstances. The digitalization of society has transformed the fundamentals of services and equipment and revolutionized delivery and maintenance. To meet evolving expectations of stakeholders, the mining industry is evolving and undergoing new rapid technological changes, which have been fast-tracked due to the pandemic. Applications that raised suspicions previously, such as remote monitoring of employees and unmanned equipment, are now considered essential to ensure operational efficiency and safety. "The industry spotlight has shifted from increasing capacity to enhancing productivity through optimization and digitalization. Utilizing the right data and combining it with human experts can lead to significant gains in reliability, productivity and sustainability," confirmed Deon de Kock, president of FLSmidth in sub-Saharan Africa, the Middle East and South Asia.

> **The big benefits of digital transformation are in the combination of data from across the entire mining flowsheet that will unlock massive potential in optimisation, process efficiency and resource use.**
>
> **- Deon de Kock, President, Sub-Saharan Africa, Middle East & South Asia, FLSmidth**

Data analysis and acquisition are vital for mines to realize their future in automation. Increasingly, technology-focused service providers such as ABB, Maptek and TOMRA Sorting and equipment suppliers ensure they offer a platform that allows for data visualization from machinery and equipment, which is also critical in the aftersales market.

TOMRA Sorting, which offers sensor-based solutions for the mining, recycling and food industries, invested in the production of a cloud-based data platform known as TOMRA Insight. "The information is collected and visualized for the client in such a way so that it is actionable and can optimize upstream or downstream processes," elaborated Albert Du Preez, SVP, head of TOMRA in South Africa.

The client can follow up on the status and throughput of machines remotely. The platform also improves personnel efficiency, enables operators to act quickly and reduces the need to constantly monitor operations manually.

Maptek, an Australia-based software provider to the mining industry, has developed a machine learning tool that accesses and analyses data rapidly, known as the DomainMCF. Gideon Slabbert, general manager of Maptek in South Africa, highlighted that data quality is just as important as its acquisition. Therefore, data validation is vital, which is why Maptek's software addresses this issue. "The combined effective output of machine learning and AI is equivalent to the work of 1,000 scheduling engineers. The genetic algorithm approach cross breeds different scenarios to give a combined best solution for presenting to clients in a much shorter time," explained Slabbert.

In the blasting space, the South African leading manufacturer of explosives BME also relies on data analytics under its XPLOLOG system. The company is investing in innovations to enhance operational safety by allowing for real-time monitoring.

"BLASTMAP is essentially the start of the cycle for the process of blasting, allowing you to easily design and predict the outcome of blasts," highlighted Ralf Hennecke, general manager of technology of marketing of BME. "The information is sent to the XPLOLOG system, which then applies it in the field. Management can see what is happening on the block and during blasting in real-time."

Significant investments in innovation and R&D are also being made by OEMs to develop autonomous electrically powered fleets. Local South African manufacturer Rham Equipment started investing in this transition years ago. Meanwhile, Vermeer Equipment Suppliers, the exclusive distributor of US-based Vermeer branded equipment throughout Sub-Saharan Africa, supplies partially automated equipment with auto-steer functions, which can execute a pre-loaded 3-dimensional mining task. "I see far more opportunities in terms of autonomous technology for fleets of multiple equipment on one mine site," commented Vermeer's managing director Frank Beerthuis.

All this new advanced technology will alter the labour market dynamics and require new skills to create, maintain and operate. "When it comes to digitization and automation, skills may be lacking. This is not only in the SADC region but is rather a global phenomenon," explained Hennecke.

To respond to these challenges, JSE-listed contractor Murray and Roberts relies on a training academy to help find and retain talent, as well as train clients. "The centre is essential in training our workforce and developing the skills we need for the modern mine by focusing on occupationally directed technical skills and safety training," elaborated Mike da Costa, CEO of global mining at Murray and Roberts. "Using simulators and virtual reality, training can also be conducted virtually."

Nonetheless, even by ensuring training and availability of technology, mines will not automatically adopt a new system or software due to multiple reasons, one of which is the difficulty in integrating a mine's different platforms and software, which make it difficult to analyse various data sources to guide decision making. In an effort to solve this issue, ABB developed the Ability System 800xA. "In many cases in the South African mining industry you find several different control systems on a plant with poor integration," explained John Manuell, local division manager of ABB. "The 800xA system can effectively consolidate information from multiple sources across a mine, which can then be used in other higher-level digital implementations. It is not only a distributed control system but also an electrical control system, a safety system, and a collaboration enabler with the capacity to improve engineering efficiency, operator performance and asset utilization for mining operations."

> **We are currently working on real-time capturing of safety and audit data from underground and using AI for analysis to enable proactive action.**
>
> **- Mike da Costa, CEO - Global Mining, Murray & Roberts**

Digitization is the hot topic for the mining industry, and for a good reason. African mines are adopting these technologies just as much as Australian or South American mines. While there may be hindrances to the digital mining revolution, mine modernization is crucial to surviving competition due to its evident cost and efficiency benefits. •

Industry Views: What is Hindering the Digital Mining Revolution in Southern Africa?

"Connectivity is crucial for smart mining, and this might be an inhibitor in some instances where mine sites are remote. An entire infrastructure needs to be built around the mining industry to move towards digitization and automation efficiently."

– Ralf Hennecke, General Manager, Technology and Marketing, BME

"The digital revolution is upon us, and if we do not adapt and adopt, we will fall behind. We have projects underway to ensure that our products and systems embrace the fourth industrial revolution."

– Freddy Mugeri, CEO, Fabchem Mining

"Traditionally, mining in Southern Africa has been conservative in adopting new technologies. The challenge is getting everyone involved in the change management process and driving the most value out of software for the mining company."

– Gideon Slabbert, General Manager, Maptek

"A hindrance is the lack of greenfield projects in Southern Africa. It is more challenging to retrofit old mines with new technologies than it is to look at digital offerings in a more modernized design right from the beginning."

– John Manuell, Local Division Manager, ABB

"Digital products of the future will significantly enhance productivity and reduce operating costs, which will invite the hesitant risk-averse players to adopt these technologies to be able to compete and survive in the market."

– Wilfred Barkhuizen, CEO, thyssenkrupp Industrial Solutions

"Globally, the mining mind-set is the biggest constraint to the adoption of digital solutions. Mining is a very conservative industry where people tend to follow the same processes, failing to see the opportunities that true innovation can bring."

– Albert Du Preez, SVP, Head of TOMRA Mining, TOMRA Sorting Mining

Energy

Does the future of powering mines lie with renewables?

Africa has yet to cut its ties with coal. "Most coal power stations in Africa will not close prematurely, though there may no longer be new investments into coal projects as we move beyond coal to sources of energy with lower emissions," commented Andrew van Zyl, director and principal consultant at SRK Consulting.

While the move to alternative energy sources presents an attractive opportunity, this energy transition will cause disruption. For example, in South Africa alone, the transition threatens 120,000 South African jobs since coal mines and power stations are more labour intensive than renewable energy plants. However, power supply issues are topical across the region, especially in South Africa. "Eskom is experiencing difficulties that impact the reliability of supply. A load shedding system has been implemented to lessen the burden on power stations. However, from an operational point of view, the power supply is of great concern," explained Banzi Giyose, co-founder and vice president of BG Global, a majority black-owned international mining investment firm.

Renewables offer an attractive alternative in an industry where power represents 20 – 30% of costs. "We see a growing desire by the mines, investment communities, governments and the public in general to decarbonize," confirmed Alistair Jessop, head of power at Vivo Energy, the Shell licensee supplying mines around the country. "Some countries have regulatory hurdles that need to be crossed, but the markets for renewable energies are opening up."

South Africa crossed a huge regulatory hurdle recently, when the regulation on private power generation was altered in June of 2021, allowing private actors to generate up to 100 MW of power without a license. "This intervention reflects our determination to take the necessary action to achieve energy security," said President Cyril Ramaphosa in an online briefing.

Dylan Tudor-Jones, country manager of Gransolar Group in South Africa, which entered the South African market because of the government's agenda to introduce renewables into the energy mix for the country, identified the 2019 integrated resource plan (IRP2019) as a turning point in South Africa's attitude towards its future energy mix. "Prior to the IRP2019, the energy mix did not include or promote solar, wind and gas generation alternatives as strongly as it does now," he added.

The government's changing priorities to focus on fostering a clean economy also prompted other global solar players to begin distributing and operating in the South African market, such as JA Solar, 247Solar and juwi; all offering a cheaper, cleaner alternative to South Africa's energy provided by Eskom, which witnessed a 350% increase in price between 2007 and 2017, in addition to a further year-on-year 15% increase in April 2021.

"Another reason Africa is a target market for 247Solar's new technology is we see that leadership in these countries are more willing to take risks," stated Bruce Anderson, CEO of 247Solar, a spinoff of MIT supplying renewable turnkey energy solutions to the mining industry across Southern Africa. "The region is home to many off-grid mines that rely on costly and unreliable power. These are good targets for our products due to the abundance of sunshine."

While mines can choose between wind, biodiesel, geothermal and hydropower energies, the clear winner in the region for off-grid mines is solar energy. For example, mid-tier African-focused gold producer Pan African Resources is investing in a 10 MW solar PV plant that will be commissioned in Q3 of 2021 at its Evander mine, to be executed by juwi. The project will utilize bi-facial module technology, which will maximize the energy yield from the available land area. "This will decrease the power cost for the Elikhulu operation by approximately 30%, allowing for an ROI of fewer than five years for an US$8 million investment. We will eventually look to expand the solar plant at Evander to 30 MW and establish a 10 MW plant at Barberton," elaborated CEO Cobus Loots.

"The grid-connected renewable energy project is the largest project and the first of its kind in the South African mining space," added Richard Doyle, managing director of juwi in South Africa.

The strategy was echoed by Donovan Chimhandamba, CEO of Nyanza Light Metals, a South African titanium oxide pigment producer, as he highlighted that of their total energy demand of 28 MW, at least 15 MW would come from solar and core generation from excess steam.

In Namibia, Trevali Mining is aiming to reduce greenhouse gas emissions by 25% by 2025, relative to 2018. "To reach this goal, in Rosh Pinah's expansion we will have a smaller tailings footprint as the tailings will be pumped back underground. We also signed with Emesco to supply us with solar power for 30% of our energy consumption," explained Rikus Grimbeek, president and CEO.

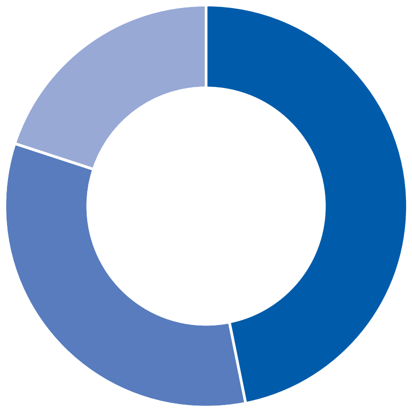
In April of 2021, Namibia, Botswana and the US signed a memorandum of intent to create a Mega Solar project under USAID's Power Africa Initiative in collaboration with the African Development Bank, the International Bank for Reconstruction and Development, and the International Finance Corporation (IFC). National power utility company NamPower in Namibia wants to also add 250 MW of renewable energy plants by 2025, costing US$338 million, to address Namibia's domestic supply issue as the country generates less than half of the energy it consumes and imports power from Eskom, which is unreliable.

While renewable energy presents an attractive power solution for mines, it also presents some challenges. "Renewable energy sources are not reliable baseload power and require backup power sources, which in most cases is a carbon-emitting fossil fuel," commented Murray Hill, managing director and CEO of Elevate Uranium, holder of the largest prospective uranium exploration leases in Namibia. "Meanwhile, nuclear power plants require less maintenance and are designed to operate for longer stretches before refuelling." •

> **Companies are employing a staged approach of deployment of renewables over the coming five to 20 years. This may start with wind or solar PV, but in order to get close to achieving 100% renewable energy and matching the load (particularly for off-grid sites), a combination of technologies is required.**
>
> **- Peter Drager, Head of Development (Hybrid and Offgrid) EMEA, juwi**

INDUSTRY'S ELECTRICITY CONSUMED BY COMMODITY SOUTH AFRICA

Sources: Eskom, GBR



Mxolisi Mgojo & Nombasa Tsengwa

MM: CEO
NT: CEO-designate and Managing Director of Minerals
EXXARO RESOURCES


MM


NT

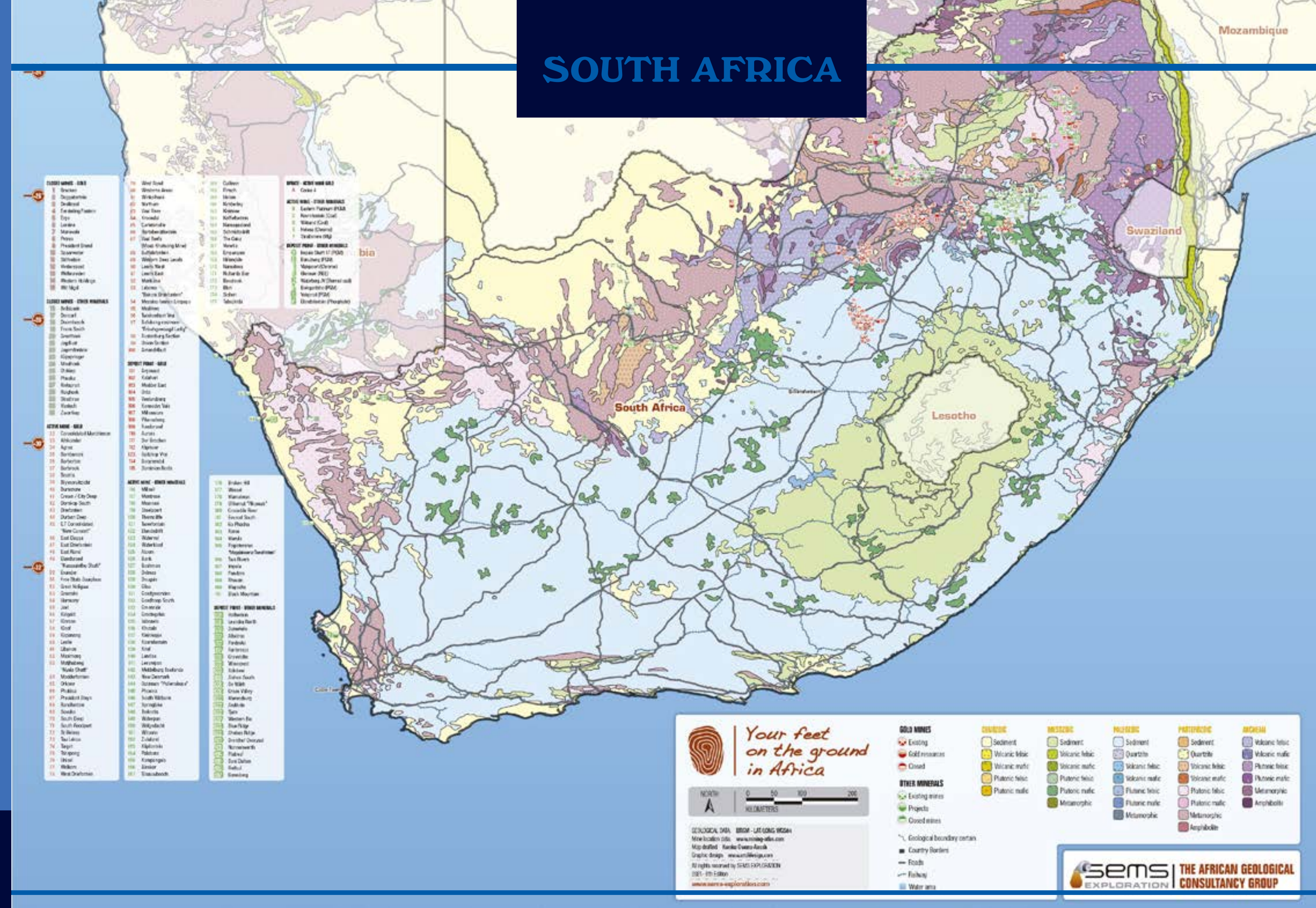
Can you explain Exxaro's strategy for a low-carbon world?

NT: Our revenue is generated mainly from coal sales to domestic and international energy markets. We are the largest coal supplier to Eskom and the fourth largest South African exporter of thermal coal. South Africa's latest Integrated Resource Plan 2019 (IRP 2019) expects approximately 5,400 MW of coal-fired electricity generation by Eskom to be decommissioned by 2022, increasing to 35,000 MW by 2050. Any new coal power capacity must use clean coal technology due to international restrictions on financing coal-fired power plants.

We want to ensure that our revenue is primarily generated from low-carbon business operations while moving towards carbon neutrality (scope 1 and 2) by 2050. We have already started to move to electric vehicles and are conducting in-pit crushing to reduce our emissions.

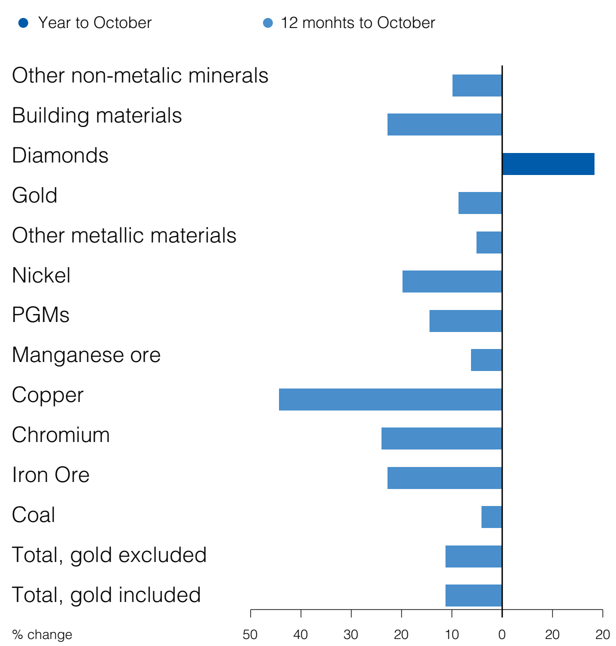
MM: Since 2010, we have focused on ESG principles to participate in the transition to a low-carbon world and greening the energy system to reduce emissions while supporting prosperous and safe communities. The commissioning of our wind farms demonstrates that we are committed to powering a clean world with a portfolio of clean energy resources. •

SOUTH AFRICA



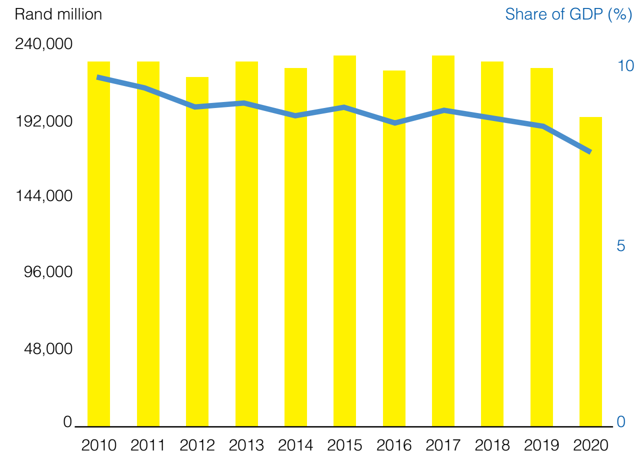
COMMODITY PRODUCTION PERFORMANCES IN 2020 COMPARED TO 2019

Sources: Statistics South Africa, Minerals Council South Africa



MINING GROSS DOMESTIC PRODUCT

Sources: Statistics South Africa, South African Reserve Bank, Minerals Council South Africa



MAIN PRODUCERS	MAIN JUNIORS
Harmony Gold, Gold Fields, Kumba Iron Ore, Implats, Anglo American Platinum, Exxaro Resources, Sibanye-Stillwater, DeBeers, DRDGOLD, Pan African Resources, Northam Platinum	Orion Minerals, Afrimat, Tharisa

Gwede Mantashe

Minister
MINISTRY OF MINERAL RESOURCES AND ENERGY
SOUTH AFRICA

"The revival of and growth of the mining sector cannot be possible without a stable and secure energy supply. It is for this reasons that we have made it our preoccupation to drive a robust energy security program."

What have been the Ministry's achievements over the past year and what is on its agenda for 2021 – 2022?

Following the outbreak of the Coronavirus in 2019, and the subsequent nationwide lockdown in March 2020, South Africa sought to save lives and protect livelihoods. Several interventions to revive the economy were developed through the economic reconstruction and recovery plan. In the mining and energy portfolio, our interventions ranged from allowing collieries and refineries to remain operational throughout the nationwide lockdown to ensure continued and uninterrupted supply of energy to society.

Accordingly, outcomes of these interventions manifested in the Q3 GDP readings when our economy registered a recovery of 66.1%. Mining and quarrying registered a growth rate of 288% contributing 11.8% point to the overall GDP. In March 2021, mining registered a 21.3% year on year growth, following a 0.8% year on year growth in February 2021 performance. This served as a confirmation that our interventions are yielding positive results in the economic reconstruction and recovery journey.

South Africa has suffered due to the lack of exploration, primarily greenfield. What is the current state of exploration in the country and how is it being promoted?

The Department has commenced with the procurement process of a new modern system that seeks to simplify and improve efficiency. With this system, the Department seeks to ensure provision of reliable and precise information on the location of exploration and mining rights. We believe this will reduce the turnaround time in the process of granting exploration and mining rights. The fundamental objective of this system is to attract investment in the mining sector and to grow the economy.

We believe mining without exploration is unsustainable. Hence, we are working in earnest to ensure the finalization of the country's exploration strategy to increase our share of the global expenditure in the next 3 to 5 years. We have through the Council for Geoscience (CGS) rapidly increased mapping coverage from below 5% to almost 9% to date, with particular focus on areas with the greatest potential for recovery of world class minerals. We welcome the ongoing participation of our social partners and in particular the Minerals Council South Africa in the development of this strategy.

To what extent is the move to renewables risking the future of coal mining in South Africa?

The revival of and growth of the mining sector cannot be possible without a stable and secure energy supply. It is for this reasons that we have made it our preoccupation to drive a robust energy security program. Our interventions in this regard are informed by the country's Integrated Resource Plan (IRP) 2019, which incorporates all sources of energy as part of the national energy mix. This includes technologies such as solar, photovoltaic, coal, gas, and battery storage.

We remain committed to rapidly expanding our energy generation capacity in line with the Economic Reconstruction and Recovery Plan. To achieve this, we are implementing multiple measures that will fundamentally change the trajectory of energy generation in our country. For example, we initiated the procurement of the Risk Mitigation Independent Power Producer projects that can be deliver a total of 1,995 MW of power into our electricity grid within 12 to 18 months approval. 11 preferred bidders have been announced and are expected to reach financial closure by the end of September 2021. Another initiative is the amendment of Schedule 2 of the Electricity Regulation Act to increase the regulation licensing threshold for embedded generation from 1 MW to 100 MW.

We also successfully opened Bid Window 5 of the Renewable Energy Independent Power Producer Procurement Program to procure 2,600 MW of new energy generation capacity from wind and solar energy technologies.

In addition, the Electricity Regulations on new generation capacity were revised to enable municipalities in good financial standing to develop their own power generation projects or buy power from Independent Power Producers. The necessary requirements have been clarified in this regard.

We endeavour to create an enabling environment through investor friendly legislation. In this regard, we finalized the amendment of the Gas Amendment Bill to unlock investment into the gas sector and facilitate the development of gas infrastructure; amended the blending requirements of biofuels and to expand the definition to include second and third generation fuels; finalised amendment of the Clean Fuels Regulations to ensure a reduction of the sulphur content in standard grade diesel from 50 to 10 parts per million; gazetted the LPG Strategy which seeks to address a suite of challenges prohibiting access and affordability of this energy source; we are also working on amending the Mine Health and Safety Act to address challenges relating to the health and safety of mineworkers. Other facilitators include the approve of the Upstream Petroleum Bill and the National Nuclear Regulator Amendment Bill by Cabinet. •

Sunset or sunrise industry?

While some countries in Southern Africa have been renowned mining destinations for over a century, such as South Africa and Botswana, others, such as Mozambique and Angola, are emerging mining players with a goal to elevate their mining industries. The regional hegemon, South Africa, is known for its richness in gold, which drove its development in the mid 1800s. The rush for diamond and platinum began in 1860 – 1870s, as well as coal mining which expanded to fuel the region's rapidly growing industries.

Industrial changes sparked social change, which had a huge impact on the industry when coupled with apartheid tensions, which still impacts the industry today under the broad-based black economic empowerment (BEE) regulatory framework. "South Africa's economy has been continuously hollowing out, the sources of growth exhausted, key sectors in recession, productivity falling, and unemployment, poverty and inequality at record levels," elaborated Claude Baissac, CEO of Eunomix, a quantitative risk analysis specialist with a focus on South Africa. "The tragedy and the opportunity is that South Africa possesses incredible assets, natural, economic, social and political. Mineral resources are abundant. But the investment climate, however, is extremely poor."

Even though mining has been an economic cornerstone of the country for more than a century and anchor to many communities, investment in the industry has stalled. "The industry lost its shine as its multi-factor productivity continues to decline and extraction is becoming increasingly complex," commented Fanie Prinsloo, managing director of Martin Engineering in South Africa, a bulk and material handling solutions supplier.

The mining industry's contribution to South Africa's GDP grew 6% year-on-year in 2018, according to MCSA, but it witnessed a 2% decrease in 2019, along with a 1.3% decrease in production. Once the darling of the South African mining industry, gold mining has experienced a systematic decline.

An erratic, unstable regulatory framework, unreliable energy provision, and the slow adoption of modern mining techniques as well as lack of exploration and investments in new mines have led to the industry's structural decline. The turbulence also has its roots in external factors, such as the falling global demand for platinum and diamonds. However, the current commodity prices are breathing life back into the industry once again. Nonetheless, bottlenecks remain around the country's lack of political and regulatory stability that hinder investment.

A particular challenge has been the backlog in licenses and mining rights. A survey of Minerals Council member companies conducted in December 2020 indicated that there are around 170 outstanding mining rights, prospecting rights, change of ownership, renewals and environmental authorizations applications pending. This backlog is holding back investment in projects worth approximately R30 billion (US$2.1 billion). "The Regulator requires the capacity to handle large volumes of work, and it requires people with the required skillset to assess applications to finality and an online cadastral system that works. One of the biggest difficulties has been the defective online Samrad application system," elaborated Ntsiki Adonisi-Kgame, executive for natural resources and environment at ENSafrica, the biggest law firm in the continent. "A lengthy application process has a domino effect and hinders progress in exploration and, ultimately, investment in mining."

The future of the South African mining industry is contested. However, the industry's potential remains enormous and undisputed given its mineral endowment and rich mining history. "South Africa has had its fair share of challenges, but it remains rich with opportunities for investments," explained Peter Flint, managing director of ArmCoil Afrika, a privately owned South African supplier and repairer of transformers and electric motors. "It hosts the experience and expertise in the mining industry to rise again."

Regulatory concerns

The South African mining charter has been extensively debated and revised twice since its inception. The last revision resulted in the 2018 mining charter (Mining Charter III), which came into force on the 1st of March 2019 and significantly increased BEE threshold requirements regarding procurement, employment and ownership. Even though it was a step in the right direction, in-

"It is constant changes in empowerment legislation that create uncertainty and deter investment, even for investors like ourselves. We hope we now have more certainty and clarity through the engagement and discussion that has occurred."

- Mike Teke, CEO, Seriti

troducing long-awaited changes, there still remains room for improvement.

One of the concerns with the current charter is centred on the recognition of continuing consequences since it stipulates that a previously conducted BEE transaction would have to be revisited to comply with the current BEE laws. Another concern is local content obligations regarding mining equipment that is not available in South Africa. "There are still many difficulties. The procurement section of the 2018 mining charter is unworkable and was not adequately thought through when it was gazetted," highlighted Lili Nupen, founder and director of South African mining-focused boutique law firm NSDV. "The fact that the charter is seen as a legislated document, where it is merely a policy, creates issues. The charter should be a guideline on how to transform sustainably instead of box-ticking a specific legislative requirement. This is one of the Minerals Council of South Africa's concerns as well."

Even though the mining charter has been finalized, there are changes on other regulatory fronts. "The regulatory environment in which we operate is very volatile, bringing significant uncertainty," confirmed Francois Uys, CEO of the Siyanda Bakgatla platinum mine.

"There is still great uncertainty within environmental legislation. The government's 'One Environmental System' aims to streamline the licensing processes for mining, environmental authorizations and water use. Still, this legislation has also not been concluded, which adds to the lack of stability," elaborated Hope Tyira, Siyanda's executive head of sustainable development.

Meanwhile, black economic empowerment (BEE) in the mining industry is under the Broad-Based Socio-Economic Empowerment Charter for the Mining and Minerals Industry, 2018. While BEE laws in mining have facilitated the growth of local players, they also negatively impacted non-black owned service and equipment providers, according to Fanie Prinsloo, managing director of Martin Engineering: "Service providers are struggling with the BBBEE laws, which significantly increase the cost of doing business. It's becoming increasingly onerous to manage all the requirements of complying with BBBEE legislation," he explained.

"South Africa has failed to promote and support local manufacturers from a regulatory perspective. Even though BEE laws aim to address institutional racial inequality in South Africa, they adversely affect the South African economy's health. The Broad-Based Black Economic Empowerment regulations favouring BEE companies and manufacturers made it challenging for us to compete," agreed Flint of ArmCoil Afrika.

International companies operating in South Africa must invest in navigating BEE laws to ensure compliance. German-owned Loesche, the market leader in designing, manufacturing and servicing vertical roller mills, is investigating the employment equity investment programme (EEIP) as an alternative route to a black ownership structure, according to managing director in South Africa, Christian Gerhard: "The Department of Trade and Industry has an EEIP whereby you can invest 3% of your turnover into a greenfield type project where you beneficiate either the community or the owner of the project. We have identified three projects where we can get involved," he clarified.

On the other hand, Christina Zondi and Mncedisi Makhamba of Drill Rod Specialist (DRS) view these changes from a different perspective. "The local demand for our products, coupled with the local mining charter requiring local procurement and participation of indigenous black South Africans in the economy allowed for DRS to be established and to enter a partnership with Sandvik. Local content laws have significantly facilitated the growth of DRS," they commented.

The obligations imposed under Mining Charter III remain a source of contention, and the lingering regulatory confusion needs to be addressed to prevent the sun from going down on the South African mining industry. •

Roger Baxter

CEO
MINERALS COUNCIL SOUTH AFRICA

"There is a clear and overriding need to grow the industry and, to do that, we need to improve its global competitiveness. Creating regulatory certainty is critical for investors."

How did the South African mining industry respond to the Covid-19 pandemic?

The mining industry is one of the country's leaders when it came to vaccinating its 450,000 employees as well as their dependents and community members living near mines. We are above 75% of employees fully and partially vaccinated, which is well above the national average. The proactive approach in returning employees safely to work in 2020 and the focused vaccination program has allowed mining companies to benefit from high commodity prices to the benefit of all stakeholders, especially the government, which has offset the economic reverses in the rest of the economy with higher tax contributions from the mining sector in the past two years.

We developed a risk-based approach in dealing with Covid, and our Standard Operating Procedures formed the basis of the guidance that was subsequently regulated by the Department of Mineral Resources and Energy, and it gave the industry a significant head start on how to operate and reopen during the 2020 lock-down, ramping up operations even while many other sectors could not.

What are some of the most significant mining projects and initiatives to look out for in South Africa?

There is a clear and overriding need to grow the industry and, to do that, we need to improve its global competitiveness. Creating regulatory certainty is critical for investors.

The largest investment the mining industry has pending is more than R60 billion worth of energy projects. Our members have in excess of 30 renewable energy projects that will generate 3.9 gigawatts, which will sharply reduce their reliance on state-owned Eskom's coal-fired electricity plants. This will serve multiple purposes of greening the industry, cutting Scope 2 emissions, reducing carbon tax payments, and lowering exposure to the state's increasingly expensive and erratic electricity supplies.

However, the regulatory processes to start these projects remain time consuming and complex. The Minerals Council is in close talks with the government and Eskom to expedite approvals for the projects to take advantage of the announcement by President Cyril Ramaphosa in June 2021 to allow private companies to fund and construct embedded generation projects up to 100 MW. This was a major structural reform the industry has called for to revive the moribund economy.

Covid has catalysed unprecedented levels of engagement, especially between the DMRE and the industry. Six task teams were established between the DMRE and Minerals Council to focus on exploration, the policy and regulatory framework, infrastructure constraints, local procurement, and beneficiation, improving the operational environment including dealing with crime, a one-stop- shop to unblock outstanding mining licenses, and rights and a communications task team.

A survey of Minerals Council member companies conducted in December 2020 indicated that they have about 170 outstanding mining rights, prospecting rights, Section11 change of ownerships, renewals and environmental authorisations that are holding back projects worth about R30 billion.

We are working closely with the regulator to free up the backlog of these rights and some 4,000 more, which are preventing the industry from exploring for minerals, build mines and buy or sell mineral rights to re-energise and revive the industry.

We are disappointed that a jointly agreed exploration strategy has yet to be released by the DMRE more than a year after we held extensive talks with the regulator. Similarly, the DMRE's decision to opt for a bespoke cadastre system to replace the dysfunctional SAMRAD system is a disappointment. The Minerals Council had suggested the purchase of an internationally proven, off-the-shelf system to expedite the transparent, corruption-free management of mineral rights.

What is the status of the current Mining Charter?

A High Court judgement in September 2021 ruled the Mining Charter 2018 is a policy document, that the continuing consequences of previous black economic empowerment deals should be recognised and that specific provisions the Minerals Council challenged should be removed.

The Minerals Council and its members remain fully committed to the transformational objects of the Mineral and Petroleum Resources Development Act (MPRDA), but the objectives must create policy and regulatory certainty for long term investment and inclusive growth in the sector.

The provisions in the 2018 Charter related to mining companies not complying with ownership and mine community development requirements, and thus being in breach of the MPRDA, potentially having their mining rights suspended or cancelled was also removed in the judgment. The Minerals Council will continue to engage the DMRE on a constructive basis to create the necessary policy and regulatory certainty and to attract much greater investment into the exploration and mining sector. •

Insights From the Ground on the South African Mining Industry's Health

"Fundamentally the South African mining industry is struggling, especially in the gold space, but there are still opportunities to grow, especially with the increased commodity prices."

– Keith Scott, CEO, Fraser Alexander

"South Africa is sitting on 70% of the world's PGMs and is well endowed with other significant minerals. Although most commodities are on a bull run, we face some unique challenges. The lack of FDI can mainly be attributed to policy uncertainty, labor unrest, skills deficit and deficient power supply."

– Danie Pretorius, CEO, Master Drilling

"The South African mining industry has a lot to offer as a leading producer of chrome, manganese, platinum, vanadium and gold. The country is also a prominent player in the PGM space and copper, which are witnessing significant growth due to decarbonization efforts."

– Lehlohonolo Amos Molloyi, CEO, MEMSA

"Mineral resources are abundant. But the investment climate is extremely poor, with the government presiding over an empire of red tape, collapsing strategic infrastructure, high administered costs and plain bad governance and corruption."

– Claude Baissac, CEO, Eunomix

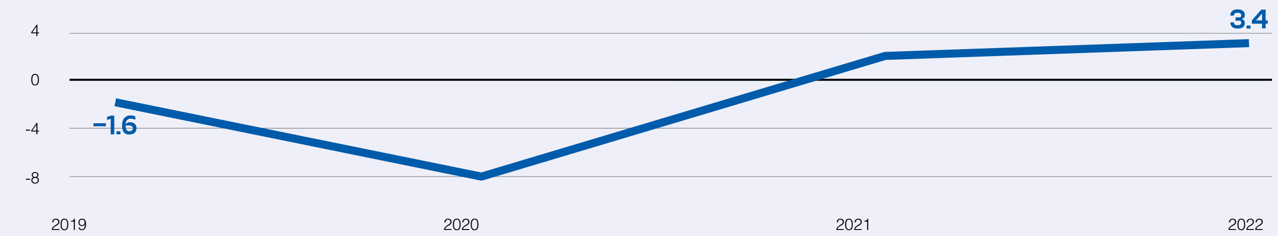
"The economy of South Africa was built on the back of mining, and we still think of ourselves as a mining country. However, it is a sunset industry that is still somehow expected to deliver what it has in the past."

– Nick Tatalias, Managing Director, METC Engineering

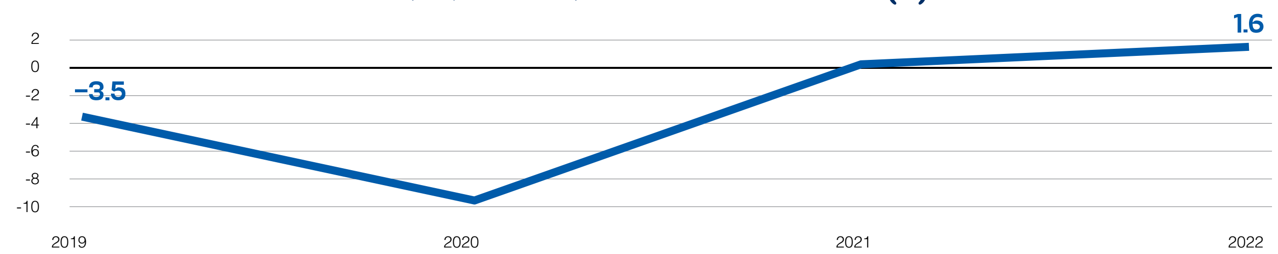
"We need more flexibility. The South African regulation is a one-size-fits-all approach so whether you are an established miner, a junior miner, or even just in the exploratory phase, the same regulatory rules and laws apply – and this is where the difficulty lies."

– Lili Nupen, Founder & Director, NSDV

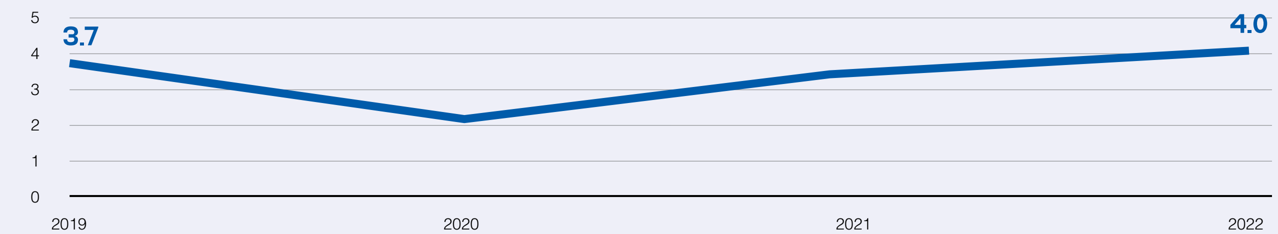
REAL GDP GROWTH (%)



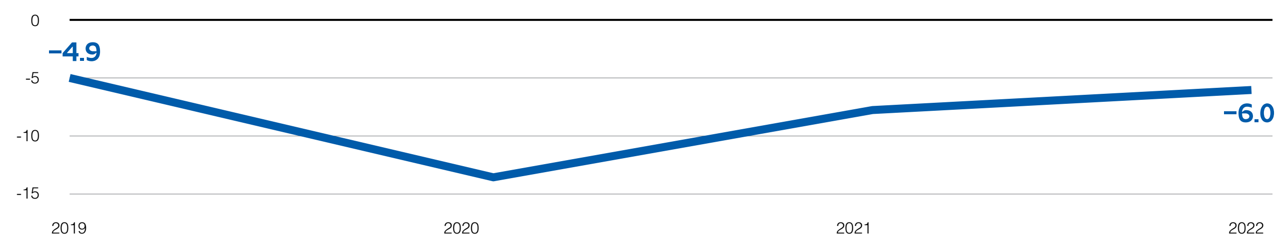
REAL GDP PER CAPITA GROWTH (%)



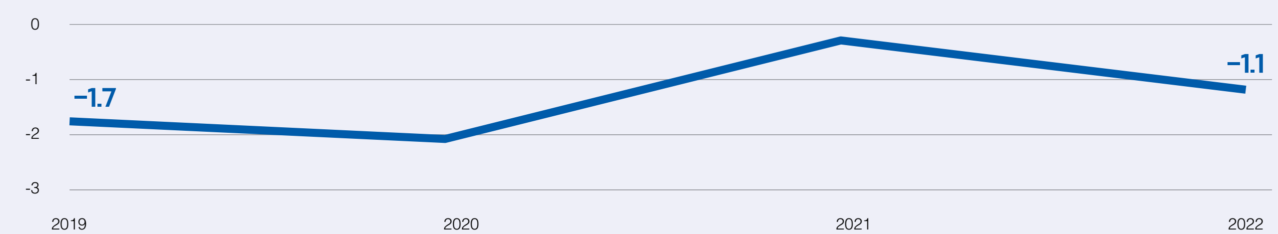
CPI INFLATION (%)



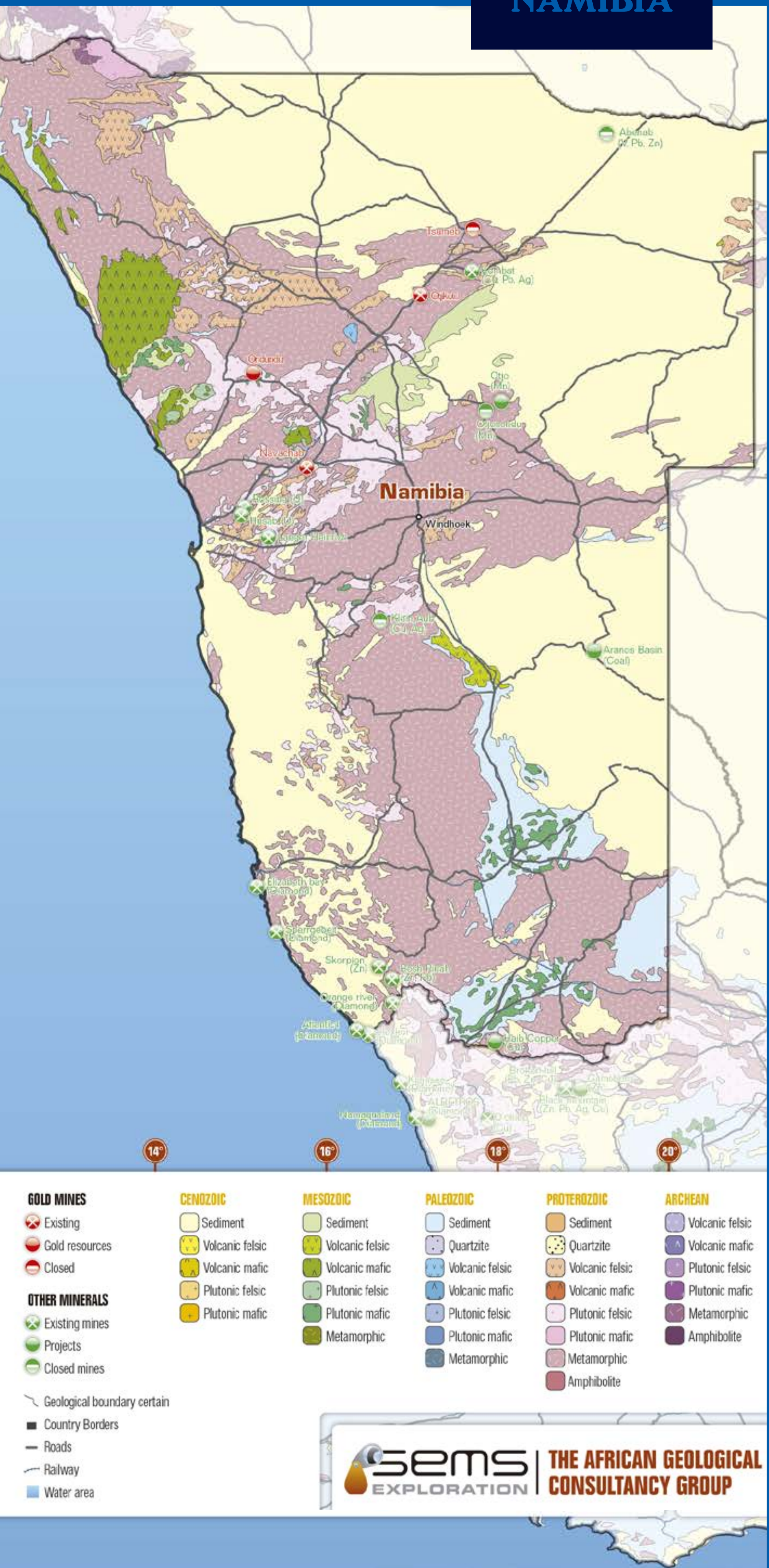
BUDGET BALANCE (% OF GDP)



CURRENT ACCOUNT (% OF GDP)



Source: Data as of December 2020 and are from domestic authorities; figures for 2020 are estimates and figures for 2021 and 2022 are projections by the African Economic Outlook team. Data for the budget balance as a % of GDP reflect a financial year that begins April 1 and ends March 31 the following year.



CAPITAL

Windhoek

POPULATION

2.5 million

GDP GROWTH 2022
(PROJECTED)

2.6%

TOP EXPORTS

Diamonds, copper, uranium

CONTRIBUTION OF MINING TO GDP 10%

MAIN PRODUCERS

B2Gold, Swakop Uranium, Rössing Uranium, Orano Resources Namibia, Trevali Mining

MAIN JUNIORS

Trigon Metals, Lepidico, Bannerman Energy

EASE OF DOING BUSINESS (RANKING)	ACCESS TO ELECTRICITY
104 out of 190	55% of the population

MINING ROYALTIES 2-10%

Sources: World Bank, AfDB, International Trade Administration, World Nuclear Association, Koep & Partners, Chamber of Mines Namibia

Namibia's Mining Industry Driving Development

Bordering South Africa, Botswana, Angola and Zambia, this largely deserted ranch land with its small population of 2.5 million is positioning itself as a gateway to the Southern African market as it enjoys one of the most stable and peaceful political environments not only in the region but on the continent. It is also home to uranium, diamond and metal ores.

The Namibian economy is projected to grow by 2.6% and 3.3% in 2021 and 2022, respectively, according to the African Development Bank (AfDB). However, it faces substantial risks as it battles with the rapid spread of Covid, which is overwhelming a small population where vaccine rollout has been slow. "We were already in the midst of a recession that started in 2016, which we have been struggling to recover from," explained Gert Maritz, CEO of Lithon, a group of companies primarily focused on engineering, development and investments supporting the mining industry in South Africa and Namibia. "The pandemic exacerbated pre-existing structural challenges and we witnessed an economic contraction of around 8%, especially as demand for diamonds dwindled."

The government is trying to mitigate the risk and revive local tourism, agriculture, retail, and wholesale trade through its economic recovery program of US$0.5 billion. According to the World Bank, even the mining sector contracted by 12.2% year-on-year in 2020 due to the falling demand for diamonds and domestic factors. "Overall, the impact of Covid was well-buffered by the nature of the diversified mining portfolio of the country," highlighted Fabian Shaanika, sector lead of mining and natural resources at Rand Merchant Bank (RMB) in Namibia.

Namibia is the world's fourth-largest uranium producer, has the seventh-largest diamond output and hosts smaller mining operations in other strategic commodities such as copper, iron and zinc. The mining value chain is one of the historic bedrocks of Namibia and it accounted for 33.6% of GDP in 1980 and today accounts for approximately 11.1% of GDP and employs over 1.5% of the labour force, according to the Namibian National Planning Commission (NPC). The mining sector is also the largest source of foreign exchange earnings and led to the establishment of towns such as Orangemund and Arandis.

The Namibian mining industry is attractive due to the country's consistent economic and political stability, well-established infrastructure and rich mineral resources. The country witnessed an increase in its Investment Attractiveness Index from 58.22 in 2019 to 59.72 in 2020 in the Fraser Institute's Annual Survey of Mining Companies. "Namibia is an excellent mining jurisdiction. It is politically and legally stable, and the permitting and licencing process is clear, precise and visible," confirmed Jurie Wessels, executive chairman of Vanadium Resources, an Australian junior mining company. "It also has a very receptive and involved Minerals Department that is not overly bureaucratic."

Nonetheless, it poses some challenges to operators, especially regarding regulatory duplication and lack of skilled labour. According to André Snyman, managing director of Walvis Bay Salt Holdings, a solar salt producer in Namibia, the weak labour force is a product of the country's ailing educational system. "The education system in the country is problematic due to the constant lack of funds. Many of Namibia's strengths are weakened due to improper management fuelled by corruption," he said.

All African jurisdictions, with the exception of Namibia, increased their Policy Perception Index (PPI) scores in the Fraser Institute's survey in 2020. Namibia, however, witnessed a 13-point decline

> **"To position itself competitively, the country must focus on attracting foreign investment, especially regarding technology; fostering a sound education system; and to ensure the availability of cost-effective energy and water supply."**
>
> **- André Snyman, Managing Director, Walvis Bay Salt Holdings**

as its ranking fell from 14th out of 76 jurisdictions in 2019 to the 47th out of 77 jurisdictions in 2020. "There have been some uncertainties in Namibia about legislation that could possibly be introduced and this has affected Namibia's rankings recently," indicated Werner Ewald, managing director of Bannerman Energy, an ASX and NSX listed exploration and development company with a 95% interest in the Etango uranium project in Namibia.

To address regulatory inconsistencies and ensure certainty in the licensing process, the government has implemented a complete moratorium on issuing new licenses within Namibia. However, there remains a lack of clarity concerning other regulatory frameworks, such as regarding the future of local content laws, for example, as well as the National Equitable Economic Empowerment Bill (NEEEB). "The NEEEB has been on the table for many years and has several pillars associated with it. The one pillar that sometimes creates some uncertainty is the ownership pillar. If legislation keeps hanging, it creates uncertainty," elaborated Ewald.

Nevertheless, the regulatory uncertainty in Namibia is minimal compared to other SADC mining countries, and the country has more established communication channels and open discussions with mining companies before any drastic changes are made. "There is an ongoing dialogue between mining companies and the government, which is rare, so we are fortunate to be operating there," confirmed Ricus Grimbeek, president and CEO of Trevali Mining, a Canada-based natural resource company, operating the Rosh Pinah underground mine.

Local beneficiation and value addition journey

Being a small commodity-dependent economy makes Namibia susceptible to the volatility of commodity prices. There have been several attempts to diversify the mining sector and to process its products, which the Namibian government is promoting under its National Development Plans (NDPs), Industrialization Policy (IP) and its implementation document 'Growth at Home Strategy.'

Examples of increasing value addition through beneficiation are the production of uranium oxide from uranium ore, processing zinc on a small scale, production of gold bars (B2Gold) and copper cathodes. According to Shaanika of RMB, there has also been an enormous drive to promote the local cutting and polishing of diamonds and approximately 15% of the diamond production in Namibia is handled by a local company.

In zinc, Vedanta Zinc International (VZI) is investing N$6.5 billion to develop the Skorpion refinery. "We commenced with a US$430 million refinery conversion project to co-treat sulphide and oxide ores and to increase capacity to refine zinc sulphide concentrate from the Gamsberg mine," explained Laxman Shekhawat, executive director of VZI. "This project sees the refinery's production double its capacity to 300,000 mt/y within the next 18-20 months."

However, the challenge with local beneficiation is power, as Namibia relies on imported power from South Africa. Recently, however, the country's power infrastructure is rapidly developing, according to Joe Walsh, managing director of Lepidico, a vertically integrated lithium exploration and development company operating the Karibib project in Namibia. "By around 2025, Namibia expects to generate some 80% of its power from renewable sources," he confirmed. •

> **We commenced with a US$430 million refinery conversion project to co-treat sulphide and oxide ores. It will potentially beneficiate zinc concentrates from local zinc mines in Namibia and then export the refined product, making Namibia a net zinc exporter.**
>
> **- Laxman Shekhawat, Executive Director and Business Head, Vedanta Zinc International**

CURRENT ROYALTY AND TAX RATES BY MINERAL CATEGORY

Source: Ministy of Mines & Energy, National Planning Commission

tax payable	mineral royalty rate (%)
Minerals Royalty Rates	Precious Stones (Diamond) mining: 10%
	Dimension Stone: 5% on all unprocessed stone blocks
	Precious metals, base & rare: 3%
	Nuclear fuel minerals (Uranium): 3%
	Semi-precious stones, industrial & nonnuclear fuel minerals: 2%
Corporate Income Tax	Diamond mining: 5%
	Other minerals: 37.5%
	Non-mining activities: 40%
Export Levy	Raw minerals (5%)

Veston Malango

CEO
Chamber of Mines Namibia

> **"In recent years, investments into mine expansion and redevelopment are being made as a result of the successful and continued advocacy efforts of the Chamber."**

What have been some of the Chamber's milestones and achievements over the last years?

Some of the big successes of the Chamber of Mines in recent years are mostly related to the reversal of tax proposals that would have unintentionally destroyed Namibia's mining industry. The tax proposals were rescinded as a result of the Chamber's direct intervention and consultation with Government. The Chamber demonstrated how the tax proposals would eliminate any new growth or investment into Namibia's mining sector, a crucially important pillar of Namibia's economy.

The Chamber also succeeded in reversing a number of harmful policy proposals in recent years. In essence, this advocacy role of the Chamber has been crucial to ensure the continued growth of the sector. In the last seven years, the sector has witnessed cumulative investments of over N$38 billion which can be attributed to maintaining Namibia's mining framework through the advocacy work of the Chamber of Mines. These massive new mine developments and investments would not have transpired had the above-mentioned tax proposals been legislated.

In recent years, investments into mine expansion and redevelopment are being made as a result of the successful and continued advocacy efforts of the Chamber.

How did Covid impact production, development and exploration?

In 2020 the mining sector contracted by 15%. This was mostly due to the reduced output from the diamond and uranium sectors, which were negatively affected by the Covid-19 pandemic. An old zinc and lead mine, that was recently re-developed and brought back into production had to be placed on care and maintenance as the Covid-19 protocol could not be implemented in the confined underground mine, and as a result of the declining prices of base metals, which plummeted even further in the first half of 2020 due to the pandemic.

Thankfully, the mining industry was recognized as a strategic sector to keep the Namibian economy afloat. Despite operations being allowed to continue, the mining sector was negatively impacted by staff disruptions and shortages due to the pandemic. The supply of critical inputs and transportation of capital goods were also delayed due to travel restrictions in Southern Africa. This interrupted expansion and development plans of some operations.

Exploration activity was also curtailed for the most part of 2020 due to travel restrictions, however, it recorded a sharp increase in the later part of the year which was driven by a substantial rebound in mineral commodity prices.

All in all, Namibia's mining sector remained resilient in the face of Covid-19, and continues to sustain operations while ensuring the utmost safety and health of the mining workforce.

What are the biggest challenges facing Namibian miners today from a regulatory perspective?

The two most prominent issues still outstanding from a regulatory perspective are the finalization of the Namibia Investment Promotion Act (NIPA) and the New Equitable Economic Empowerment Bill (NEEEB). The two pieces of legislation have received considerable input from private sector. The finalization of NEEEB and NIPA have been pending for more than five years, and will significantly shape the investment landscape in Namibia once they are finalized. Their conclusion is thus critical to ease investor sentiment, and unlock and realize major investment into Namibia's mining and other key sectors.

The Chamber is of the view that Namibia's performance in the annual Fraser surveys will greatly improve once NIPA and NEEEB have been finalized.

Which metals have the most exciting prospects and potential in Namibia?

Gold is an exciting prospect for Namibia at the moment. The gold mines in operation have embarked on expansion projects and there are two promising gold exploration projects.

Namibia also has a number of base metals projects that have now become more attractive. This includes the old Kombat copper mine, which has been redeveloped and produced its first copper concentrate towards the end of last year.

Currently, there is much optimism for the uranium market which has seen a sustained price increase since August last year. There has been a marked increase in the exploration for uranium in Namibia, and it is most likely that two advanced projects will soon enter mine development, namely Bannerman's Etango project and Reptile Uranium's Tumas project. Paladin's Langer Heinrich uranium mine, which was placed on care and maintenance in 2018, is securing financing for the re-start of operations which is supported by an improving uranium price environment.

Lastly, battery minerals, particularly lithium and tin, are also promising commodities, and Namibia has previously produced these minerals. •

Industry Views: How Attractive is Namibia as a Mining Investment Destination?

"Namibia is one of the top countries for mining in Sub-Saharan Africa. We have been able to establish excellent communication channels with the relevant parts of government and there is a well-established mining industry."

– Joe Walsh, Managing Director, Lepidico

"Namibia is the ideal mining investment destination due to its solid infrastructure, skilled workforce and political stability. Unlike some other African mining destinations, there are no hidden mining super taxes or substantial financial burdens that risk the project's profitability."

– Jed Richardson, President and CEO, Trigon Metals

"Although some of the SOE's driven processes have been slow, there was always transparency and support from the Namibian government. The country emphasizes local content development but regulations are not restrictive as in South Africa."

– Carsten Mosch, Executive Director and CEO, Lodestone Namibia

"Namibia has been underexplored in the past and still holds significant opportunities. The country ranks as one of the best mining jurisdictions in Africa, with a stable multi-party democracy and a constitution promoting and encouraging foreign investment."

– Michael Stares, President and CEO, White Metal Resources Corp.

"Namibia ranks as one of the world's top five uranium-producing nations and has been mining and exporting uranium for close to 50 years. There have been some uncertainties in Namibia about legislation that could possibly be introduced and this has affected Namibia's rankings recently."

– Werner Ewald, Managing Director – Namibia, Bannerman Energy

"Namibia is an excellent mining jurisdiction. It is politically and legally stable, and the permitting and licensing process is clear, precise and visible. It also has a very receptive and involved Minerals Department that is not overly bureaucratic."

– Jurie Wessels, Executive Chairman, Vanadium Resources

"Namibia has ample exploration potential and is an extraordinary mining jurisdiction. The government is supportive of mining and Namibia is the only country in the world that has an association dedicated to promoting and supporting the uranium industry – the Namibian Uranium Association."

– Murray Hill, Managing Director and CEO, Elevate Uranium

Concluding Remarks

"Even though the world is moving towards cleaner energy solutions, in Africa, coal remains the most reliable power solution for developing countries, and this is where we see the opportunity for growth."

– Debratna Nag, CEO, Jindal Mining

"Green Hydrogen is expected to play an essential role in decarbonizing global energy and transport systems and will make a notable contribution to climate protection. Global developments in Hydrogen Fuel Cell Electric Vehicles (FCEVs) provide mines with a viable option of FCEV mobility solutions."

– Eric Vemer, CEO, Howden

"We see a growing desire by the mines, investment communities, governments and the public in general to decarbonise. Some countries have regulatory hurdles that need to be crossed, but the markets for renewable energies are opening up."

– Alistair Jessop, Head of Power, Vivo Energy

"Globally people might have different views of the African market. Still, I want to invite companies to spend time studying the region and the immense growth it has experienced over the years. One needs to step into this market to see the great future and opportunities."

– Hadyr Koumakpai, General Manager Africa, JA Solar

"When commodity prices started increasing substantially, South African commodity-based businesses saw an increase in their profits, which benefits us greatly as they are now investing in new equipment and up-to-date technology."

– Rhys Evans, Director, ALCO-Safe

"Africa is a big continent, and providing grid energy to so many off-grid sites is a challenge. For mines to be able to self-generate power without relying on huge diesel generators is an enormous opportunity for the sector."

– Rob Hounsome, Africa Regional Manager, SLR Consulting

"A significant challenge is the resistance of mines to adopt new technologies. When cash flows are reasonable there is little incentive to innovate, but there is nothing like disaster and hardship to sharpen the mind and discover better ways of doing things."

– Kevin Reynders, Managing Director, Rham Equipment

Democratic Republic of the Congo (DRC)

"The low carbon economy will likely require US$50 trillion of investment over the next three decades, making it the biggest purchase order in history."

- Benedikt Sobotka,
CEO of Eurasian Resources Group
and Co-chair of the Global Battery Alliance

Image courtesy of MCSC

Le Scandale Géologique

DRC has been the subject of bad press for years, and this cycle of bad news exacerbates and probably exaggerates the challenges, creating a biased representation whereby positive aspects are excluded.

- Mustafa Rawji, Managing Director, Rawbank

A local legend says that God, on his way to creating the world and endowing each place with different riches, became very tired by the time he arrived at the DRC. There, in the heart of Africa, he decided to leave all the remaining gifts he had in his basket. Under the DRC's ground lies almost half of the world's known supply of cobalt, some of the highest-quality copper, large deposits of lithium, gold, diamonds, as well as coltan, tin, tantalum, and tungsten (3Ts). Above ground, the country is covered with the world's second-biggest rainforest, over 80 million ha of arable land, dissected by the Congo River, second only to the Amazon.

On the ground, however, poverty is widespread; 60 million out of 90 million Congolese live on less than US$1.90 a day, according to the World Bank.

In the 19th century, Belgian geologist René Jules Cornet described DRC's natural richness as a "scandale géologique." The phrase caught on, but today the scandal is more broadly understood as social, humanitarian, and even political, and not merely geological. The U$24 trillion estimated worth of DRC's mineral potential is contrasted with other facts: 40,000 children are believed to work illegally in mines, based on UNICEF data, while subcontractor workers get paid as little as 40 cents/hour, as reported by the Guardian newspaper. Furthermore, illegal minerals represent a source of revenue for armed groups in Eastern DRC, fuelling seemingly endless violence.

The stories exposed in the media have lasting effects on the country's reputation but result in relatively limited change. A few years after publishing a report showing the extent of child labor in the mining sector, Amnesty International showed evidence that the practice is still prevalent, even if the DRC has implemented specific penalties for resorting to children workers. The industrial mining industry is rarely directly involved in these cases, but gets caught in the same narrative whereby locals are exploited just like the ore they work with, and where minerals are used to fund the war.

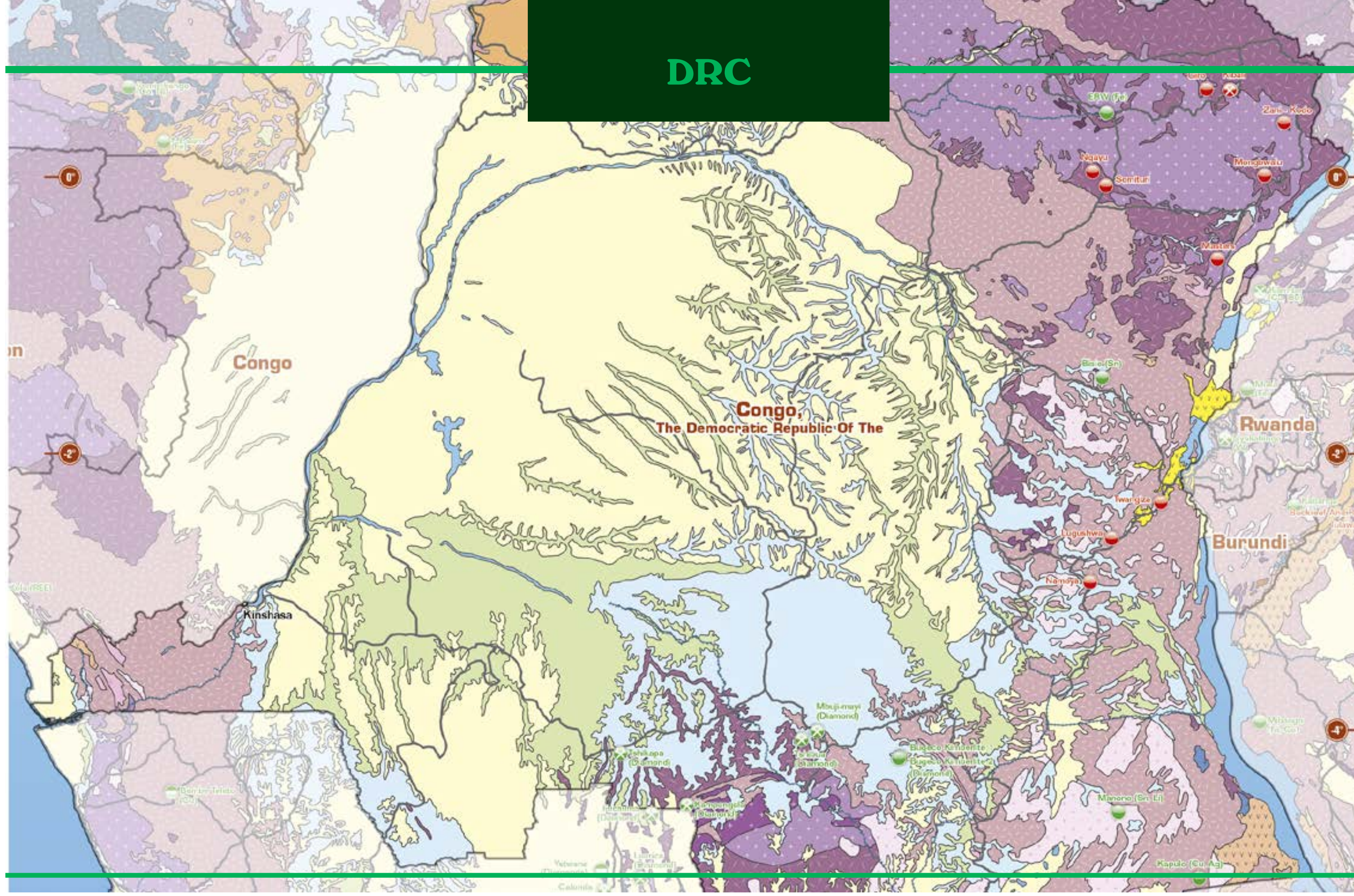
Both regulators and downstream consumers have put more pressure on the DRC to improve transparency across its supply chains and eradicate links with social abuses or conflict. In 2010, the US passed legislation to reduce the purchase of "conflict minerals," identified by the US and the EU as tantalum, tungsten, and gold (3TG); all of which are found in eastern DRC. Cobalt, however, is not mentioned in this list, probably because cobalt is sourced from the much more stable southern region, but also because restraining cobalt supply from the DRC would mean threatening up to 70% of the world's cobalt supply.

In the aftermath of the prominent breaches exposed by Amnesty, but also after International Rights Advocates sued Tesla, Apple, Microsoft, and Dell in relation to child labor within their supply chains, carmakers and electronic companies have looked for alternatives to DRC's cobalt. BMW decided to buy cobalt from Morocco and Australia. Apple temporarily interrupted cobalt purchases from the DRC after the Amnesty International report came out. But those with a large and growing need for cobalt cannot afford to cut off the country from their suppliers' list. Tesla has instead been focused on reducing the use of cobalt in its EVs by 60% in the last seven years. Also, the EV leader has been driving research in lithium-ion phosphate (LFP) batteries that don't contain cobalt for its new car models. Panasonic, Tesla's battery supplier, recently announced it is working on developing cobalt-free batteries. Second-generation LFPs have also become very popular in China, where they captured 52% of the market share in the first eight months of 2021. Nickel-cobalt-manganese (NCM) batteries are another alternative that reduces the use of cobalt with higher nickel concentrates.

However, cobalt remains difficult to replace because its high-energy density is linked to longer battery life, so prototypes of batteries without cobalt or with less cobalt have limitations.

In 2020, Tesla struck a deal with Glencore, the world's largest cobalt mining company with two operating copper and cobalt mines in DRC's Katanga region, agreeing to buy 6,000 tonnes of cobalt annually (mt/y) for its giga-factories in Berlin and Shanghai. Tesla commented that it is reviewing information provided by suppliers for "red flags and risks associated with ethical sourcing." •

DRC



CAPITAL
Kinshasa

POPULATION
89.56 million

GDP GROWTH 2022 (PROJECTED)
4.5%

TOP EXPORTS
Refined copper and copper alloys, cobalt oxides and hydroxides, copper ore

CONTRIBUTION OF MINING TO GDP
32%

ESTIMATED PEOPLE WORKING IN MINING
11% of the population

MINERAL RESERVES
Cobalt, copper, diamonds, gold, lithium

MAIN PRODUCERS
Barrick Gold, Ivanhoe Mines, Glencore, MMG, CNMC, CMOC, Zijin Mining Group

MAIN JUNIORS
AVZ Minerals, Alphamin Resources, Amani Gold, Tantalex Resources

MINING CORPORATE TAX 30%

FREE CARRIED INTEREST 10%

MINING ROYALTIES 3.5%
10% for strategic minerals (cobalt, coltan, lithium, germanium)

GOLD PRODUCTION OUTPUT 2020
60.9 tonnes

COBALT PRODUCTION OUTPUT 2020
85,855 tonnes

EASE OF DOING BUSINESS (RANKING)
183 out of 190

ACCESS TO ELECTRICITY
19% of the population

Sources: AfDB; World Bank; WTO; DRC Central Bank; US Geological Survey, World Bank, EITI; World Gold Council; Central Bank of Congo

Driving change: The responsible sourcing of cobalt and other key materials for the EV industry

Benedikt Sobotka, CEO of Eurasian Resources Group and co-chair of the Global Battery Alliance

The latest installment of the UN's landmark IPCC report, published in February 2022 and signed by 270 scientists, concludes that the world has a "brief and rapidly closing window" to respond to climate change. The 2015 Paris Agreement set the goal of keeping the rise in mean global temperatures to well below 2 degrees centigrade. Seven years later, it is clear we need to take far more urgent action if we are going to reach this target.

The battery value chain is one of the major and immediate drivers to realise the Paris Agreement goals in the transport and power sectors. Research from the Global Battery Alliance and McKinsey indicates that as a clean energy power source batteries can enable 30% of the required reductions of carbon emissions in the transport and power sectors, and the EU Commission has named batteries as the fastest growing storage technology.

At the heart of the battery supply chain is the production of cobalt, a key metal in the lithium-ion batteries used in electric vehicles, smart phones and other electronic devices. Electric vehicle sales more than doubled between 2020-2021 to reach 6.6 million vehicles, which, in turn, led the price of cobalt to surge by 120%. In some of the key markets, we believe the share of EVs in new car sales may exceed 50% by 2030, above most analysts' expectations of 30%. The Democratic Republic of the Congo (DRC), where the majority of the world's cobalt is currently produced, is well-positioned to benefit from this – but only if the metal can be extracted sustainably.

Estimates suggest that as many as 1 million children are involved in the DRC's mining industry, and dangerous working conditions are still commonplace in artisanal and small scale mining (ASM). It is vital that the switch to the green economy does not come at the expense of some of the world's most vulnerable communities.

Public and private organisations need to work together in a way that strengthens the transparency of battery materials across the value chain. Capital must be directed to solutions that are not only green, but also socially sustainable. This means establishing harmonised principles for digital traceability, access and transparency so as to hold companies and nations to account and guarantees for consumers that the batteries in their EVs and smart devices have been responsible sourced.

Traditionally, it has been difficult to track cobalt continuously from the mine to the EV. This presents significant obstacles to being able to assess the sustainability of the cobalt used in these EVs: How much carbon was emitted during extraction? What were the safety standards of the mine it came from? Were children involved with the mining?

To solve these issues, Eurasian Resources Group (ERG) has co-founded two multi-stakeholder initiatives. One of these is the Global Battery Alliance (GBA), whose 90+ members include NGOs, industry actors, academics and policy makers, such as Microsoft, BASF, the World Economic Forum and others. The GBA is in the process of developing the 'Battery Passport', a digital representation of a battery that conveys information about all applicable ESG and lifecycle requirements based on a comprehensive definition of a sustainable battery. At the core of this definition is full transparency on a battery's provenance, ensuring the materials and production processes have been ethical and sustainable. The concept of a battery passport has already been endorsed during global policy discussions, such as at the 2021 G7 Leaders' Meeting and the draft EU Directive on Batteries, and our hope is that it will become the standard benchmark for all batteries worldwide.

ERG has also helped launch Re|Source, a blockchain solution developed with CMOC, Glencore, Tesla, Umicore and others for end-to-end traceability. The goal of Re|Source is to trace responsibly sourced cobalt and other battery metals in real operating conditions from the mine to the electric vehicle. The solution is set to be rolled out this year, enabling companies in the supply chain to account for every unit of the material.

Solutions like these are the reason why major strides have been taken in the responsible sourcing of key materials like cobalt. However, there is still a lot of work to be done. The low carbon economy will likely require US$50 trillion of investment over the next three decades with the IEA predicting that mineral requirements will need to be quadrupled to create clean energy technologies and meet the Paris Agreement goals by 2040, making it the biggest purchase order in history. •

Mining in the two economies

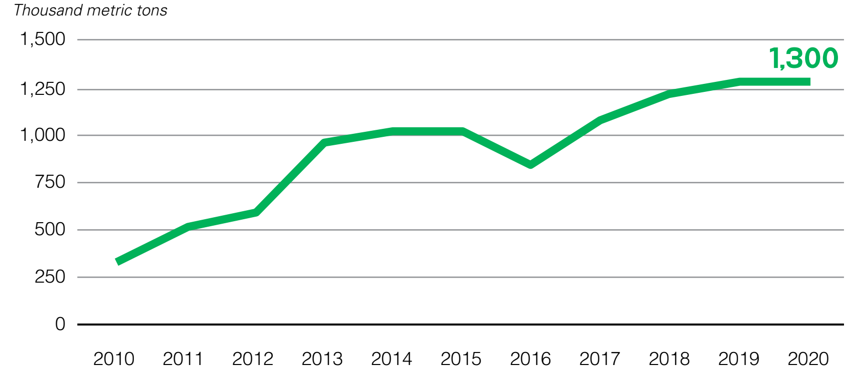
Though not irreplaceable, cobalt is a metal that is poised to grow in importance. The World Bank expects cobalt demand to rise 500% by 2050, driven by the battery market. This galloping demand puts the DRC in a good position, Southern Congo sitting on 3.4 million metric tons (mt) of cobalt, which is about half of the world's known supply. Just as the world relies on DRC's minerals, the DRC relies on its mining industry, which brings 90% of its total exports value and creates thousands of jobs in a country where the majority of people are unemployed. Improved commodity prices and higher mineral production allowed the economy to recover with 3.3% GDP growth in 2021, with a favorable outlook of 4.5% growth for 2022, and a narrowing foreign account deficit. But that means more money will also enter the informal economy, where 85% of DRC's population is active.

Ravaged by war for decades, the DRC offers few employment opportunities, so most people make a living in precarious jobs, while some have joined the country's over 100 armed groups. The informal economy incorporates the war economy, where minerals become a core source of revenue for militia that preys on mineral cargo, especially from artisanal miners.

Artisanal mining activity is already leaving deep marks on the environment, explained Cécile Amory, general manager at local contractor MCSC: "Small mines suddenly reopened when prices soared, relying on artisanal miners and/or small fleets of inappropriate equipment. They

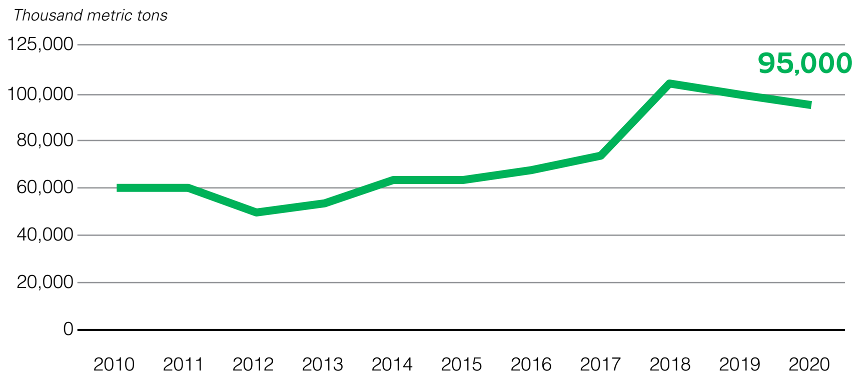
PRODUCTION VOLUME OF COPPER IN DRC

Source: Statista



PRODUCTION VOLUME OF COBALT IN DRC

Source: Statista



> **Between 2018 and 2019, the mining industry saw accelerated growth, with increased mining activity and a high demand for equipment purchases. Today, the drastic rise in commodity prices, with copper and cobalt in the spotlight, have drawn more attention into the DRC.**
>
> ***- Marcus Carlson, Country Manager DRC, Epiroc***

dig up incorrectly with no forward planning, putting the entire operation at risk for future use. In the name of short-term gains, the mine and surroundings can be damaged for the long term."

In a domino effect, higher artisanal activity harbors more illicit activity from armed groups. The DRC must ensure that the income generated from its mineral resources is directed towards the development of the country. But with more money at stake, the industry is worried that legal taxation will increase. Louis Watum, president at the Chamber of Mines, told GBR the Chamber is already fighting a surge in resource nationalism brought on by the rise in commodity prices: "Multiple direct and indirect taxes, many of which fall outside of the mining code, have been introduced in the past year. The government owes the industry over 1 US$ billion in VAT, and, despite its commitment to pay the debt, implementation has been lagging."

In 2018, a new mining code that amended its 2002 predecessor was largely seen as a protectionist move that would repel investments, but these premonitions did not necessarily come to fruition. The new code tipped the balance in the government's favor by slashing the stability clause from 10 to five years, increasing the country's holdings in operating companies from 5% to 10%, increasing royalty rates, stipulating taxes on super-profits, and demanding the localization of local proceeds.

20 years after the first mining code was passed, the country is enjoying a period of relative stability. The election of President Tshisekedi in 2019 marked the first peaceful transfer of power in the DRC's history, even if the results were initially contested. President Tshisekedi has adopted a hard stance on combating fraud in the mining sector, and ordered that all mining licenses granted under his predecessor, Joseph Kabila, to be audited. Most shockingly, Tshisekedi recently announced that the US$6 billion controversial "infrastructure-for-minerals" deal with Chinese investors is also being reviewed. The clean-up, he told his ministries, will increase the contribution of mining to the state budget and help combat fraud. Mining minister Antoinette N'Samba was asked to identify the mining companies that had not ceded 10% of shares to the state when they changed from exploration to exploitation, as required in the mining code. •

Improving ESG practices in the formal and semi-formal sectors

Three letters – E, S and G – have gained significant resonance in the mining world, but their interpretation and implementation are heterogeneous, with stark differences between the formal, semi-formal, and informal mining sectors, each with very different value chains. For example, DRC's cobalt industry is 80% represented by mechanized, large-scale mining (LSM). The rest is made by small-scale mining (ASM).

Environmental and social issues have been reported in both sectors, but making generalizations is difficult without the existence of a benchmark to validate or sanction ESG performance. The different sustainability certification schemes and initiatives set out by the UN or OECD are applied on a voluntary basis, with big discrepancies between large operators facing the scrutiny of their international shareholders, and smaller companies that follow their own rules. "Those of us who are in the country have witnessed unthinkable things, like mines that pumped out the excessive toxic waste accumulated at their TSF through sprays, splashed out into the surrounding environment by the wind, or some leaking wall in a TSF, letting the waste flows into the rivers," Cécile Amory, general manager at Mining Contracting Services Congo (MCSC) shared with GBR.

Nevertheless, service providers offering ESG packages are noting a greater interest in the quality and purity of the products, their carbon footprint, and their traceability. "Customers want to know exactly what leaves the country," said Xavier de Longueville, regional director for Africa at Group Robinson International, an inspection and lab service company with a US headquarters. "In the past, buyers and sellers would simply focus on exports without taking into account the analysis done in the DRC, but the arrival of blockchain has put traceability in the spotlight," he said.

Without an established measuring tool or method, equipment dealers offer a good metric to analyze the industry's concern with ESG. Dem Group, a dealer of Hitachi, John Deere and Atlas Copco among other brands, has received more requests for zero-emission machinery. Equipment manufacturers are on the ESG case, with clear roadmaps for a greener future: "Hitachi is coming to the market with a new generation of products with green add-ons but also an ability to retrofit. For instance, older products can be installed with hydrogen capacity later on. By 2025, Hitachi wants to introduce battery technology across its portfolio, and by 2030, the producer plans to have machines equipped with fuel cell technology," said Jean Launay, mining sales engineer at DEM Group in the DRC.

One of Dem Group's clients is AVZ Minerals, an Australian company with an ambition to develop one of the lowest carbon footprints for its hard-rock lithium mine at the Manono lithium and tin project in southern DRC. Similarly, Ivanhoe Mines wants to achieve carbon-neutrality at its flagship Kamoa-Kakula mine. DRC's risky environment did not allow these miners to stay passive about the ESG profile of their operations, pushing them to the opposite extreme of immaculate standards. For example, the Kibali gold mine operated by Barrick Gold is considered to be one of the most highly automated subterranean bullion mines in the world, where the use of automated software allows operators to work safely from the surface to control underground haulage.

> **We all think we know the meaning of these three letters – E, S and G - but the implementation is often lagging or poor.**
>
> **- Ralph Heath, Africa Regional Manager, WSP Golder Mining**

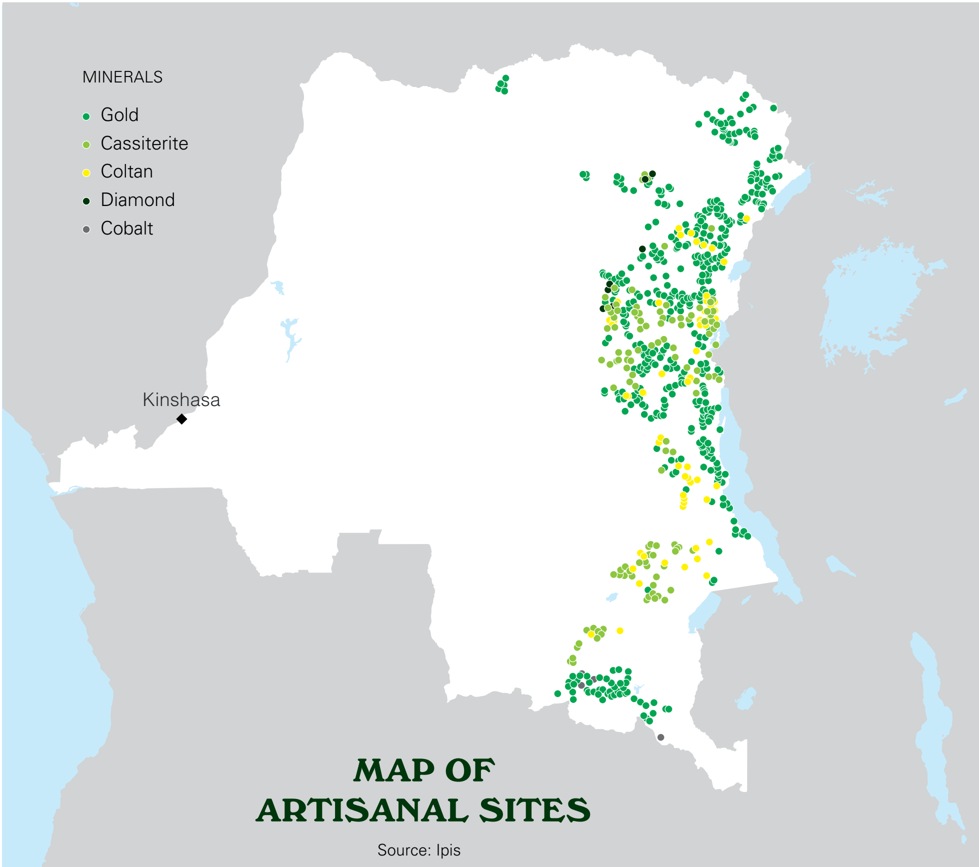
The main difficulty for formal mining operators is to control misconduct or unfairness within their extended value chains. One of the most common grievances shared by workers in the mining sector is poor salaries, but what happens in most cases is that big producers hire contractors who then hire and pay subcontractors, and it is the subcontractors that get pay unreasonably low amounts. For example, at the Tenke Fungurume mine, one of the largest copper mines in the DRC, 70% of workers are paid through subcontractors. Soraya Narfeldt, the CEO of global remote site service provider Ra International, explained that miners and contractors alike run a constant risk of unwillingly becoming part of a value chain that uses child labor by associating themselves with the wrong supplier. "It is paramount to ensure transparency both upstream and downstream of the value chain and explain to each of our hundreds of suppliers the correct procedures and the importance of compliance," she advised.

Nerfdelt compares the arrival of mining companies in remote places to a "moon-landing"; an experience of alienation and intrusion felt by both hosts and visitors. Mining companies must take the time to understand someone else's world, she advises, or the exclusion can take the form of resentment and even anger or violence.

Community development must go beyond "building a few classrooms," agrees Louis Watum, president at the DRC Chamber of Mines. Watum feels the 0.3% of annual turnover that goes to mining communities together with other royalty commitments should be used to create long-term development that will be relevant in the next few decades even if the mines will no longer be active by then. Right now, too much ESG work is about ticking boxes. •

> **MNCs operating in the country adhere to their Groups' internal ESG norms and have better adoption tools, but for locally based enterprises, the conversation on ESG has only just started.**
>
> **- Jean Jacques Mukula, Partner, PwC**

Cleaning the tainted supply of artisanal cobalt



MAP OF ARTISANAL SITES

Source: Ipis

A car contains about 10 kg of cobalt, while a phone takes around 8 g. Chances are high that some of the cobalt that goes into cars, phones, and other electronics has been artisanal mined, considering that the DRC supplies two-thirds of cobalt demand and 20% of this comes from the ASM sector. Artisanal mining has been legalized since 1981 under president Mobutu Sese Seko and is organized in cooperatives. In reality, however, a lot of artisanal mining falls outside of organized structures and takes place illegally.

Artisanal miners manually dig for the ore using basic tools like picks and shovels. The simplicity of their methods has inspired the moniker of "diggers" or "creuseurs". The practice is often dangerous, especially since diggers enter sites illegally, adventuring into perilous tunnels without protective equipment or other safety measures. Illegal and clandestine mining also leaves big marks on the environment, diggers destroying protected natural reserves or washing the ore in local rivers until the water becomes undrinkable. But the biggest risks are directly upon themselves. A joint study by the KU Leuven University and the University of Lubumbashi found that children living near explored mining districts presented 10 times more cobalt in their urine compared to samples taken from non-mining towns. Pregnant women in southern Congo are found to have the highest ever reported metal concentrations, found another study published in The Lancet.

In 2019, a landslide at one of Glencore's mining sites killed 43 illegal mines that had infringed on the property. Locals said that right after the tragedy happened, creuseurs went back into the mine and continued digging, as reported by the New Yorker. Every year, thousands of artisanal miners are thought to die in the Congo, so why do people risk their lives like that? With 80% of DRC's population unemployed, artisanal mining is a lifeline, especially for low-skilled workers and their families. In fact, ASM mining is a source of income for more people than industrial mining: 40 million people work in ASM globally, but only 7 million in LSM, based on IndustriAll Global Union.

The total number of ASM workers in the Congo is unclear, but in the Lualaba province alone, officials estimate there are around 200,000 cobalt artisanal miners and up to 1 million people directly dependent on their work. Lualaba's largest city, Kolwezi, now counting half a million inhabitants and known as the cobalt capital, has grown with the coming of industrial mining, followed by creuseurs. Large communities of creuseurs live on the craters of copper and cobalt mines. Every year, ASM is believed to produce between 15,000 mt to 30,000 mt of cobalt, most of which is illegally exported to China.

In response to the serious allegations of human rights abuses, but also seeing a financial opportunity in the huge share of ASM cobalt, the government created a new entity whose monopoly over artisanal cobalt in the country would help homogenize – and monetize – the sector. With state-owned mining company Gécamines as its main shareholder, Enterprise Générale du Cobalt (EGS) was created in 2019 with four objectives in sight, as its CEO, Jean Dominique Takis Kumbo, laid down for GBR: (1) To improve the living conditions of artisanal miners, and especially of vulnerable people like children, pregnant women, and the elderly. (2) To combat fraud linked to the illegal trade of artisanal cobalt and increase tax revenue. (3) To oversee the traceability of operations. (4) To strengthen the country's reputation on the international stage.

> **"The DRC must rise as a cobalt leader ethically and sustainably, prioritizing the people working in the field. Our vision at EGC is to ensure that our strategic mineral resources generate wealth for the Congolese people, and we can achieve this by fair wages, contributing to the development of communities, promoting local entrepreneurship, and improving the livelihoods of diggers and their families."**
>
> **- Jean Dominique Takis Kumbo, CEO, Enterprise Générale du Cobalt (EGC)**

In effect, EGC will procure the cobalt from authorized cooperatives and process it locally into cobalt hydroxide.

Most interestingly, EGC has brought in an external partner, the Singaporean-based commodity trading company Trafigura, that will pre-finance the set-up of artisanal mining zones and of buying stations, as well as purchase the cobalt hydroxide from EGC and sell it into international markets. As the largest trader in the DRC, with a total trade volume of 1.3 million mt in the last financial year, Trafigura will be the only dealer of its size to have developed an ASM cobalt model accepted by the market.

With a reputable trader on board to broker the passage of ASM cobalt into global markets, the DRC will be able to see its artisanal cobalt confidently marketed as "sustainably sourced," for the first time at this scale. "Artisanal mine sites can be responsibly operated," commented James Nicholson, head of corporate responsibility at Trafigura. "Rather than pushing artisanal mining to the sidelines, our approach has been to bring actors together – including producers, traders, and downstream receivers – to engage on improving working practices, legitimizing activities, and, in time, enabling access to market," he added.

Trafigura has been trading in the DRC since 2015 and already has the experience of valorizing an ASM site from its work at the Mutoshi mine, operated by Chemaf – a subsidiary of Shalina Resources. About 5,000 artisanal miners under the local cooperative COMIAKOL worked at Mutoshi, demonstrating that ASM cobalt can have a positive impact under a multi-stakeholder approach formed by a multinational trader, a mining company, local cooperatives, and the American NGO Pact overseeing the implementation of working standards.

Now, EGC, Trafigura and Pact are replicating the Mutoshi success at the first artisanal site, Kasulo, where there are 10,000 artisanal miners. Kasulo is a town where the discovery of cobalt upended the lives of its dwellers. A detailed coverage by the New Yorker relayed how hundreds of people in Kasulo began digging in their own plots and under their homes after finding out that they live atop of billions of dollars worth of cobalt. In 2019, 10,000 families were paid by the government to relocate. The governor of Lualaba province granted the mineral rights at Kasulo to Congo Dongfang International (CDM), and EGC is now in discussions with CDM to take back the property which it claims belongs to Gécamines.

Besides navigating the negotiation over the sites adequate for artisanal mining under EGC's guardianship, another challenge is to convince illegal, freelance diggers to join cooperatives and get a license instead of going on their own and sneaking in on sites. Creuseurs feel that sustainable sourcing benefits the elites, not them, because they would have to pay additional levies to cooperatives, landowners, and state officials. They are right in this sense. Gold diggers, for example, would have to pay 15% in different taxes even if the official export tax is only 2%. Just like cobalt diggers, gold diggers would be rendered uncompetitive by these legal taxes, so they prefer to sell their ore on the black market.

One of the strongest carrots the government has to incentivize illegal diggers to formalize are better wages and a higher pricing point for ASM ore, since artisanal miners are usually forced to sell below the market price. On its side, the government is well incentivized to bring artisanal miners into the formal economy. In 2019, at least 1.1 mt of gold was smuggled out of the provinces of North Kivu, South Kivu and Ituri, according to the UN Group of Experts on the Congo, even if official reports only registered exports of 73 kg. If the real amount was legally exported, the DRC would have received over US$1.88 million in taxes. A similar case applies to untaxed cobalt. Moreover, with cobalt demand on the rise and a flagging supply pipeline in the formal sector, ASM cobalt is the most immediate answer to growing cobalt needs. •

> **"We believe we can give access of a big part of DRC's production to the market in a responsible manner and at a time when the world needs it the most. On the one hand, there is a global deficit in both copper and cobalt, and on the other hand, there are DRC's huge reserves and low carbon production prospect, combined with heavy scrutiny into minerals sourcing and the reluctance of financiers to step into the country. Trafigura can help bridge these gaps."**
>
> **- Socrates Economou, Head of Nickel and Cobalt Trading, Trafigura**

DRC's Minerals: A wholesome slice of the periodic table

DRC's over 2.3 million km2 size contains more minerals than any other country in the world: Copper, cobalt, coltan, gold, lithium, the 3Ts, diamonds, cassiterite (tin), zinc, manganese, silver, cadmium, germanium, palladium, uranium, platinum, iron ore, bauxite, coal and limestones. It's not just the long list that makes the country rich, but also the spectacular quantities and qualities these metals come in. The DRC holds the largest known reserves of both coltan and cobalt, as well as exceptional copper grades averaging 3%, at least three times more than the global average.

DRC's prospects have not disappointed developers who took their chances on the country. Kibali gold mine, a JV between Barrick Gold and AngloGold Ashanti, is the biggest gold mine in Africa, with a production of over 800,000 oz/y in 2021. Alphamin Resources found the world's highest-grade tin mine in Mpama North, while Glencore bought the world's biggest cobalt mine in 2017, Mutanda. Other projects are on their way to becoming leaders in their space. Ivanhoe's Kamoa Kakula is considered the highest-grade copper discovery and positioned to become one of the biggest copper mines globally. AVZ Minerals is developing the world's largest hard rock lithium deposit at the Manono project – a staggering success considering the DRC is not even producing lithium yet.

Despite the series of record-breaking discoveries, only a few minerals from the long list are commercially mined. Investments in the country have prioritized the large deposits of copper and its byproduct, cobalt, found in the southern regions of Haut-Katanga and Lualaba. The Copperbelt provided a safe and attractive option, offering higher yields compared to neighbor and competitor Zambia, where the Copperbelt stretches south. The DRC holds the title of the biggest cobalt producer in the world, and the largest copper producer in the continent.

With Kamoa entering production last year, DRC's copper output saw a record year of 1.7 million mt/y in 2021, above the previous 1.6 million mt/y record established in 2020. Kamoa alone produced 105,884 mt of copper in concentrate in 2021, and it has a 2022 production guidance of 290,000 to 340,000 mt/y as part of its phase two expansion. Alongside Kamoa, Eurasian Resources Group's Frontier mine, the Tenke Fungurume mine owned by China Molybdenum, and Glencore's Kamoto Copper Company (KCC) are other giant producers in the country, followed by smaller mines like MMG's Kinsevere.

Different sources, including The Times and Benchmark Mineral Intelligence, point that 15 out of 19 cobalt-producing mines in the Congo are owned by Chinese interests, the five biggest Chinese mining companies operating in the country having borrowed a total of US$124 billion from Chinese state-backed banks. Other sources estimate that about 70% of the entire mining sector is controlled by Chinese companies, many of these being large, mostly state-owned enterprises, while others are small and medium-sized companies that have tapped into the gap left by Western players.

On the other hand, cobalt production had been declining in the last few years, as Glencore interrupted production at Mutanda, the world's biggest cobalt mine, responsible for about 20% of global supply. Two years after sitting idle, Glencore announced it will reopen the mine in 2022. Cobalt is currently

> **The country sees rather limited M&A activity. Instead, investment goes mostly into capacity building. Mines that have been on care and maintenance were brought back into production, and projects in the early development stages have quickly advanced into production, with very high yields.**
>
> **- Amedeo Anniciello, CEO, Standard Bank**

trading at US$71,000/mt, and demand is expected to grow at 10% CAGR between 2021 and 2025.

Glencore's peer, Eurasian Resources Group (ERG) is undergoing a massive capacity expansion at the Metalkol Roan Tailings Reclamation (RTR) project in the Kolwezi area. The Metalkol RTR is the third standalone cobalt producer in the world, with a total 2020 production of 10,500 mt of cobalt, after Glencore's Kamoto 23,000 mt/y output and China Molybdenum's TFM production of 15,440 in the same year.

While cobalt and lithium claim their place in the battery metals space, copper's role in the energy transition has been more complicated to argue. Ivanhoe's founder and CEO, billionaire Robert Friedland, was among the first to call copper a "green metal," perhaps ahead of its time. Today, copper is finally getting the credit for its important utility in solar and power plants, electric vehicles, batteries, and greener buildings. Goldman Sachs argued in a detailed report the centrality of copper in the energy transition, forecasting a bullish price of US$15,000/mt by 2025, in contradiction with the outlook of other analysts, including the World Bank, who expects the price to drop to US$7,544/mt by 2025.

Judging by the large sums of money that move in the DRC, the country's investment climate seems to follow a "go-big-or-go-home" logic, fed by deep pockets. Kibali absorbed an investment of over US$2.1 billions, Kamoa-Kakula's development costs have surpassed the US$1 billion mark, while Chinese investments most often count in the billions. At the other end of this extreme, however, DRC has struggled to attract exploration dollars to favor a competitive and healthy junior sector that could pick up ground and transform them into feasible projects. Louis Watum, president at the DRC Chamber of Mines, said other countries like Senegal, Mali and Guinea attract more exploration dollars per square km than the DRC.

However, rising commodity prices and the radiance of successes like Kamoa for copper, Manono for lithium and Kibali for gold are encouraging the search for the next big story. •

> **DRC's total mineral wealth is measured in the tens of trillions of dollars, but security threats, perceived poor institutional capacity and a severe infrastructure and energy deficit are big investment detriments. We have a lot of homework to do to attract more investment into mining, like coming up with the right policy mix and a transparent mining registry system.**
>
> **- Louis Watum, President, DRC Chamber of Mines**

Patrice L'Huillier

Chief Operating Officer
ERG Africa

What have been the latest developments at ERG's copper and cobalt assets in the DRC?

ERG's assets in the DRC continue to move from strength to strength. At Metalkol RTR we successfully ramped up production in 2021 with our copper operations nearing Phase 2 production capacity of 100,000 t/y of copper. Our cobalt production at Metalkol RTR exceeded design capacity of 20,000 t/y, making it the second-largest standalone cobalt operation in the world. While operations were delayed due to the coronavirus pandemic, we have continued to explore opportunities for the construction of a battery precursor plant to be exclusively supplied with cobalt from Metalkol RTR.

At Frontier mine we also had a record year in terms of copper production and are prioritising the feasibility study for a further pit expansion (Cut 4), which has the potential to extend the life of mine by approximately 10 years.

In parallel, we are working towards resuming production at Boss Mining. Our ambition is to restart with a limited scale before 2023.

What is ERG's exploration strategy in the DRC and how is this informed by current supply and demand fundamentals?

In the DRC ERG has always focussed on copper and cobalt. The surge in price of these metals due to demand for EV metals and other green technologies has simply served as a catalyst for our operational expansion and exploration activities.

The minerals currently being mined in the DRC are a result of historical discoveries and, although bountiful, will not meet the prolonged demand generated by EV targets and clean energy solutions using cobalt and copper. This is further exacerbated by the reality that the capability to recycle these materials is only anticipated to come online in 15 years time, therefore necessitating a steady and sustainable supply of primary ore to meet demand.

There is huge potential to increase copper and cobalt production in DRC because there are many areas that have not yet been explored or have been under-explored. In 2021 we actively accelerated exploration activities and we are now investing in further geophysical and geochemistry projects along the copperbelt in partnership with Gécamines. In addition to maximising the exploration potential within our existing portfolio, we are also looking to acquire new licences with high-potential.

How do you see the role of the DRC in responding to cobalt demand in the long-term?

The DRC government and private mining operators have a significant role to play, firstly, in identifying new, underexplored areas in the country which can meet demand for 20 years from now and, secondly, to demonstrate that cobalt can be sourced responsibly. That's certainly our strategic vision – in partnership with the DRC government, acting as an exemplar for mining and metals in Africa. We are positively contributing to the world's clean energy transition that is driving the cobalt demand if we can mine and produce in the right and responsible way, ethically and ensuring mutually beneficial outcomes for our stakeholders. •

Marna Cloete

President
IVANHOE MINES

Kamoa-Kakula is projected to become one of the largest, highest-grade, and lowest-carbon copper mines in the world. Please can you comment on the significance of this project for both Ivanhoe and for the country?

The Kamoa-Kakula Joint Venture is truly a generational mineral discovery based on the size, grade and continuity of the ore bodies. It's hard to overstate how important the discovery is for Ivanhoe Mines, our operating partners, and the people of the Democratic Republic of Congo. The government is a 20% owner at the joint-venture level.

How is the success of Kamoa-Kakula as a greenfield discovery endorsing DRC as a mining jurisdiction?

The project has proven that responsible mining in the DRC is very achievable, and that with strong community and government partnerships you can advance a world-scale copper project to production on schedule and under budget.

Kamoa-Kakula has also highlighted the huge potential in the very young, talented workforce in country that is just waiting for training and opportunities.

We are currently planning to achieve net-zero emissions at Kamoa-Kakula, with the major innovation involving the adoption of emission-less battery electric equipment.

What is the evolution of the Kipushi zinc-copper-germanium-silver redevelopment?

On February 14, 2022, we announced a new agreement with our partner Gécamines, DRC's state-owned mining company, for the planned rebirth of the historic Kipushi Mine. When production begins, it will be the world's highest-grade major zinc mine, with average grade of 36.4% zinc over the first five years.

Kipushi also will be fully powered by clean hydroelectricity, aligning with Ivanhoe's vision to produce "green metals".

Do you have a final message?

Our outstanding operational success in 2021 is a product of the culture and values promoted throughout the organization. We are focused on training and empowering young, talented workforces to operate globally significant mining operations for generations. We invest deeply in our people, and we celebrate their diversity. Collectively we are determined to create long-term stakeholder and shareholder value through continued investment in discovering and developing world-class orebodies, technological innovation, strong corporate governance, environmental stewardship, empowering our host communities and intense focus on health and safety. •

Weiquan Xia

General Manager
MMG

What have been the main developments at MMG in the past year?

Overall, MMG had strong financial performance and completed an equity placement in 2021, which enabled us to significantly reduce debt and strengthen our balance sheet. We have advanced our own projects while keeping a close eye on external opportunities. Both our Kinsevere operation in DRC and Las Bambas in Peru have significant development projects under review. We are well positioned to grow.

On an Africa operations level, we are focused on actively advancing our copper cathode production in the Copperbelt. This strategy is centered on advancing our Kinsevere Expansion Project which is expected to be approved this year and then looking beyond to other assets in the region either via acquisition or through exploration.

MMG has driven various community development initiatives. Could you comment on your ESG approach?

On a global level, MMG seeks to positively contribute to the communities in which it operates by maximizing the value delivered to local stakeholders through more employment and local supply opportunities and by delivering social development programs.

In 2021, we committed to the Cahier de Charge in the DRC, which will deliver 18 projects in the areas around the Kinsevere operation. These projects are developed in close consultation with local community members and the program is set to deliver USD$6 million worth of projects over five years.

We are particularly proud of the Farmers Assistance Program which has assisted hundreds of farmers in the production of maize. We are also proud of our work in making education more accessible to local children by offering scholarships, building schools and supporting teachers. We have also delivered an adult literacy programme for residents in local villages.

How has DRC's operational environment in the south of the country evolved?

The industry has evolved from being dominated by state-owned companies to more private companies present today. However, challenges remain particularly around security, changing legal and regulatory frameworks, and infrastructure challenges such as sourcing reliable power supply. Additionally, the growth of the artisanal mining sector over the past decade has presented safety and security concerns, particularly in cobalt mining. •

Exploration: Copper and Katanga

Copper and cobalt projects in the DRC have found enthusiastic support in the past year. In one of the largest debt-financings for a privately-owned company in the DRC, Trafigura signed a US$600 million off-take agreement with Shalina Resources for the development of the Mutoshi copper and cobalt mine and the expansion of the Etoile copper and cobalt mine. Shalina bought the Lubumbashi-based Etoile mine in 2006, and gradually built a portfolio of over 80 permits, including the Mutoshi mine in Kolwezi. Shalina has already invested US$300 in the project, and the additional funds from Trafigura will bring the project into production by Q3 2023. With a production profile of approximately 20,000 mt/y of cobalt hydroxide and 75,000 mt/y of copper cathode, Shalina is poised to become one of the largest producers in the country.

> **Before the pandemic and the commodity boom, the junior sector was effectively paralyzed. Copper stabilizing at around US$10,000/mt and cobalt surpassing US$50,000/mt created an influx of exploration activity that was not possible at lower prices. Juniors and their investors are ready to take more risks even for small projects.**
>
> **- Simon Tuma-Waku, Vice President Mines, Fédération des Entreprises du Congo (FEC)**

Said Abbas Virji, Shalina's director, thinks Mutoshi is a giant with an immense upside: "The more we drill the more resources and reserves we find. The current life of mine for Mutoshi North is projected at 10 years with an annual nameplate capacity of 16,000 mt/y cobalt contained in cobalt hydroxide and 50,000 mt/y of copper cathode. The life of mine can be doubled with Mutoshi North West and East effectively creating a super-pit, but our immediate priority is to optimize the ore body in Mutoshi North so we can commence mining and settle our financing facility."

Although Trafigura has been supporting Shalina in the past with short-term loans, the recent agreement extends for five years and validates Trafigura's trust in the project, as well as in the country.

Another significant copper-cobalt deposit hoped to come onstream in coming years is Kisanfu, considered to be one of the largest, highest-grade undeveloped copper and cobalt deposits, holding an estimated 6.26 million mt of copper and 3.1 million mt of cobalt. In 2020, China Molybdenum Group paid US$550 million to US-based Freeport-McMoRan to acquire 95% of Kisanfu. Less than a year later, another Chinese player joined in, this time the battery maker Contemporary Amperex Technology Co (CATL), buying a 25% stake in Kisanfu, which leaves Moly with the remaining 75%. China Molybdenum's recent acquisition of Kisanfu is part of a larger expansion plan that the company is driving through both greenfield and brownfield investments. Kisanfu is only 33 km from the Tenke Fungurume mine (TFM), which also belongs to Moly. Moly bought TFM in 2016 for US$2 billion, and last year it announced it will spend US$2.5 billion to double copper and cobalt production.

The Chinese interest in DRC's copper-cobalt reserves has only been strengthening over the years, DRC's voluminous resources being the perfect match for the magnitude of Chinese demand, growing steadily in the last decade. Ties between the two countries consolidated over infrastructure-for-minerals mega deals, whereby the DRC traded off its minerals in exchange for money placed in its scant infrastructure. Hong Kong-listed MMG was among the first to make a decisive step in the DRC when it bought Anvil Mining in 2012. Now MMG controls the Kinsevere mine, which, almost 10 years after the acquisition, produces 48,017 mt/y of copper.

The DRC has become a melting pot between Chinese, Western, and national state interests, represented by holding entities like Gécamines or La Congolaise d'Exploitation Minière (Cominière). For instance, Kamoa, a flagship for the DRC, finds at the top of its shareholder list the China CITIC Bank Corporation, owning 26% of equities, and Zijin Mining Group with 13.5% of equities, closely followed by the founder of the company, Robert Friedland, who retains 13.5% of the company.

In one of the latest deals bearing the trademark of China-DRC direct state relations, DRC's state entity Gécamines entered a JV structure with Chinese state entity CNMC (China Non-Ferrous Mining Group) to develop a new copper and cobalt mine called Deziwa, about 35 km away from Kolwezi. Deziwa opened in 2020 and it is supposed to produce 80,000 mt/y of copper and just as much cobalt. The deal is part of a larger accord involving five mines. •

Lithium and Manono

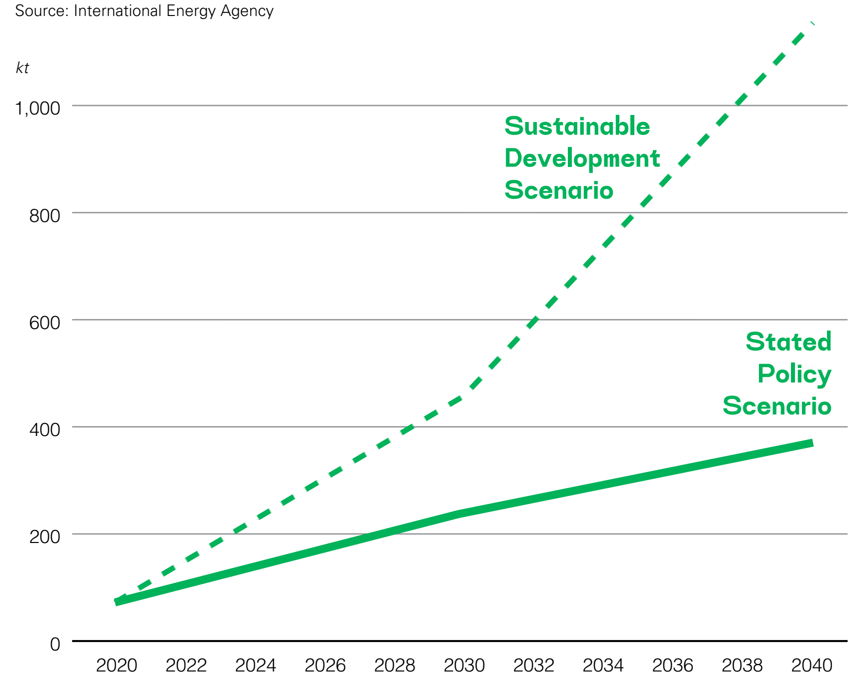
While copper prospectors search for another Kamoa in the Katanga region, the lithium space has mostly revolved around the city of Manono and the Tanganyika Province. In the southeast of the DRC, this region has a rich reserve of spodumene pegmatite-type ores that have never been mined for lithium. AVZ Minerals, an Australian listed explorer focused on lithium, tin and tantalum, made a significant discovery at Roche Dure, as part of its Manono lithium and tin project, called after the name of the nearby town. The total measured and indicated resource at the Manono project is 274 million mt at 1.66% Li2O. The discovery has focalized investors' attention on lithium, a mineral that the government declared strategic with the new mining code. As strategic minerals, lithium, cobalt, coltan and germanium entail a higher royalty rate of 10%, increased from 2% with the new legislation of 2018.

Chinese investors are the first to follow the country's lithium opportunity. AVZ recently secured US$240 million from Suzhou CATH Energy Technologies, who will take a 24% stake in the JV in exchange for financing the project. That will bring down AVZ's control from 75% to 51%, the rest of the shares split with holding company Cominière (25%) and the new investor. AVZ has already signed several mineral offtake agreements with Chinese Groups including with GFL International, a subsidiary of Ganfeng Lithium, and with Shenzhen Chengxin Lithium and Tianyi Lithium Industry Co.

In many cases, it is large Chinese companies with interests in copper and cobalt mines that are grabbing opportunities in the lithium space. One of AVZ's largest shareholders is Huayou International, which owns the Congo Dongfang International cobalt mine in the DRC. Ivanhoe's main shareholder, Zijin Mining Group, also moved into the exploration lithium space by opening a new JV with Cominière called Katamba Mining, which will focus on two greenfield exploration projects in the proximity of the Manono lithium mine. Zijin Mining is China's biggest listed gold producer.

TOTAL LITHIUM DEMAND BY SECTOR AND SCENARIO

Source: International Energy Agency



> **I believe African countries will gradually shift from being the "take-from" to being "go-to" places, and the current DRC administration has done a wonderful job correcting some of the wrongs of the past.**
>
> **- Hadley Natus, Chairman, Tantalex Lithium Resources**

But another project might start production ahead of AVZ and certainly before Katamba. Tantalex Lithium Resources is a Canadian company with the mining rights for the Manono-Kitotolo lithium and tin tailings above ground of AVZ's property, as well as the exploration licenses to develop a 45 km strike length corridor of lithium-cesium-tantalum (LCT), which the company calls the "Southwest Pegmatite Corridor." Tantalex has the backing of AfriMet Resources, an African-focused trader.

Hadley Natus, the chairman of Tantalex, sees a great fit for Tantalex to respond to the lithium growth story: "The EV market is estimated to grow 18-fold in the next decade, which means we will need 8-12 times more lithium supply to match demand. The future of lithium is very bright and Africa is well-placed to contribute in this space, especially with the kind of low-cost tailings project that we operate."

Natus draws an interesting analogy between the growth story of lithium around Manono and that of copper in Katanga 40 years ago. "If we want to understand how the lithium market will consolidate in the DRC, the copper industry in the mid-1990s Katanga is a good reference. Back in the day, there was general skepticism about copper production in the country, and yet today, the DRC is a leading copper producer. I think Manono, for lithium, could become what Katanga has become for copper, and much more," said Natus.

Adding to Natus' parallel, another resemblance between the development of copper and that of lithium and other minerals in the DRC is that both sectors rely on the Chinese to invest in processing capacity. 80% of DRC's copper and cobalt smelters are controlled by Chinese entities. In one of the latest such investments, Zijin approved in 2021 a US$769 million smelter for the Kamoa-Kakula project in the DRC to process the ore and make blister, a partially purified form of copper. Tantalex has also been in discussions with Ximei Resources, one of the biggest suppliers of tantalum to China, to establish a tantalum refining plant in the Manono area. Tantalex would be providing the tantalum concentrates (cassiterite and coltan) and Ximei would obtain up to 50% of the product, as part of an offtake agreement to be negotiated between the two parties – a familiar "infrastructure for minerals" formula, but at the same time, a pioneering project in Africa and an important step forward for the country.

"The tantalum market is very small, very niche, and very technical. Most of the conversion plants are located in Southeast Asia or China, while the Congo is one of the largest exporters of tantalum raw material. The DRC has everything for the battery metals space, but we must push for more in-country developments rather than sending raw minerals tens of thousands of kilometer away for processing, just to be shipped back to the same place in a different form. The DRC can produce tin, tantalum and lithium domestically provided the right infrastructure is in place," said Natus. •

Kibali inspiration and the junior gold sector

About US$28 billion worth of gold is believed to lie underneath eastern DRC's soils, according to OSISA statistics, but the country counts just one gold producer – Kibali, which produced 812,152 oz Au last year, beating all other gold mines in Africa. At the same time, Kibali has no competitor in the country, and artisanal mining makes up for the rest of DRC's total 60.9 mt/y gold output.

Gold around the current Kibali mine was discovered at the beginning of the 20th century. Taking ownership of the site, Belgian colonialists founded Société des Mines d'Or de Kilo-Moto (SOMIKO) in 1926. The unrest following independence in 1960 wiped out most records of the gold poured over those few decades. In 2004, Moto Goldmines acquired a dominant stake in SOKIMO, and in 2009, Randgold Resources and AngloGold Ashanti acquired Moto Goldmines and SOMIKO's concession, growing Kibali to its contemporary glory.

> **Some juniors might be apprehensive about exploration in the DRC but at Amani Gold, we have a highly experienced board that has worked extensively in the region. Our Chairman, Klaus Eckhof, has a strong record of success in the region and our director Peter Huljich is a director of AVZ Minerals, a great lithium success story in the DRC.**
>
> **- Conrad Karageorge, CEO, Amani Gold**

Today, gold explorers present in the country orbit around the same area reigned by Kibali. Just 35 km from Kibali and on the same Kilo-Moto greenstone belt is the Giro project, developed by Australian junior Amani Gold. The two deposits – Kebigada and Douze Match – form a 4.4 million oz gold resource with an average grade of 1 g/t Au. The rest of Kibali's neighborhood is monopolized by Loncor Gold, which operates a huge 3,500 km2 license on the Ngayu Greenstone Belt, about 200 km away from Kibali.

Loncor's CEO, John Barker, calls its flagship Adumbi project a "Covid baby:" Breaking out of a decade when the gold junior segment had been "in the doldrums," Loncor grew Adumbi from 1.3 million oz to 3.66 million oz indicated and inferred resources since the pandemic hit. Despite a value at current market prices close to US$1 billion (after-tax) as shown in the recent PEA conducted by DRA Global, Adumbi is valued at US$60 million – a huge mismatch in Barker's eyes: "Adumbi has a likely mined grade around 1 g/t higher than most of its East and West Africa peer groups. Given the recent PEA valuation, our attributable value of the PEA is close to US$850 million at current metal prices."

Amani also raised A$16 million in September last year and plans to do 10,000 m drilling in 2022 to grow the resource at Giro. Its CEO, Conrad Karageorge, thinks the environment for gold has improved, especially for Perth-based companies where the Australian IPO market hit a record: "There is definitely a feeling that we are in a commodity super-cycle, and juniors are receiving commensurate attention. In terms of the gold story, the number of projects that have become economic has grown substantially over the past two years ultimately thanks to the rising gold. I personally think gold still has a long way to go," said Karageorge.

Even more difficult is to attract the attention of investors to a project outside of Kibali's immediate and extended perimeter, or in an area with high-security risks, especially in the eastern provinces of North Kivu and Ituri, currently under military siege. The Misisi gold project is located in South Kivu, the province bordering Rwanda and Burundi, and it has caught the attention of Rackla Metals, a company founded by Simon Ridgeway, also co-founder of Fortuna Silver Mines. Rackla is completely switching focus from its North American assets to the DRC through the acquisition of Misisi project and the 3.1 million oz @ 2.1g/t Au resource it comes with. The company has suspended trading until it secures the money required for the acquisition. Subject to the acquisition, the company will change its name and begin trading as Goldenhawk (TSXV: GHWK), as well as bringing in Darryll Castle as new president and CEO.

Darryll told GBR how Misisi had once belonged to Anvil Mining, a company where he was CEO and that was eventually acquired by MMG in 2012. Before he took charge of Anvil, the company had sold the Misisi Akyanga deposit to Casa Mining: "Misisi had escaped the attention of Anvil at the time, proving just how copper was a much more promising opportunity allowing companies to raise money and build exceptional operations. Ever since the DRC opened its doors to investors, many miners have stopped at the opportunities promised by cobalt and copper."

DRC's overwhelming copper deposits have been, for the longest time, the main point of interest for investors, but Castle thinks the upturn in commodity prices may get people to do the hard work and take a look again at DRC's gold potential. In his view, the most difficult part is to convince investors to take a look at the asset rather than dismissing it from the start, based solely on general perceptions about the country: "One can think of a country as a person; it will take a person with a bad reputation many years of good behavior to earn the trust and forgiveness of others (...) The problem today is that too many won't even engage in the risk-reward equation, discarding the DRC altogether."

Misisi's history is an example of how easily some assets get lost in a country of dizzying, endless possibilities. The DRC is most likely missing out on other mineral opportunities, and diamonds may be one of them. The DRC is believed to hold about 150 million carats in diamond reserves, the third largest in the world after Russia and Botswana. In 2020, the country accounted for 21% of global production. But the state-owned Miniere de Bakwange (MIBA) has been accused of serious dysfunction and the government had to inject US$5 million to help MIBA become profitable in 2020. In September 2021, MIBA signed an MoU with Russia's Alrosa, the company behind world giant Catoca, but the exact terms of the collaboration remain unclear so far. •

Logistics and Security: Give it a day, or two, or three in the DRC

"In the DRC, everything takes time," said Oliver Dallaway, the director of hydraulic services company African Mining Services (AMS). What may take one business day in other parts of the world, in the Congo it could take up to three, a costly delay that businesses must factor into their planning. The country is not only incredibly large, stretching thousands of km north to south and east to west, but it is also locked in the heart of Africa, Lubumbashi finding itself about 2,000 km away both from the nearest ports of Dar-El-Salaam via the eastern route, or Durban, through the southern corridor. With less than 2% of the country's 152,400 km national road network paved, Africa's second-largest country relies on a minimal infrastructure that only gets worse in the conflict-ridden eastern regions.

When the pandemic started, importing goods into the DRC was the main issue, but as mining activity in the country resumed, getting minerals out of the country proved just as troublesome: "The most serious impact came from the limitation of exports in the DRC and Zambia: Production at mining sites continued, but without the possibility to transport materials out of the country, huge stockpiles were created," said Xavier de Longueville, regional director for Africa at Group Robinson International.

Between precipitating mineral demand coming from China, and hollowing lockdowns in South Africa, DRC producers had to reorganize their logistics chains to avoid build-ups. De Longueville said that mining companies improved their logistics planning considerably over this period, for instance, by making sure trucks are fully loaded to maximize efficiency. But logistics companies absorbed most of the pressure of those growing stocks on both import and export ends while typical trade routes were blocked by lockdowns or overcrowding. As carriers and freight forwarders resorted to alternative multimodal transport or alternative corridors and the price of logistics climbed stubbornly high, prices for equipment, spare parts, consumables and services carried out abroad also went up.

The high cost of DRC's logistics is not, however, a mere function of supply and demand fundamentals paired with tough infrastructure. Widely known but little spoken about are the extra fees applied at border checkpoints or city tolls, which local operators report changing from one day to another without any justification or clear legal backing.

On top of these dubiously applied taxes, bureaucratic custom formalities are another headache for logistics service providers, though the country is working to start digitalizing its paper-based customs administration: "Custom formalities remain the biggest impediment in the sector. Bureaucratic procedures slow process and multiply the work we have to perform, which is energy and time consuming for every logistics provider," said Fanon Beya, director at ConnexAfrica, one of the oldest logistics operators in the country.

"The DRC has been mired in violence for many years; an old story of remnants of the Hutu army fleeing from Rwanda into the Kivu jungles 25 years ago. Since then, they have recruited youth, taken hostages from local villages and caused havoc wherever they went. Towards the border with South Sudan, along the Uganda border, and the border to the Central African Republic the government has lost a great deal of control and normal life has become impossible.."

- Tobias Posel, Managing Director, Central African Mining Services(CAMS)

The mining industry itself is not exempt from fees related to import-export, an area that is heavily regulated by a chain of actors authorized to audit the industry – the Central Bank, the Bureau of Foreign Trade, the Customs Office, and the Insurance Control Authority, according to Arlette Mboyo, founder of operational and regulatory risk management firm Akili Consulting. Akili was created five years ago to act as a preventive external auditor in a regulatory minefield. Mboyo explains that DRC's regulatory import-export infrastructure is quite unique because the country is considered a high-risk zone and therefore requires more stringent banking supervision to combat terrorist financing, in line with international banking standards.

Security maps of DRC paint different operational environments across the country, ranging from stable to very high-risk in the east of the country, where ceaseless violence has brought the provinces of North Kivu and Ituri under military siege. This means that all civil structures in these provinces, including civil courts and provincial assemblies, are controlled by the military, which has deployed increased security personnel who can monitor communications and restrict movement. Authorities instruct that travelling in these regions should only take place during the day, in convoy, and keeping close communication with local officials or diplomatic representations. Service and equipment companies serving operators in these areas need to take all necessary precautions. Equipment dealers serving the North Kivu region will typically limit their activity to direct shipments to the city of Goma, the capital of the province. Service and equipment providers present in the region have reported a rising number of Chinese mining actors looking to establish a permanent base in the country. Nevertheless, the city that has attracted the most service providers in recent years is Kolwezi, in the southern – and significantly more stable – region of Lualaba. With 80% of its mining clients now in Kolwezi, and only 10% in Lubumbashi and another 10% in Likasi, Tractafric Equipment decided in 2020 to move closer to its clients by relocating from Lubumbashi in Kolwezi. Other companies have made a similar change. This year, Epiroc will inaugurate a new office, warehouse and workshop facility in Kolwezi, officially moving from its current base in Lubumbashi. ConnexAfrica also invested US$11 million in a new logistics hub in the cobalt capital, Kolwezi. "(This is) our largest project in recent years. Our goal is to build omnipresence in our regions and be recognized as a clearing, multi-modal transportation and general logistics provider," said its director, Fanon Beya.

The country's security situation is very granular, informs security services company GardaWorld, whereby the east of the country is trapped in an asymmetric war of multiple actors, including neighboring countries and over 100 active rebel groups, whereas security incidents are limited in the south. But, according to Olivier Schorochoff, the managing director for GardaWorld DRC, the southern mining provinces have seen an increase in kidnappings for ramson, together with a rise in the number of convoy attacks to steal copper and cobalt over the past 12 months. GardaWorld has 1,500 security officers in the eastern part of the country, where it works mostly with the UN and international NGOs, and two years ago it expanded to Katanga where it competes with over 200 security companies.

Although the violence in the east of the country has kept most investors at a distance, some companies have adventured into the proclaimed no-go areas and found outstanding success. Alphamin Resources operates the world's highest-grade tin resource in North Kivu, the Mpama North, offering grades four times higher than most other operating tin mines in the world, according to the producer. Conventional thinking dictates that an environment of peace is needed to attract investment, but in a country where peace is derailed by economic grievances, investment could help install peace and prosperity. This is the argument that Louis Watum, president at the DRC Chamber of Mines, forwards: A preposterous lack of investment since the country's independence has been a harbinger to violence, as generations of youth have taken up arms and joined militia. To reverse this tragic trend, investment should not be waiting for the country to stabilize, but act as a contributing element to stability. "Peace results by creating an island of prosperity that attracts both job seekers and businesses, and where proper economic activity can replace militia activity. We should change the narrative, inject capital and stimulate growth at the same time as the army pressures rebel groups," Watum said. •

"I believe many of DRC's provinces have been neglected because of a lack of understanding of these regions. The DRC is very large, with many portions of the country being difficult to access by road or plane, so Tractafric has designated a team of experts that will be ready to intervene in difficult locations and which will help us gain a better understanding of each territory."

- Paul Pierres, Handling and Agriculture Director, Tractafric.

Local services: The DRC bubble

The pandemic showed a dangerous side to global interconnectedness as the virus spread fast across borders. To control the contamination, the world broke into smaller, local bubbles, and each bubble had to face its own capacities and dependencies – a difficult mirror to look into for many countries. But in the DRC, a lot can actually be done locally - something that more actors in the mining industry have come to realize over the past two years. Inspection company Group Robinson International offers different types of analysis at its lab in Lubumbashi, yet the general preference of mining companies was to send samples abroad, usually to South Africa, to run environmental and other tests. A simple cost comparison would suggest that the price for an analysis done in the DRC is significantly higher compared to one executed abroad, but looking closer into additional costs, including shipping costs, not to mention the lost time during transportation, the price difference evens. It was only during the pandemic that more mining companies engaged in this calculation, resolving that a lot of trouble can be saved by opting for closer-to-home services: "Covid-19 has had an impact on demand for in-country services, simply because logistics became very complicated during this time. I think it will take a couple more years for the market to fully trust DRC testing facilities, but consistent quality will eventually tip the balance," said Xavier de Longueville, regional director at Robinson.

For French company HTDS, which supplies high-tech systems for laboratories like Robinson, having a local presence is likely to be its strongest competitive advantage. While its competitors run the DRC business from Zambia, South Africa or India, HTDS is the only provider of this type of equipment that has established a local DRC subsidiary, and in the future, it wants to further increase its local presence by investing in a warehouse. At this stage, the warehouse and larger stock capacity are still out of its reach as the company is still recovering after two very difficult years: a frozen 2020 and a hectic 2021.

> **One of the positive developments brought about by the introduction of local subcontracting laws is the rise of more local subcontracting businesses, which we support through financing, training, or putting them in touch with the right partners. Otherwise, the confusion surrounding the definition of a 'subcontractor' persists and no further clarifications were added.**
>
> **- Noël Mabuma, CEO, Congo Equipment**

"Our sales effectively stopped between January and August in 2020. Because the management of many mining companies is located abroad, their inability to travel onsite has certainly slowed down their decision-making process, including decisions on acquiring equipment. Also, the events that had traditionally been important platforms for making business didn't take place during the pandemic, so we did not have the chance to introduce our equipment to the market," said Derrick Kyaba, country director at HTDS in the DRC.

The pandemic proved even more challenging for local contractors and subcontractors who fully depend on mining activity. MCSC witnessed some of its clients fleeing the country or suspending activity without notice, and sometimes without paying the fees they owed to their hired contractor, with the pandemic as a pretext to acquit themselves. With 70% of the country's mining sector now controlled by Chinese investors, Congolese contractors have also had to learn how to deal with a new type of client. Chinese miners have different cultural and operational expectations, reasons why they prefer to bring in Chinese contractors. Almost all local contractors interviewed by GBR said they are struggling to enter the Chinese market, and the local content law that should act to their advantage is not helping.

Since the introduction of the new mining code of 2018, a new law obliges mining companies active in the DRC to ensure their contractors are Congolese entities, but the wording in the law continues to create confusion, which is exploited as an excuse for selective implementation. The word "sous-traitance," used in the legal text, translates in French as an umbrella term for all contractors, but in English it has a more restricted meaning of subcontractor (or a contractor hired by another contractor). Without further explanation, debates over the intended meaning have reached no conclusion, and the law continues to be implemented inconsistently.

The introduction of the law is one thing, and the implementation is a whole different story, especially when it comes to the lower layers of the value chain, including contractors themselves, explains Oliver Dallaway, the director of African Mining Services (AMS): "The subcontracting law introduced in 2018 still lags uniform implementation; some mines respect it while others don't. The intended impact of the law falls short of being realized and the lack of enforcement hinders the growth of the country and does not allow Congolese companies like ourselves to advance."

AMS has no Chinese customers in its portfolio. Yet, other companies are managing to bridge this gap, the pandemic most probably helping to bring the two tables closer together. As well as causing a change in the composition of the market, the arrival of Chinese producers replacing the majority-western producers has also radically re-shaped the structure of the market, now dominated by a multitude of smaller, more cost-sensitive players rather than a few giant operators. Congo Equipment, the exclusive CAT dealer since 2007, used to work with only three big companies in the past, but today its clients are numerous and smaller Chinese companies. Chinese clients now represent 80% of Congo Equipment's business by volume, a very accurate representation of the makeup of the mining industry. Noël Mabuma, the company's CEO, explained how the company won this market: "Chinese customers want to work with partners rather than machine dealers and being able to send technicians who speak their language is greatly appreciated. I believe many of our peers fail to consider these aspects, which does not allow them to gain the confidence of Chinese companies."

While other companies felt completely pushed aside by the price focus of Chinese miners, Congo Equipment understood that penetrating this market is about earning trust and adapting the business to new types of needs. The dealer established a full Chinese business unit, with Mandarin speakers in sales, accounts, after-sales, and even a China-based representative, close to the headquarters of these smaller actors active in the DRC. Congo Equipment also expanded its rental service, after observing that the contract durations between mining companies are now much shorter, in the order of months rather than years. Their clients suddenly became more interested in rentals than buying. Congo Equipment has 70 machines it can rent out.

> **With 80% of the DRC mines being Chinese-owned, the investment pool has drastically changed. This shift in ownership also changed the dominant operational culture, manifesting in the supremacy of costs over other considerations, including safety. We respect the work with Chinese customers, but it has to be noted that winning the contract can feel like a price battle and the contracts themselves tend to be short-term.**
>
> **- Cécile Amory, General Manager, Mining Contracting Services Congo (MCSC)**

Price has become central in the mining equipment sector, disrupting the usual hierarchy between mining equipment brands. Group Thema, a distributor of Chinese brand Sinotruk, is gaining a dominant market share in the equipment segment, displacing the once-dominant American or French truck makers in the Katanga region. If Chinese producers squeeze the price margins tight, so must Congolese contractors who serve them. Patrick Thema, the group's CEO, said Sinotruk has little competition: "There are many other equipment suppliers in Katanga, but these often exceed the financial means of most local mining companies. The Chinese are aware of this constraint and they manufacture affordable equipment that can turn a reasonable profit for small and local mining companies. Larger mining companies without such financial restraints can afford other options, but the reality is that most trucks operating in mines around the country are Chinese, so they will choose Chinese-made equipment," he explained. •

Power: Unsatiated needs, bountiful possibilities

In a country afflicted with a syndrome of unrealized-but-immense potential, the DRC power scene is yet another example: The country suffers from a severe power deficit, with an electrification rate as low as 1% in rural areas, yet, the DRC could technically become Africa's largest energy exporter. The Congo River has the second-largest flow and second-largest watershed after the Amazon, and has the potential to generate 100,000 MW, twice the capacity of all Sub-Saharan Africa. In reality, the DRC only produces 2,844 MW. The extreme distance between real and potential capacity has made some commentators wary of the word "potential," which to some sounds like a disguise for idealistic hopes. This is perhaps why some media have called the Inga 3 dam, a massive US$80 billion hydroelectric project on the Congo River rapids, a fantasy.

The Inga 3, or Grand Inga, is the world's largest proposed hydroelectric scheme with a planned potential of 4,500 MW, but after over a decade since first being commissioned, hopes that the project can be finalized have thinned. After Inga 1 was commissioned in 1972 to produce 351 MW, Inga 2 appeared 10 years later with a capacity of 1,424 MW. The four decades gap in this chronological series makes "Inga 5" or "Inga 6" a better name for Inga 3. Even if some have lost count over these decades of waiting, the current President is trying to bring Inga back on track; in 2021 he appointed the Australian iron ore producer Fortescue Metals Group to develop the project.

DRC's larger hydropower potential is seen as the ultimate solution for Africa's power shortages. Furthermore, this is the most desirable energy solution because it comes from a renewable source. Once completed, South Africa and Nigeria have already indicated they will buy between 2 and 3 GW of energy from the DRC. The other big collective buyer is the Katanga mining industry, which will purchase 1.3 GW. According to Simon Tuma-Waku, the VP at Fédération des Entreprises du Congo (FEC), Katanga runs a deficit of about 1,000 MW.

Mining and mineral processing companies are seriously conditioned by this deficit and by regular power blackouts. "Currently, we utilize about 60% of our total capacity due to the power deficit," said Navin Dalmia, managing director at Rubamin, a copper blister producer with a smelting capacity of 30-35,000 mt/y from its nine furnaces in the DRC.

DRC's energy deficit is not only limiting production capacity and capacity additions, but it is also hindering exploration, energy being a sin qua non condition for project feasibility. Unable to rely on the national grid, the largest mining operators in the country have invested in hydropower. Kibali is a standard example of modern hydropower infrastructure, and Barrick's first African project to introduce battery power to maximize the efficiency of the hydro-electric generation. Kamoa Kakula also uses energy generated by the Inga 2 hydropower facility, as part of an agreement between Ivanhoe Mines Energy and SNEL, the national electricity company (Societe Nationale d'Electricite). Turning the challenge into an opportunity, most mines in the DRC use clean energy.

As attractive as it is to run on renewable river power, building a hydropower station comes with substantial upfront costs, even if lower operational costs make up for the investment in the long term. Canadian gold junior Loncor Gold proposes two CAPEX and energy scenarios for its flagship Adumbi project in the DRC: a higher US$530 million pre-production CAPEX that includes a hydropower station, versus installing cheaper diesel generators and saving up to US$150 million in upfront costs. "When our independent consultants conducted our PEA, they identified five to six sites eligible for generating hydropower. Three sites were incorporated into our base case, pushing the CAPEX to US$530 million. In reality, we are already exploring the likely option of a third party independently financing, building and operating the hydro scheme. Under such a likely scenario, CAPEX for Adumbi would probably fall back towards the US$390 million range," said CEO John Barker.

While the mining industry has been able to overcome the energy challenge by pinning down capital for hydropower financing, electricity is becoming an even bigger issue for DRC's population, with only 19% of Congolese having access to the grid. Things are only getting worse, explained Divesh Hassamal, the managing director of solar energy supplier Dev Solaire: "Kinshasa is projected to become Africa's most populous city by 2030, surpassing Lagos in Nigeria. While electricity demand is growing together with the population, the national grid's capacity has not been evolving, and mediatized projects like the Inga 3 hydropower project have not advanced to expectations."

Even with Inga 3 completed, Hassamal said the new capacity will be directed towards the mining sector. Indeed, most private energy investments also prioritize the mining industry, leaving a gap for municipal and rural needs. Hassamal works extensively with the government and UN agencies in micro-grid projects to supply electricity to villages, and demand is on the rise. Even though solar energy on its own cannot sustain the energy demands of a large mining operation, 15% of Dev Solaire's revenues comes from the Lubumbashi mining industry, which it supplies with solar streetlights and other peripheral projects. The mining sector typically opts for solar alternatives to gain independence from the national power grid offered by the Societe Nationale d'Electricite (SNEL). •

"We recognized early on that to get the best out of Kibali we had to get low-cost power, so we built three hydropower stations. The mine has a very low carbon footprint, and the local community gets hydropower as well."

- Mark Bristow, President and CEO, Barrick Gold

Image courtesy of Barrick Gold

"Without the power issue, Congo could easily double national production. The DRC needs significant investments to solve this issue, but the problem is that, even when upgrades are made, the old infrastructure in place fails or is no longer compatible with the new one."

- Navin Dalmia, Managing Director, Rubamin

Insights from the ground on DRC's operational environment

DRC's largest corporate investment bank:
"Interest rates have been reduced from a high of 18.5% down to around 8.5% in local currency terms. Corporates are able to borrow dollars at lower rates than previously thanks to the high liquidity in dollar terms. From a macroeconomic perspective, the country's reserves have also significantly increased to about US$5.0 billion from US$700 million, and the local currency has been quite stable."

– Amedeo Anniciello, CEO, Standard Bank DRC

DRC's largest (banking) lender:
"While the corporate story for mining continues to play itself out, we think that the next wave of growth will come from the SME sector. A mark of our performance is the impact we have on the local economy, but more than a 'feel-good story,' helping SMEs at an early stage secures customers in the long-term and sets the foundations for long-term relationships that are not just transactional but founded on loyalty.

– Mustafa Rawji, Managing Director, Rawbank

Import-export regulatory risk consultant:
"International trade is under strong supervision in the country, regulated by several actors, notably the Central Bank, the Bureau of Foreign Trade, the Customs Office, the Office of Control, and the Insurance Control Authority, all of which legislate with separate texts. In addition, import and export mining activities must also comply with the Mining Code. In this chain of regulatory actors, operators are exposed to sanctions at each level. It is costly and time-consuming for mining companies to develop an internal structure that can meet the requirements of specific texts."

– Arlette Mboyo, Regional Head, Akili Consulting

HR & recruitment service provider:
"The Congo has a big gap between the needs of the markets and the traditional education system, unchanged since the 1980s. This translates into a skills gap and makes for challenging talent sourcing. The education system prioritizes the formation of lawyers, economists and doctors, but the economy needs people with technical abilities too."

– Djo Moupondo, CEO, SODEICO

Security service provider:
"In the mining regions the main risk is social, emerging from tensions between miners and artisanal miners digging on private premises. Conflicts can erupt and we have seen cases of mines being invaded by people. Mining companies and security companies need to work with local communities and local authorities to reduce these risks."

– Weid Vereycken (WV), Regional Manager Haut-Katanga and Lualaba, GardaWorld

Insights from the ground on DRC's operational environment

Logistics services provider:
"In the DRC, the biggest disruption came with the lockdown in South Africa. The closing down of South Africa brought a halt on investments but also on exports. We faced a situation when inbounds were limited, while the outbound cargo was very high. Nevertheless, we are happy to have been able to develop multiple solutions and corridors for our customers and we are very optimistic for 2022."

– George Ioannou, Head of Africa, Polytra

Equipment supplier:
"When it comes to digitalization, the need for real time data is the key adoption driver, which is also a part of Epiroc's 6th Sense solutions. Mine operations want to know how much ore they extract from the mine or the exact location of the people at the site (who wear tags and they can be easily found should anything happen). In underground projects, these concerns are even more seriously considered."

– Marcus Carlson, Country Manager DRC, Epiroc

Energy supplier:
"The DRC is blessed in natural resources and has many opportunities for renewable energy; enough to power the continent and not just the country itself. Depending on the region, the DRC has year-round sun, wind and running waters. The DRC has a hydroelectric potential of around 100,000 MW, but only around 2.5% of this is being utilized."

– Divesh Hassamal, Managing Director, Dev Solaire

Final message from the DRC Chamber of Mines:
"I advise investors to look carefully at the cost of doing business and prepare a robust economic model, as well as a competent and loyal local team, and then to commit. If you've done your homework diligently the returns can exceed your wildest dreams!"

– Louis Watum, President, Chamber of Mines DRC

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